

STUDY GUIDE 2006-2007

STUDY PROGRAMMES AND COURSES IN ENGLISH



University of Technology and Economics

Lappeenranta University of Technology is a university specialised in technology and economics. Education in technology began in 1969, and business administration education was launched in 1991. Over 5000 students study on the Skinnarila campus today. By the end of 2005, the university has produced 5500 Masters of Science in Technology, 900 Masters of Science in Economics and Business Administration, 188 licentiates and 227 doctors.

Expertise in technology and business are combined in a unique way in training and research at Lappeenranta University of Technology (LUT). The university's areas of emphasis involve the forest and metal cluster, energy and information and communication technology. Expertise in Russian business and industry and the promotion of entrepreneurship play an important role in all of the university's fields of specialisation.

Values that impact the activity of Lappeenranta University of Technology are ethics, high quality and the "Skinnarila spirit". The Skinnarila spirit embodies 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 2006 – 31 JULY 2007

The periods and exam and intensive course weeks for the academic year 2006-2007:

AUTUMN SEMESTER 2006

Periods

Period 1 4 Sept. – 20 Oct. 2006
Period 2 30 Oct. – 15 Dec. 2006

Intensive Week

Week 43 23 – 27 Oct. 2006

Exam Weeks

Week 35 28 Aug. – 1 Sept. 2006
Week 43 23 – 27 Oct. 2006
Week 51 18 – 22 Dec. 2006

SPRING SEMESTER 2007

Periods

Period 3 15 Jan. – 2 March 2007
Period 4 12 March – 4 May 2007

Intensive Weeks

Week 2 8 – 12 Jan. 2007
Week 10 5 – 9 March 2007
Week 19 7 – 11 May 2007

Exam Weeks

Week 2 8 – 12 Jan. 2007
Week 10 5 – 9 March 2007
Weeks 14-15 5 April & 10-11 April 2007
Week 19 7 – 11 May 2007
Week 20 14 – 16 May & 18 May 2007

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 eve of *vappu* (the Finnish labour day) 30 April 2007 and on 2 May 2007 there are no exams.

Saturday exams may be organised on 28 October 2006 and 10 March 2007; the departments will decide on the arrangements at a later date.

The exam schedule is available at http://www.lut.fi/en/lut_students/studying_at_lut/exams.html and posted on the bulletin board outside Student Services.

Course schedules are available on the university web site at http://www.lut.fi/en/international_students/exchange_students/studying_at_faculties.html.

Orientation for new students is organised 30 August – 1 September 2006.

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1 Studying at Lappeenranta University of Technology

1.1 Study Entitlement and Registration for the Academic Year

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 2006-2007 starts 1 June 2006 and ends 28 August 2006. **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 (28 August) will be removed from the student register and will no longer be entitled to study at LUT. Further information on registration for the academic year is available at the Study Affairs Office and at http://www.lut.fi/en/lut_students/studying_at_lut/student_affairs_office.html.

1.2 Study Guidance

Orientation for new students will be organised at the beginning of the academic year. The students will learn more about the university, departments 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.

Answers to the most common questions on studies are provided in this study guide and on the university web site at http://www.lut.fi/en/lut_students/index.html and on the web sites of the departments at http://www.lut.fi/en/lut_students/studying_at_lut/departments.html. Individual study guidance is offered by the study coordinators, student advisers, tutors and teachers. Furthermore, the staff of the Study Affairs Office and the entire university is there to help students with issues related to their tasks.

Study coordinators are experts in studies provided by their department. They offer study guidance from the very beginning of the studies until graduation. They help with e.g. the individual study plan (credit transfer from previous studies and other universities, substituting courses etc.) and with students' applications and other administrative issues.

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 in matters related to them. Students can consult them during their office hours.

Study coordinators of international students:	name:	tel:
• Master's Degree Programme in Electrical Engineering	Ms Julia Vauterin	05-621 6701
• Master's Degree Programme in Information Technology	Ms Merja Seppänen	05-621 2814
• Master's Degree Programme in Mechanical Engineering	Ms Minna Loikkanen	05-621 2444
• Master's Degree Programme in Process and Chemical Engineering	Ms Piia Vahvanen	05-621 2267
• International Business and Technology Management	Ms Pirkko Rauhamäki	05-621 6082

1.3 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.

You can access WebOodi and instructions for its use at http://www.lut.fi/en/lut_students/studying_at_lut/web_oodi.html.

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.

How to Modify Your Contact Information

If your contact information changes, you should make sure that the Study Affairs Office gets the new information and that it is updated in the student register. You can update the information (e.g. name, address, municipality of residence, e-mail and telephone) in WebOodi. If you can not access WebOodi, you should give the information directly to the Study Affairs Office.

1.4 Registration for Courses

The times and places of courses are given in the course schedule on the university web site http://www.lut.fi/en/lut_students/studying_at_lut/exams.html.

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.

You can register for courses through WebOodi at http://www.lut.fi/en/lut_students/studying_at_lut/web_oodi.html .

Registration for courses in the academic year 2006-2007 starts 1 August 2006 and ends as follows for each period:

Registration for courses in Period 1 ends	3 Sept. 2006 at 23:59
Registration for courses in Period 2 ends	29 Oct. 2006 at 23:59
Registration for courses in Period 3 ends	14 Jan. 2007 at 23:59
Registration for courses in Period 4 ends	11 Mar. 2007 at 23:59

In the autumn semester, lectures start on Monday, 4 September 2006, and in the spring semester on Monday, 15 January 2007.

Further instructions on registering for language courses are provided in the Language Centre study guide and on the Internet at www.lut.fi/kike.

Remember to register for courses and exams separately.

1.5 Registration for Examinations

The dates and times of examinations are given in the exam schedule on the university web site http://www.lut.fi/en/lut_students/studying_at_lut/exams.html. You can register for exams through WebOodi at http://www.lut.fi/en/lut_students/studying_at_lut/web_oodi.html .

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 attend, 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 or afternoon exam). This means you can take one morning and one afternoon exam in the same day.

1.6 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 passed (H).

The basis for the course evaluation (exam, assignment etc.) is given in the course descriptions in the study guide. The coursework affects the final grade of the course together with the exam. The teacher determines how much the coursework is emphasised in the evaluation.

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 the reasons for giving the 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 Study Affairs Office within 14 days of receiving the teacher's reply. The decision of the degree committee is final, no appeal can be made.

1.7 Regulations on Studies

The provisions laid down in the Universities Act and the decree on universities apply to LUT.

The provisions on education, studying and degrees in the Government Decree on University Degrees (794/2004) and LUT's regulations for teaching and studying (approved 23 March 2005) entered into force 1 August 2005. The decree and regulations are available on the university web site at http://www.lut.fi/en/lut_students/index.html.

Disciplinary Measures

LUT's regulations for teaching and studying (section 57) 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 him or her is made 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 in 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 director of the department 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 director of the student's department 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.

1.8 Degree Certificates

Students receive separate degree certificates for the Bachelor's degree (180 ECTS cr) and Master's degree (120 ECTS 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	Sufficient
1.50 – 2.49	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.

Students will receive a special mention in their Master's degree (120 ECTS cr) certificate of having carried out their studies in an outstanding way (*oivallisesti*) 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 ECTS credits included in the degree must be carried out at LUT and graded on a scale of 1 – 5.

International degree students will receive their Master's degree certificate both in English and in Finnish.

As an appendix to the degree certificate, which will be both in Finnish and in English, students will receive a transcript of records in Finnish and English, a Diploma Supplement in English, and on request a separate transcript of courses completed outside Lappeenranta University of Technology.

Students must fill out an application for the degree certificate. The forms and instructions are available at http://www.lut.fi/en/lut_students/index.html.

2 Support Services for Studies

2.1 Study Affairs Office

The Study 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

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 +358 5 621 6061, +358 5 621 6062 and +358 5 621 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 Study Affairs Office. A fee of € 2.00 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.

2.2 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 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. International Services provide also guidance and counselling in practical matters to all international students.

Students of Master's degree programmes in English are not, however, entitled to participate in student exchange.

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 land internships, Master's thesis work 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 also cooperate with State Employment Services.

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.

2.3 Origo and the Learning Centre

LUT's Learning Centre supports the university's students and teachers in the development of teaching and learning and in the use of information and communication technology. Students may use facilities and equipment in Origo, and the staff offers assistance in the use of information and communication technology. Origo is located in the university library. There is a large number of computers at the students' disposal, with a variety of software and equipment installed. There is also an exam room.

The Learning Centre supports the development of teaching through different development projects. These projects promote the development of e.g. study guidance, tutoring, the evaluation of teaching and learning and virtual teaching. In addition, the Learning Centre organises training related to the development of teaching for LUT staff members.

2.4 Library

The university library is open to the university's students and staff members as well as to people outside the university. The library's services include lending, information services, interlibrary lending, photocopy services and the circulation of journals, magazines and newspapers. The library and Learning Centre staff can help you use the library and search for information.

The library is open during the semesters from Monday to Thursday 8.30 - 18.00 and on Friday 8.30 - 15.30. At other times it is open from Monday to Friday 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 General Introduction to the Degrees in Technology

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

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:

- Degree Programme in Energy Technology
- Degree Programme in Chemical Technology
- Degree Programme in Mechanical Engineering
- Degree Programme in Electrical Engineering
- Degree Programme in Information Technology
- Degree Programme in Industrial Engineering and Management
- Degree Programme in Environmental Technology

The degree programmes in English are:

- 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 New Packaging Solutions
- Master's Degree Programme in Mechanical Engineering

Measurement of Studies

The studies are measured in ECTS 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 compulsory, 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 apply for a major subject and the department council decides on admissions. The application period and admissions are usually in the spring semester. Further information will be provided by the departments. If the number of applicants exceeds the number of study places in the major subject, admissions can be based on the applicants' number of credits, grades and professional experience.

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 this guide in the section of each degree programme.

Minor subjects provided by the departments are introduced in this study guide in the section of each department. Minor subjects organised by several departments in cooperation, the Department of Business Administration and the Language Centre are presented in section 4.8.

Individual Study Plan (HOPS)

At the beginning of their studies, students prepare an individual study plan (HOPS). The study plan is made for the entire duration of the studies, i.e. until the higher university degree is completed. The departments will give further information on how to prepare and update the individual study plan. Further details are available on the department web sites and from study coordinators and student advisers.

Credit Transfer

Credits from studies in other Finnish or foreign universities or institutes can be transferred to LUT degrees. In such cases, students must submit an application to the department.

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). Students with a polytechnic degree may substitute a maximum of 120 ECTS credits in their Bachelor's degree based on their previous studies. They would thus need to complete at least 60 ECTS credits at LUT (50 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 coordinators.

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). 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 credit. If the employment relationship is less than 15 working days, it will not be approved as an internship.

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

Departments give further instructions on internships e.g. on their web site.

The internship is approved by a person assigned by the department. The relevant application form and photocopies of work certificates are submitted to departmental contact persons. Please check the names of contact persons from your department.

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 department 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 department sets the date for the maturity test. The 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 maturity test in connection with their Master's 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 department may decide to accept the presentation given by the student in the Master's degree seminar as the maturity test. Departments 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, he or she must pass 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 on the department web sites. Students are to sign up for the maturity test in the department's office:

- Energy and Environmental Technology: Tiina Kronqvist, tel. +358 5 621 2730, room 3423, tiina.kronqvist@lut.fi
- Chemical Technology: Judy Hyvönen, tel. +358 5 621 2100, room 2443, judy.hyvonen@lut.fi
- Mechanical Engineering: Riitta Ruokonen, tel. +358 5 621 2436, room 1218A, riitta.ruokonen@lut.fi
- Electrical Engineering: Piipa Virkki, tel. +358 5 621 6700, room 6414, piipa.virkki@lut.fi
- Information Technology: Mari Toitturi, tel. +358 5 621 2817, room 6537, mari.toitturi@lut.fi
- Industrial Engineering and Management: Leena Myyryläinen, tel. +358 5 621 2621, room 4653, leena.myyrylainen@lut.fi

3.1 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 or optional 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 usually 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 department. The thesis is evaluated on the scale excellent (5), very good (4), good (3), very satisfactory (2), satisfactory (1) and failed (0).

The Bachelor's thesis is prepared according to the instructions given by the vice-rector in charge of teaching. Further details are presented at http://www.lut.fi/en/lut_students/studying_at_lut/instructions_for_studying.html.

3.2 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 60-70 ECTS cr
- minor subject, at least 20 ECTS cr
- elective or optional studies 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 ECTS cr.

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 ECTS cr), the department in question may require complementary studies depending on the student's previous education. 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 ECTS 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 department council confirms the topic of the thesis, assigns a supervisor and a second examiner, and grades the thesis. 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 department council.

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

Before starting their thesis, students must read the related instructions given by the vice-rector in charge of teaching. The Master's thesis instructions can be found in Chapter 11 and at http://www.lut.fi/en/lut_students/studying_at_lut/instructions_for_studying.html .

3.3 Postgraduate Degrees

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

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 70 ECTS credits, which is divided into 40-45 ECTS credits of major studies and 25-30 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 to the department council. The rector decides whether or not to grant the right to postgraduate studies after hearing the department council.

Further information on postgraduate studies is available at http://www.lut.fi/en/international_students/postgraduate_students/index.html

4 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.

4.1 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.

4.2 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.

4.3 Fields of Specialisation

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

1. **Information Processing**
2. **Communications Engineering**
3. **Technomathematics**

1. **Students of Information Processing** 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:

- Research and development of information processing systems and software
- Project planning and management
- Research and teaching in universities

2. **Students of Communications Engineering** gain knowledge and will become experts in the following areas:

- Design, development and maintenance of communications systems
- Development of communications software and hardware products

Students will get specialized in designing and implementing communications software. They will gain in-depth view of network architectures including wired, wireless and optical networks. Students will learn how to develop secure services to wireless terminals. In courses related to Parallel and Distributed Computing students will learn the basic concepts of parallel computing and different ways to harness the power of various parallel computer platforms. Students gain knowledge on parallel algorithms and deepen it on more advanced courses. Existing programming skills will be enhanced to utilize parallel methods in distributed and shared memory machines by implementing algorithms on our laboratory's parallel computing environment. Various changing themes relating to parallel computing and data communications are discussed in seminar courses.

3. Students of Technomathematics are trained to apply computational methods, mathematical models and advanced data-tools to problems in technical development, industrial research and different tasks of information processing in society. The students will be trained to tackle tasks in many fields and areas including

- 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

Study programme is a combination of information technology, applied mathematics and modelling skills. The student will select two of the following study modules: Computational Modelling of Technical Systems, Theory of Applied Analysis, Data Analysis and Stochastics and Discrete and Fuzzy Models and Methods. Also a supporting module in information technology is included.

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

Information Processing

Students majoring in Information Processing 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 information processing 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 Engineering

Students with major in Communications Engineering are expected to master engineering mathematics, especially statistics, discrete mathematics, and trigonometric series. From physics the areas covered are both electronics and wave motion. A student is expected to have basic knowledge in wired and wireless communication systems and in protocols in communications.

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

Technomathematics

Students entering technomathematics are assumed to have a BSc in applied mathematics, computer science or information technology. The students should have basic knowledge in computers including data structures, algorithms and some programming skills. Furthermore, the students must have basic knowledge in information technology as a whole including hardware, operating systems, familiarity with PC work station and basic data 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 dynamics.

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.

4.5 Degree structure of the Master's Degree Programme in Information Technology

Master of Science 120 ECTS cr

	<i>ECTS cr</i>
Studies in Science	20,0 – 22,0
Major Subject	29,0 – 30,0
Supporting Studies for Major Subject	6,0 – 11,0
Minor Subject	20,0 (min.)
Elective Studies	10 – 12,0
Master's Thesis	30,0
<i>Total</i>	<i>120,0 (min.)</i>

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.

4.5.1 Information Processing

Studies in Science 20 ECTS cr

	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ki7119000 Academic Seminar for International Programs	1	1 – 2	6
Ko4000300 Introduction to MSc Studies	1	1 – 2	1
Ti5212500 Object-Oriented Programming	1	1 – 2	5
Ti5213000 Unix and System Programming	1	2 – 3	5
Ti5319500 Research Methods	1	1	3

Major in Information Processing 29 ECTS cr

29 ECTS credits from the following list should be selected, with at least 3 of the courses marked with (*).

	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5216000 Pattern Recognition (*)	1	3 – 4	7
Ti5216100 Machine Vision (*)	2	1 – 2	7
Ti5216200 Active and Robot Vision (*)	1 – 2	1 – 2	7
Ti5216300 Evolutionary Algorithms (*)	1 – 2	1 – 3	5
Ti5317000 Parallel Computing	1 – 2	1 – 2	6
Ti5414100 Statistics II	1 – 2	2	3
Ti5416200 Numerical Analysis II	1	4	3

Supporting Studies for Major 11 ECTS cr

	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5213100 Introduction to Machine Vision and Machine Learning	1	3 – 4	6
Ti5216400 Languages, Compilers and Interpreters	1	3 – 4	5

Minor Subject 20 ECTS cr

One of the minors should be selected

or	Communications Engineering
or	Technomathematics
or	Business Administration

Master's Thesis 30 ECTS cr

Elective studies 10 ECTS cr

4.5.2 Communications Engineering

Studies in Science 20 ECTS cr

	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ki7119000 Academic Seminar for International Programs	1	1 – 2	6
Ko4000300 Introduction to MSc Studies	1	1 – 2	1
Ti5212500 Object-Oriented Programming	1	1 – 2	5
Ti5315000 Network Programming	1	2 – 3	5
Ti5319500 Research Methods	2	1	3

Major in Communications Engineering 30 ECTS cr

Compulsory , 15 cr

	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5315800 Communications Software and Architectures	1	1 – 2	5

Ti5315900	Communications Software Laboratory Work	1	3 – 4	5
Ti5312700	Network Design and Traffic Engineering	1	3 – 4	5

Elective courses, 15cr

Student must choose 15 cr from the following list:

List of Selectable Courses		year	per.	ECTS cr
Ti5317411	Distributed Object Programming	2	1 – 2	6
Ti5318800	Secured Communications	1 – 2	3 – 4	6
Ti5319600	Research Methods, Laboratory Project	2	2 – 4	5
Ti5318300	Wireless Service Engineering	2	1	5
Ti5317000	Parallel Computing	1	1 – 2	6
Ti5319600	Parallel Programming	1	2 – 3	5
Ti5317300	Advanced Parallel Computing	1 – 2	3 – 4	5
Ti5317200	Design of Parallel Algorithms	1 – 2	3 – 4	5

Supporting Studies for Major, 10 cr

Student must choose 10 cr from the following list:

		year	per.	ECTS cr
Ti5213000	Unix and System Programming	1 – 2	2 – 3	5
Ti5213100	Introduction to Machine Vision and Machine Learning	1	3 – 4	6
Ti5216300	Evolutionary Algorithms	1 – 2	1 – 3	5
Ti5217000	Information System Research	1	1 – 2	7
Ti5416200	Numerical Analysis II	1	4	3
Ti5416600	Fuzzy Sets and Fuzzy Logic	1 – 2	2	6
Ti5414100	Statistics II	1 – 2	2	3
Ti5414200	Simulation	1	1	4
Ti5414400	Logic and Discrete Methods	1	4	4

Minor Subject 20 ECTS cr

One of the minors should be selected

	Information Processing
or	Technomathematics
or	Business Administration

Master's Thesis 30 ECTS cr

Elective studies 10 ECTS cr

4.5.3 Technomathematics

Studies in Science 22 ECTS cr

		year	per.	ECTS cr
Ki7119000	Academic Seminar for International Programs	1	1 – 2	6
Ko4000300	Introduction to MSc Studies	1	1 – 2	1
Ti5319500	Research Methods	2	1	3
Ti5414300	Differential Equations	1	3	5
Ti5414400	Logic and Discrete Methods	1	4	4
Ti5414700	Linear Algebra and Normed Spaces	1 – 2	1	3

Major in Technomathematics 30 ECTS cr

Courses marked with (*) are compulsory.

Two of the four modules should be selected, 15 ECTS credits from both:

Module 1: Computational Modelling of Technical Systems		year	per.	ECTS cr
Ti5414200	Simulation	1 – 2	1	4
Ti5416100	Integral Transforms	1	4	3
Ti5416200	Numerical Analysis II (*)	1	4	3
Ti5416300	Nonlinear Optimization (*)	1	4	4
Ti5416700	Fuzzy Engineering	1	4	6
Ti5417600	Advanced Mathematical Methods	1 – 2	1 – 4	3 – 6

Module 2: Theory of Applied Analysis		year	per.	ECTS cr
Ti5413300	Complex Analysis (*)	1	3	3
Ti5416100	Integral Transforms (*)	1	4	3
Ti5416600	Fuzzy Sets and Fuzzy Logic	1 – 2	2	6
Ti5417100	Stochastic Theory and Models	1	3 – 4	3
Ti5417300	Functional Analysis (*)	1 – 2	2	3

Ti5417600	Advanced Mathematical Methods	1 – 2	1 – 4	3 – 6
Module 3: Data Analysis and Stochastics		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5414100	Statistics II (*	1 – 2	2	3
Ti5414200	Simulation	1	1	4
Ti5416400	Discrete Optimization (*	1	4	4
Ti5416500	Statistical Analysis in Modelling (*	1 – 2	2	3
Ti5417100	Stochastic Theory and Models	1	3 – 4	3
Ti5417200	Design of Experiments	1	4	3
Ti5417400	Fuzzy Data Analysis	1	3	6
Ti5417600	Advanced Mathematical Methods	1 – 2	1 – 4	3 – 6
Module 4: Discrete and Fuzzy Models and Methods		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5416400	Discrete Optimization (*	1	4	4
Ti5416600	Fuzzy Sets and Fuzzy Logic (*	1 – 2	2	6
Ti5416700	Fuzzy Engineering	1	4	6
Ti5417400	Fuzzy Data Analysis	1	3	6
Ti5417500	Fuzzy Decision Making	1 – 2	2	6
Ti5417600	Advanced Mathematical Methods	1 – 2	1 – 4	3 – 6
Supporting Studies for Major 6 ECTS cr				
		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5417800	Case Study Seminar	1 – 2	1 – 4	6
Minor Subject 20 ECTS cr				
<i>One of the minors should be selected</i>				
	Information Technology			
or	Information Processing			
or	Communications Engineering			
or	Business Administration			
Master's Thesis 30 ECTS cr				
Elective studies 12 ECTS cr				
4.5.4 Minor Subject 20 ECTS cr				
Information Processing				
<i>Compulsory 11 ECTS cr</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5213100	Introduction to Machine Vision and Machine Learning	1	3 – 4	6
Ti5216400	Languages, Compilers and Interpreters	1	3 – 4	5
<i>Elective 9 ECTS cr</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5212500	Object-Oriented Programming	1 – 2	1 – 2	5
Ti5213000	Unix and System Programming	1 – 2	2 – 3	5
Ti5216000	Pattern Recognition	1	3 – 4	7
Ti5216100	Machine Vision	2	1 – 2	7
Ti5216200	Active and Robot Vision	2	1 – 2	7
Ti5216300	Evolutionary Algorithms	1 – 2	1 – 3	5
Communications Engineering				
<i>Compulsory 10 ECTS cr</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5315000	Network Programming	1	2 – 3	5
Ti5315800	Communications Software and Architecture	1	1 – 2	5
<i>Elective 10 ECTS cr</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5312700	Network Design and Traffic Engineering	1	3 – 4	5
Ti5316500	Performance Analysis in Telecommunication Systems	1	1 – 2	5
Ti5317000	Parallel Computing	1	1 – 2	6
Ti5317100	Parallel Programming	1	2 – 3	5
Ti5317200	Design of Parallel Algorithms	1 – 2	3 – 4	5
Ti5317300	Advanced Parallel Computing	1 – 2	3 – 4	5
Ti5317411	Distributed Object Programming	2	1 – 2	6
Ti5318800	Secured Communications	1 – 2	3 – 4	6
Ti5319600	Research Methods, Laboratory Project	2	2 – 4	5

Technomathematics

<i>Compulsory 10 ECTS cr</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5414200	Simulation	1	1	4
Ti5414700	Linear Algebra and Normed Spaces	1 – 2	1 – 3	3
Ti5416100	Integral Transforms	1	4	3

<i>Elective 10 ECTS cr</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5413300	Complex Analysis	1	3	3
Ti5414100	Statistics II	1 – 2	2	3
Ti5414300	Differential Equations	1	3	5
Ti5414400	Logic and Discrete Methods	1	4	4
Ti5416200	Numerical Analysis II	1	4	3
Ti5416300	Nonlinear Optimization	1	4	4
Ti5416400	Discrete Optimization	1	4	4
Ti5416500	Statistical Analysis in Modelling	1 – 2	2	3
Ti5416600	Fuzzy Sets and Fuzzy Logic	1 – 2	2	6
Ti5416700	Fuzzy Engineering	1	4	6
Ti5417200	Design of Experiments	1	4	3
Ti5417400	Fuzzy Data Analysis	1	3	6

Information Technology

<i>Compulsory 10 ECTS cr</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5212500	Object-Oriented Programming	1 – 2	1 – 2	5
Ti5216300	Evolutionary Algorithms	1 – 2	1 – 3	5

<i>Elective 10 ECTS cr</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ti5213100	Introduction to Machine Vision and Machine Learning	1	3 – 4	6
Ti5216000	Pattern Recognition	1	3 – 4	7
Ti5216400	Languages, Compilers and Interpreters	1	3 – 4	5
Ti5316500	Performance Analysis in Telecommunication Systems	1 – 2	1 – 2	5
Ti5317000	Parallel Computing	1 – 2	1 – 2	6

Business Administration

<i>compulsory 20 ECTS cr</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ka6720050	Cross-Cultural Marketing Strategies	1-2	2	5
Ka6720100	Integrated Marketing Communication	1-2	4	5
Ka6720150	Internationalization of the Firm	1-2	3	5
Ka6720250	Global Digital Marketing	1-2	2	5

4.6 The Courses offered in English**Information Processing**

		<i>ECTS cr</i>
Ti5212500	Object-Oriented Programming	5
Ti5213000	Unix and System Programming	5
Ti5213100	Introduction to Machine Vision and Machine Learning	6
Ti5216000	Pattern Recognition	7
Ti5216100	Machine Vision	7
Ti5216200	Active and Robot Vision	7
Ti5216300	Evolutionary Algorithms	5
Ti5216400	Languages, Compilers and Interpreters	5
Ti5217000	Information Systems Research	7

Communications Engineering

		<i>ECTS cr</i>
Ti5312700	Network Design and Traffic Engineering	5
Ti5315000	Network Programming	5
Ti5315800	Communications Software and Architecture	5
Ti5315900	Communication Software Laboratory Work	5
Ti5316500	Performance Analysis of Telecommunication Systems	5
Ti5316701	Group Work Course on Communications Software	8
Ti5317000	Parallel Computing	6
Ti5317100	Parallel Programming	5
Ti5317200	Design of Parallel Algorithms	5
Ti5317300	Advanced Parallel Computing	5
Ti5317411	Distributed Object Programming	6
Ti5318300	Wireless Service Engineering	5

Ti5318800	Secured Communications	6
Ti5319500	Research Methods	3
Ti5319600	Research Methods, Laboratory Project	5

Technomathematics

		ECTS cr
Ti5413300	Complex Analysis	3
Ti5414100	Statistics II	3
Ti5414200	Simulation	4
Ti5414300	Differential Equations	5
Ti5414400	Logic and Discrete Methods	4
Ti5414700	Linear Algebra and Normed Spaces	3
Ti5416100	Integral Transforms	3
Ti5416200	Numerical Analysis II	3
Ti5416300	Nonlinear Optimization	4
Ti5416400	Discrete Optimization	4
Ti5416500	Statistical Analysis in Modelling	3
Ti5416600	Fuzzy Sets and Fuzzy Logic	6
Ti5416700	Fuzzy Engineering	6
Ti5417100	Stochastic Theory and Models	3
Ti5417200	Design of Experiments	3
Ti5417300	Functional Analysis	3
Ti5417400	Fuzzy Data Analysis	6
Ti5417500	Fuzzy Decision Making	6
Ti5417600	Advanced Mathematical Methods	3 - 6
Ti5417700	Modelling Methodology in Process Engineering	5
Ti5417800	Case Study Seminar	6

4.6.1 Course descriptions

<i>Ti5212500</i>	OBJECT-ORIENTED PROGRAMMING	5 ECTS cr
	Oliokeskeinen ohjelmointi	
	Course will be lectured the last time in fall 2006.	
Year and Period	TkK 3, Period 1-2	
Lecturer	Senior Assistant, D.Sc. (Tech.) Ville Kyrki	
Aims	To introduce advanced concepts and techniques of object-oriented programming. To teach how to apply these techniques in practice.	
Contents	Basics of Java. Run-time object model. Reusability. Containers. Polymorphic algorithms. Reflection. Serialization. Distributed objects. Design patterns.	
Course Work	Lectures 28 h, exercises 28 h, 1st period. Practical assignment, 2nd period. Exam.	
Evaluation	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.	
Prerequisites	Ti5212200 Tietorakenteet ja C-kieli, Ti5212400 Olio-ohjelmoinnin perusteet.	

<i>Ti5213000</i>	UNIX AND SYSTEM PROGRAMMING	5 ECTS cr
	Unix ja systeemiohjelmointi	
Year and Period	TkK 3, Period 2-3	
Lecturer	Senior Assistant, D.Sc. (Tech.) Joni Kämäräinen	
Aims	To familiarize the student with advanced methods of Unix employment, based mainly on C and shell programming.	
Contents	Shells, commands and scripts. Filters and interpreted languages. System calls and library functions for I/O operations. Threads, processes and basic interprocess communication. Streams, sockets, network fundamentals.	
Course Work	Lectures 28 h, exercises 28 h, homeworks, 2nd period. Terminal project, 3rd period. Exam.	
Evaluation	0 – 5. Exam 100 %. Homeworks and project.	
Course Material	Kernighan, B.W., Pike, R.: The UNIX Programming Environment, Prentice-Hall, 1984. Stevens, W.R.: Advanced Programming in the UNIX Environment, Addison- Wesley, 1997. Robbins, K.A., Robbins, S.: Practical UNIX Programming, Prentice-Hall, 1996. Glass, G., Ables, K.: UNIX for Programmers and Users, Prentice-Hall, 1999.	
Prerequisites	Ti5212200 Tietorakenteet ja C-kieli, Ti5212600 Käyttöjärjestelmät.	

Ti5213100	INTRODUCTION TO MACHINE VISION AND MACHINE LEARNING	6 ECTS cr
	Johdanto konenäköön ja koneoppimiseen	
Year and Period	TkK 3, Period 3-4	
Lecturer	Senior Assistant, 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.	
Course Work	Lectures 21 h, exercises 14 h, homeworks, 3rd period.	
Evaluation	Lectures 21 h, exercises 14 h, homeworks, 4th period. Exam.	
Course Material	0 – 5. Exam 100 %. Homeworks. Davies, E.R.: Machine Vision, 3rd Edition, Elsevier, 2005. Mitchell, T.M.: Machine Learning, McGraw-Hill, 1997.	
Prerequisites	Matematiikka A and B, Ti5210210 Ohjelmoinnin perusteet A or Ti5210220 Ohjelmoinnin perusteet B.	
Ti5216000	PATTERN RECOGNITION	7 ECTS cr
	Hahmontunnistus	
Year and Period	DI 1, Period 3-4	
Lecturer	Senior Assistant, D.Sc. (Tech.) Ville Kyrki	
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.	
Course Work	Lectures 21 h, exercises 14 h, 3rd period.	
Evaluation	Lectures 21 h, exercises 14 h, 4th period. Practical assignment. Exam.	
Course Material	0 – 5. Exam 50 %, exercises 50 %. Practical assignment. Lecture notes. Duda, R.O., Hart, P.E., Stork, D.G.: Pattern Classification, Wiley, 2001. Theodoridis, S., Koutroubas, K.: Pattern Recognition, Academic Press, 2003.	
Prerequisites	Matematiikka A and B, Ti5212200 Tietorakenteet ja C-kieli, Ti5413500 Tilastomatematiikka I. Recommended Ti5213100 Introduction to Machine Vision and Machine Learning, Ti5413600 Numeerinen analyysi I, Ti5413700 Matriisilaskenta.	
Ti5216100	MACHINE VISION	7 ECTS cr
	Konenäkö	
	Lectured every second year only, next time 2006 - 2007.	
Year and Period	DI 1, Period 1-2	
Lecturer	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.	
Course Work	Lectures 16 h, exercises 14 h, seminar presentations 5 h, 1st period.	
Evaluation	Lectures 14 h, exercises 14 h, seminar presentations 7 h and practical assignments, 2nd period. Exam.	
Course Material	0 – 5. Exam 100 %. Practical assignments. Gonzalez, R.C., Woods, R.E.: Digital image processing, Prentice-Hall, 2002. Jain, A.K.: Fundamentals of digital image processing, Prentice-Hall, 1989.	
Prerequisites	Recommended Ti5212700 Tietokonegrafiikan perusteet, Ti5213100 Introduction to Machine Vision and Machine Learning, Ti5216000 Pattern Recognition, Sa2810600 Applied Optics.	

Ti5216200	ACTIVE AND ROBOT VISION	7 ECTS cr
	Aktiivi- ja robottinäkö	
	Lectured every second year only, next time 2007 - 2008.	
Year and Period	DI 1, Period 1-2	
Lecturer	Senior Assistant, D.Sc. (Tech.) Ville Kyrki	
Aims	To understand the theoretical basis and motivation to use geometric and active 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.	
Course Work	Lectures 21 h, exercises 14 h, 1st period. Lectures 21 h, exercises 14 h, 2nd period. Practical assignment. Exam.	
Evaluation	0 – 5. Exam 50 %, exercises 50 %. Practical assignment.	
Course Material	Lecture notes.	
Prerequisites	Trucco, E., Verri, A.: Introductory Techniques for 3-D Computer Vision, Prentice-Hall, 1998. Matematiikka A and B, Ti5210210 Ohjelmoinnin perusteet A or Ti5210220 Ohjelmoinnin perusteet B. Recommended Ti5213100 Introduction to Machine Vision and Machine Learning, Ti5413500 Tilastomatematiikka I, Ti5413600 Numeerinen analyysi I, Ti5413700 Matriisilaskenta.	
Ti5216300	EVOLUTIONARY ALGORITHMS	5 ECTS cr
	Evoluutioalgoritmit	
Year and Period	DI 1, Period 1-2	
Lecturer	Professor, D.Sc. (Econ. & Bus. Adm.) Jouni Lampinen	
Aims	Familiarize with the basics and applications of evolutionary algorithms. 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.	
Contents	Introduction to evolutionary algorithms and their applications. Evolutionary algorithms in learning, intelligent, adaptive, and self-organizing systems. Structure, components, and characteristics of evolutionary algorithms. Genetic algorithms and evolutionary strategies. Evolutionary problem solving, searching, and optimization. Design and implementation of an information system applying evolutionary algorithms. Practical problem solving using evolutionary algorithms.	
Course Work	Lectures 28 h, 1st period. Exercises 10 h, 2nd period. Project work seminars 7 h, 2nd period. Project work. Exam.	
Evaluation	0 – 5. Exam 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 using a procedural language, e.g. C, FORTRAN, Pascal, Basic, etc., Ti5210210 Ohjelmoinnin perusteet A, Ti5212200 Tietorakenteet ja C-kieli. Recommended Ti5212300 Algoritmien suunnittelu, Ti5416300 Nonlinear Optimization.	
Ti5216400	LANGUAGES, COMPILERS AND INTERPRETERS	5 ECTS cr
	Kielet, kääntäjät ja tulkit	
Year and Period	DI 1, Period 3-4	
Lecturer	Senior Assistant, D.Sc. (Tech.) Joni Kämäräinen	
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 translation, attribute grammars, intermediate representation. Machine independent optimization.	
Course Work	Lectures 21 h, exercises 14 h, 3rd period. Lectures 21 h, exercises 14 h and a terminal project, 4th period. Exam.	
Evaluation	0 – 5. Exam 100 %. Project.	
Course Material	Aho, A.V., Sethi, R., Ullman, J.D.: Compilers: Principles, Techniques, and Tools, Addison Wesley, 1987.	
Prerequisites	Ti5212000 Tietojenkäsittelyn perusteet I, Ti5212200 Tietorakenteet ja C-kieli, Ti5212300 Algoritmien suunnittelu.	

Ti5217000	INFORMATION SYSTEMS RESEARCH	7 ECTS cr
	Tietojärjestelmien tutkimus	
Year and Period	DI 1, Period 1-2	
Lecturer	Lecturer, D.Sc. (Tech.) Erja Mustonen-Ollila	
Aims	Getting familiar with the IS research methods, the IS research approaches, reference literature, data collection, data validation, and data reliability issues, statistical analyses, a research proposal and a scientific report writing procedures. Promoting the publishing procedures, and understanding the different stages of the research process. Applying qualitative and quantitative research approaches, and discovering the proper research questions or the hypotheses, and the research problems. Finding out the suitable research organisations, or partners, and a research topic. The main goal is that the student is capable independently together with the supervisor to continue her/his M.Sc. and/or Ph.D. research study in the area of Information Systems, Software Engineering, or some reference disciplines.	
Contents	Qualitative and quantitative research. IS research methods, and approaches. Constructing a conceptual framework, the research models, and the concepts. Data gathering techniques, data validation and reliability. Measurement. Statistical processing of observations. Research philosophies and philosophical methods. Scientific writing and the process of writing. The content of the research proposal. The content of a working paper. Publication procedures.	
Course Work	Lectures 21 h, exercises 14 h, 1st period. Lectures 21 h, exercises 14 h, 2nd period.	
Evaluation	Practical assignment (research proposal). Exam. 0 – 5. Exam 50 %, practical assignment 50 %.	
Course Material	Mumford, Hirshheim, Fitzgerald, Wood-Harper (ed.): Research Methods in Information Systems, 1985. Nissen, H.-E., Klein, H.K., Hirschheim, R. (ed.): Information Systems Research: Contemporary Approaches & Emergent Traditions, 1991. Boland, R.J., Hirschheim, R.A. (ed.): Critical Issues in Information Systems Research, Wiley, 1987. The Information Systems Research Challenge (Harvard 1989): Vol. 1: Qualitative Research Methods (ed. Cash, J.I., Lawrence, P.R.), Vol. 2: Experimental Research Methods (ed. Benbasat, I.), Vol. 3: Survey Research Methods (ed. Kraemer, K.L.). Järvinen, P.: On Research Methods, Opinpaja, 2004. Scientific articles in each of the sub areas.	
Prerequisites	Ti5214000 Ohjelmistotuotanto.	
Ti5312700	NETWORK DESIGN AND TRAFFIC ENGINEERING	5 ECTS cr
	Verkkosuunnittelu	
Year and Period	DI 1, Period 3-4	
Lecturer	Assistant, M.Sc. (Tech.) Oleg Chistokhvalov	
Aims	To make students familiar with fundamental methods in the design of telecommunication networks and traffic engineering.	
Contents	Introduction to the network planning problem, network algorithms, network reliability, capacity planning, network optimization, and traffic engineering.	
Course Work	Lectures 7 h, exercises 14 h, 3rd period. Lectures 7 h, exercises 14 h and practical assignment, 4th period. Exam.	
Evaluation	0 – 5. Exam 50 %, exercises 50 %. Practical assignment.	
Course Material	Robertazzi, T.G.: Planning Telecommunication Networks, IEEE Press, 1999. Kenyon, T.: High Performance Data Network Design, Butterworth-Heinemann, 2000.	
Ti5315000	NETWORK PROGRAMMING	5 ECTS cr
	Tietoliikenneohjelmointi	
Year and Period	TkK 3, Period 2-3	
Lecturer	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.	
Course Work	Lectures 14 h, exercises 10 h, 2nd period. Exercises 8 h, 3rd period. 6 practical assignments. Final assignment. Assignments can not be combined from multiple years.	
Evaluation	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. Recommended Ti5213000 Unix and System Programming, Ti5312500 TCP/IP -perusteet.
Ti5315800	COMMUNICATIONS SOFTWARE AND ARCHITECTURE 5 ECTS cr
Year and Period	DI 1, Period 1-2
Lecturer	Assistant, M.Sc. (Tech.) Oleg Chistokhvalov
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.
Course Work	Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h, project assignment, extra tasks, 2nd period. Exam.
Evaluation	0 – 5. Exam 70 %, project 30 %.
Course Material	Lecture hand-outs.
Prerequisites	Recommended Ti5214000 Ohjelmistotuotanto, Ti5312000 Tietoliikennetekniikan perusteet 1, Ti5312300 Tietokoneverkot ja datasiirto.
Ti5315900	COMMUNICATION SOFTWARE LABORATORY WORK 5 ECTS cr
	Protokollaohjelmointi
Year and Period	DI 1, Period 3-4
Lecturer	Assistant, M.Sc. (Tech.) Oleg Chistokhvalov
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 (CVOPS/OVOPS/JVOPS).
Course Work	Laboratory demonstrations 14 h, 3rd period. Laboratory demonstrations 14 h, practical assignment, 4th period.
Evaluation	Project passed/failed.
Course Material	Lecture hand-outs.
Prerequisites	Ti5315800 Communications Software and Architecture. Recommended Ti5212200 Tietorakenteet ja C-kieli, Ti5212400 Olio-ohjelmoinnin perusteet, Ti5213000 Unix and System Programming, Ti5312000 Tietoliikennetekniikan perusteet 1, Ti5312300 Tietokoneverkot ja datasiirto.
Ti5316500	PERFORMANCE ANALYSIS OF TELECOMMUNICATION SYSTEMS 5 ECTS cr
	Suorituskykyanalyysi
	Lectured every second year only, next time 2007 - 2008.
Year and Period	DI 1, Period 1-2
Lecturer	Professor, D.Sc. (Tech.) Arto Kaarna
Aims	To describe the basic methods for modelling of computer and telecommunication systems.
Contents	Markov Chains, Stochastic Petri Nets, Queueing Systems.
Course Work	Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h and practical assignment, 2nd period. Exam.
Evaluation	0 – 5. Exam 100 %. Practical assignment.
Course Material	Ghanbari, M. et al: Principles of Performance Engineering for Telecommunication and Information Systems, CRC Press, 1997. Cassandras, C.G., Lafortune, S.: Introduction to Discrete Event Systems, Kluwer Academic Publishers, 1999.
Ti5316701	GROUP WORK COURSE ON COMMUNICATIONS SOFTWARE 8 ECTS cr
	Tietoliikenteen ryhmätyökurssi

	Lectured every second year only, next time 2007 - 2008.
Year and Period	DI 1, Period 1-4
Lecturer	Part-time teacher, Petri Heinilä
Aims	Lecturer responsible: Professor, D.Sc. (Tech.) Arto Kaarna To exercise skills and knowledge on large project work on protocol and software development, implementing communications software systems. To study different methods in communications software specification, design and implementation. The course is very practical.
Contents	Particular communications software system is specified, designed and implemented with different methods (eg. UML, SDL, Java, C, C++, CVOPS). Software system is implemented as a large multi group project work during the year. The implementations made have to be working together.
Course Work	Lectures 6 h, exercises 14 h, 1st period. Lectures 4 h, exercises 14 h, 2nd period. Lectures 4 h, exercises 14 h, 3rd period. Lectures 4 h, exercises 14 h, 4th period.
Evaluation	Independent group work 150 h. Course is given only if there are enough students enrolled. 0 – 5. Activity 30 %, implementations 50 %, group work 20 %.
Course Material	Will be announced on lectures.
Prerequisites	Recommended Ti5212400 Ohjelmistotuotannon menetelmät, Ti5213000 Unix and System Programming, Ti5214100 Ohjelmistotuotannon menetelmät, Ti5214400 Projektinhallinta, Ti5315000 Network Programming, Ti5315800 Communications Software and Architecture.

Ti5317000	PARALLEL COMPUTING	6 ECTS cr
	Rinnakkaislaskennan perusteet	
Year and Period	DI 1, Period 1-2	
Lecturer	Professor, D.Sc. (Tech.) Jari Porras	
Aims	Student understands 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.	
Course Work	Lectures 28 h, exercises 14 h, 1st period. Seminars 21 h, exercises 14 h, practical assignments, 2nd period. Exam.	
Evaluation	0 – 5. Exam 50 %, presentation 25 %, practical assignments 25 %.	
Course Material	Gram, A. et al.: Introduction to Parallel Computing, Addison-Wesley, 2003.	
Prerequisites	Recommended Ti5212600 Käyttöjärjestelmät, Ti5213000 Unix and System Programming.	

Ti5317100	PARALLEL PROGRAMMING	5 ECTS cr
	Rinnakkaisohjelmoinnin perusteet	
Year and Period	DI 1, Period 3-4	
Lecturer	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.	
Course Work	Lectures 14 h, exercises 14 h, practical assignments, 3rd period. Exercises 14 h, practical assignments, 4th period. Exam.	
Evaluation	0 – 5. Practical assignments 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 Publ., 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 Ti5212600 Käyttöjärjestelmät, Ti5213000 Unix and System Programming, Ti5317000 Parallel Computing.	

Ti5317200	DESIGN OF PARALLEL ALGORITHMS	5 ECTS cr
	Rinnakkaisalgoritmien suunnittelu	
	Lectured every second year only, next time 2006 - 2007.	
Year and Period	DI 1, Period 3-4	
Lecturer	Professor, D.Sc. (Tech.) Jari Porras	
Aims	Student knows the obstacles and methods of parallel algorithm design. Through these skills student can solve problems and implement algorithms that solve those problems in parallel environments.	
Contents	Methods for the parallel algorithm design, design and analysis of parallel algorithms, parallel algorithms in different parallel environments. Algorithms are selected each year separately.	
Course Work	Lectures, discussions 14 h, exercises 14 h, 3rd period. Lectures, discussions 14 h, exercises 14 h, practical work, 4th period. Exam.	
Evaluation	0 – 5. Exam, discussions, practical work.	
Course Material	Jaja, J.: An Introduction to Parallel Algorithms, Addison-Wesley, 1992. Grama, A. et al.: Introduction to Parallel Computing, Addison-Wesley, 2003.	
Prerequisites	Recommended Ti5212300 Algoritmien suunnittelu, Ti5317000 Parallel Computing, Ti5317100 Parallel Programming.	
Ti5317300	ADVANCED PARALLEL COMPUTING	5 ECTS cr
	Rinnakkaislaskennan jatkokurssi	
	Lectured every second year only, next time 2007 - 2008.	
Year and Period	DI 1-2, Period 3-4	
Lecturer	Professor, D.Sc. (Tech.) Jari Porras	
Aims	Gives an advanced view to the problems and needs of parallel computing in the modern world.	
Contents	Selected each year separately.	
Course Work	Lectures 14 h, exercises 14 h, discussions, group works, 3rd period. Lectures 14 h, exercises 14 h, discussions, group works, practical assignment, 4th period. Exam.	
Evaluation	0 – 5. Exam, discussions, group works, practical assignment.	
Course Material	Will be announced on lectures.	
Prerequisites	Recommended Ti5317000 Parallel Computing, Ti5317100 Parallel Programming.	
Ti5317411	DISTRIBUTED OBJECT PROGRAMMING	6 ECTS cr
	Hajautettu objektiohjelmointi	
Year and Period	DI 1, Period 1-2	
Lecturer	Part-time teacher, Petri Heinilä	
Aims	Lecturer responsible: Professor, D.Sc. (Tech.) Jari Porras 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.	
Course Work	Lectures 14 h, exercises 14 h, homeworks, 1st period. Lectures 14 h, exercises 14 h, homeworks, project work, 2nd period. Exam.	
Evaluation	0 – 5. Exam 50 %, project work 36 %, homeworks 14 %.	
Course Material	Lecture notes.	
Prerequisites	Recommended Ti5212400 Ohjelmoinnin perusteet, Ti5214000 Ohjelmistotuotanto, Ti5312000 Tietoliikennetekniikan perusteet 1, Ti5315000 Network Programming.	
Ti5318300	WIRELESS SERVICE ENGINEERING	5 ECTS cr
	Langattomien palveluiden tekniikka	
	Lectured every second year only, next time 2006 - 2007.	
Year and Period	DI 2, Period 1-2	
Lecturer	Senior Assistant, D.Sc. (Tech.) Pekka Jäppinen	
Aims	To understand the challenges that wireless communication technologies and mobile devices	

Contents	Wireless service types: fixed services, mobile Internet services, ad hoc 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.
Course Work	Lectures 21 h, demonstrations 14 h, exercises 14 h, practical assignment, 1st period.
Evaluation	Practical assignment, 2nd period. Exam.
Course Material	0 – 5. Exam 50 %, practical assignments 50 %.
Prerequisites	Will be announced on lectures. Ti5312600 Siirtyvä tietoliikenne, Ti5315000 Network Programming. Recommended Ti5315200 Symbian-ohjelmointi, Ti5315800 Communications Software and Architecture.

Ti5318800	SECURED COMMUNICATIONS	6 ECTS cr
	Suojatut tietoyhteydet	
	Lectured every second year only, next time 2007 - 2008.	
Year and Period	DI 1, Period 1-2	
Lecturer	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.	
Course Work	Lectures 14 h, exercises 14 h, 1st period.	
Evaluation	Lectures 8 h, seminars 20 h, practical assignment, 2nd period. Exam.	
Course Material	0 – 5. Exam 40 %, seminars 30 %, practical assignment 30 %. 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	Ti5313500 Tietoturvan perusteet. Recommended Ti5312500 TCP/IP -perusteet, Ti5315000 Network Programming.	

Ti5319500	RESEARCH METHODS	3 ECTS cr
	Tutkimusmenetelmät	
Year and Period	DI 1, Period 1	
Lecturer	Professor, 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.	
Course Work	Lectures 14 h, practical assignment, 1st period. Exam.	
Evaluation	0 – 5. Exam 50 %, practical assignment 50 %.	
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.	

Ti5319600	RESEARCH METHODS, LABORATORY PROJECT	5 ECTS cr
	Tutkimusmenetelmät, laboratorioprojekti	
Year and Period	DI 1, Period 2-4	
Lecturers	Professor, D.Sc. (Tech.) Heikki Kälviäinen, Professor, D.Sc. (Tech.) Arto Kaarna	
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.	
Course Work	Participation in the work of the research group, 2nd - 4th period.	
Evaluation	Passed/failed. Research report and seminar presentation.	
Course Material	Literature related to the research topic, agreed with the supervisor of the work.	
Prerequisites	Ti5319500 Research Methods finished, excellent grades in studies, evidence of successful research work.	

Ti5413300	COMPLEX ANALYSIS	3 ECTS cr
	Kompleksianalyysi	
	Lectured every second year only, next time 2006 - 2007.	
Year and Period	TkK 3, Period 3	
Lecturer	Lecturer responsible: Professor, Ph.D. Heikki Haario	
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.	
Course Work	Lectures 28 h, exercises 14 h, 3rd period. Exam.	
Evaluation	0 – 5. Exam 100 %.	
Course Material	Keyszig, E.: Advanced Engineering Mathematics, 8th Ed., Part D.	
Prerequisites	Recommended Matematiikka A and B.	
Ti5414100	STATISTICS II	3 ECTS cr
	Tilastomatematiikka II	
Year and Period	DI 1, Period 2	
Lecturer	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.	
Course Work	Lectures 28 h, exercises 14 h, assignment, 2nd period. Exam.	
Evaluation	0 – 5. Exam 70 %, assignment 30 %.	
Course Material	Will be announced on lectures.	
Prerequisites	Recommended Ti5413500 Tilastomatematiikka I.	
Ti5414200	SIMULATION	4 ECTS cr
	Simulointi	
Year and Period	TkK 3, Period 1	
Lecturer	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 optimization. Building numerical simulation examples with Matlab.	
Course Work	Lectures 28 h, exercises 14 h, practical assignment, 1st period. Exam.	
Evaluation	0 – 5. Exam 100 %. Practical assignment.	
Prerequisites	Recommended Ti5413500 Tilastomatematiikka I.	
Ti5414300	DIFFERENTIAL EQUATIONS	5 ECTS cr
	Differentiaaliyhtälöt	
	Lectured every second year only, next time 2007 - 2008.	
Year and Period	TkK 3, Period 3	
Lecturer	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.	
Course Work	Lectures 28 h, exercises 28 h, practical assignment, 3rd period. Exam.	
Evaluation	0 – 5. Exam 100 %. Practical assignment.	
Prerequisites	Matematiikka A and B. Recommended Ti5413700 Matriisilaskenta.	

Ti5414400	LOGIC AND DISCRETE METHODS	4 ECTS cr
	Logiikka ja diskreetit menetelmät	
Year and Period	DI 1, Period 4	
Lecturer	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, inductive, recursion and relational methods for computer science. Graphs and trees, grammars, formal languages and parsing are included in the course. Resolution method for non-classical logics is considered. Applications of number theory to computer science are also considered.	
Course Work	Lectures 21 h, exercises 14 h, 4th period. Exam.	
Evaluation	0 – 5. Exam 100 %.	
Course Material	Grassmann, W.K., Tremblay J-P.: Logic and Discrete Mathematics. A Computer Science Perspective, Prentice Hall, 1996.	
Prerequisites	Recommended Ti5413400 Diskreetit mallit ja menetelmät.	
Ti5414700	LINEAR ALGEBRA AND NORMED SPACES	3 ECTS cr
	Lineaarialgebra ja normiavaruudet	
Year and Period	DI 1, Period 1	
Lecturer	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 methods, optimization.	
Course Work	Lectures 21 h, exercises 14 h, 1st period. Exam.	
Evaluation	0 – 5. Exam 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	Ti5413700 Matriisilaskenta. Recommended Ti5413200 Vektorikentät, Ti5416100 Integral Transforms.	
Ti5416100	INTEGRAL TRANSFORMS	3 ECTS cr
	Integraalimuunnokset	
Year and Period	TkK 3, Period 4	
Lecturer	Lecturer responsible: Professor, Ph.D. Heikki Haario	
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.	
Course Work	Lectures 28 h, exercises 14 h, 4th period. Exam.	
Evaluation	0 – 5. Exam 100 %.	
Course Material	Kreyszig, E.: Advanced Engineering Mathematics, Wiley, 1999. James, G.: Advanced Modern Engineering Mathematics, Addison-Wesley, 1993.	
Prerequisites	Recommended Matematiikka A and B.	
Ti5416200	NUMERICAL ANALYSIS II	3 ECTS cr
	Numeerinen analyysi II	
Year and Period	DI 1, Period 4	
Lecturer	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 integration, Newton-Cotes quadrature, Gaussian quadrature, Romberg integration. Numerical solution of ordinary differential equations, linear multistep methods, 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.	
Course Work	Lectures 21 h, exercises 14 h, 4th period. Exam.	
Evaluation	0 – 5. Exam 100 %.	

Course Material	Will be announced on lectures.	
Prerequisites	Matematiikka A and B. Recommended Ti5413600 Numeerinen analyysi I, Ti5413700 Matriisilaskenta.	
Ti5416300	NONLINEAR OPTIMIZATION	4 ECTS cr
	Epälineaarinen optimointi	
	Lectured every second year only, next time 2007 - 2008.	
Year and Period	TkK 3, Period 4	
Lecturer	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.	
Course Work	Lectures 28 h, exercises 14 h, homework, 4th period. Exam.	
Evaluation	0 – 5. Exam 100 %. Practical assignment.	
Course Material	Will be announced on lectures.	
Prerequisites	Matematiikka A and B, Ti5413600 Numeerinen analyysi I. Experience in programming or using mathematical software required.	
Ti5416400	DISCRETE OPTIMIZATION	4 ECTS cr
	Diskreetti optimointi	
	Lectured every second year only, next time 2006 - 2007.	
Year and Period	TkK 3, Period 4	
Lecturer	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.	
Course Work	Lectures 28 h, exercises 28 h, 4th period. Practical assignment. Exam.	
Evaluation	0 – 5. Exam 100 %. Practical assignment.	
Course Material	Will be announced on lectures.	
Prerequisites	Experience in programming or using mathematical software required. Recommended Ti5413400 Diskreetit mallit ja menetelmät, Ti5413800 Lineaarinen optimointi.	
Ti5416500	STATISTICAL ANALYSIS IN MODELLING	3 ECTS cr
	Mallien tilastollinen analyysi	
Year and Period	DI 1, Period 2	
Lecturer	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, Monte Carlo (MCMC) methods for nonlinear models.	
Course Work	Lectures 21 h, exercises 14 h, 2nd period. Practical assignment. Exam.	
Evaluation	0 – 5. Exam 100 %. Practical assignment.	
Prerequisites	Matematiikka A and B, Ti5413500 Tilastomatematiikka I. Recommended Ti5414200 Simulation.	
Ti5416600	FUZZY SETS AND FUZZY LOGIC	6 ECTS cr
	Sumeat joukot ja sumea logiikka	
	The course will be lectured next time during the academic year 2006 – 2007.	
Year and Period	DI 1, Period 2	
Lecturer	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 basing on Lukasiewicz algebras.
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, and fuzzy modelling and control.
Course Work	Lectures 28 h, exercises 14 h, 2nd period. Practical assignment. Exam.
Evaluation	0 – 5. Exam 100 %. Practical assignment.
Course Material	Nguyen, H.T., Walker, E.A.: A First Course in Fuzzy Logic, 2nd Ed., Chapman & Hall/CRC, 2000.
Prerequisites	Recommended Ti5414500 Sumeat menetelmät.

Ti5416700	FUZZY ENGINEERING	6 ECTS cr
	Sumea teknologia	
	Lectured every second year only, next time 2006 - 2007.	
Year and Period	DI 1, Period 4	
Lecturer	Ph.D. Jari Kortelainen	
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 learn some image processing methods. Finally, fuzzy cognitive maps are introduced.	
Contents	Fuzzy sets and relations. Fuzzy functions and rule-based systems. Mamdani fuzzy system and Sugeno-Tagaki fuzzy system. Universal approximator theorem. Fuzzy control. Fuzzy controllers in applications. Some image processing techniques. Fuzzy cognitive maps with applications.	
Course Work	Lectures 28 h, exercises 14 h, 4th period. Practical assignment. Exam.	
Evaluation	0 – 5. Exam 100 %. Practical assignment.	
Course Material	Bandemer, H., Näther, W.: Fuzzy Data Analysis, Kluwer Academic Publ., 1992. Kosko, B: Fuzzy Engineering, Prentice-Hall, 1996. Passino, K.M., Yurkovich, S.: Fuzzy Control, Addison-Wesley, 1998.	
Prerequisites	Recommended Ti5414500 Sumeat menetelmät, Ti5416600 Fuzzy Sets and Fuzzy Logic.	

Ti5417100	STOCHASTIC THEORY AND MODELS	3 ECTS cr
	Stokastiikan teoriaa ja malleja	
Year and Period	DI 1, Period 4	
Lecturer	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.	
Course Work	Virtual course. Lectures (web) 14 h, exercises 12 h, project assignment, 4th period. Self-study material. Exam.	
Evaluation	0 – 5. Exam 50 %, project assignment 50 %.	
Course Material	Will be announced on lectures.	
Prerequisites	Ti5413500 Tilastomatemiikka I. Recommended Ti5414100 Statistics II, Ti5414700 Linear Algebra and Normed Spaces.	

Ti5417200	DESIGN OF EXPERIMENTS	3 ECTS cr
	Koesuunnittelu	
	Lectured every second year only, next time 2007 - 2008.	
Year and Period	DI 1, Period 4	
Lecturer	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.	
Course Work	Lectures 28 h, exercises 28 h, practical assignment, 4th period. Exam.	
Evaluation	0 – 5. Exam 100 %. Practical assignment.	
Prerequisites	Matematiikka A and B, Ti5413500 Tilastomatemiikka I.	

Ti5417300	FUNCTIONAL ANALYSIS	3 ECTS cr
	Funktionaalianalyysi	
	Lectured every second year only, next time 2006 - 2007.	
Year and Period	DI 1, Period 2	
Lecturer	Lecturer, Ph.D. Matti Heiliö	
Aims	Principles of functional analysis giving a basis for understanding modern theory and methods in applied mathematics.	
Contents	Hilbert spaces and Banach spaces. Measures and Lebesgue integral, Lp-spaces. Basics of calculus of variations and optimal control. Integral transforms. Elements of wavelet theory and linear systems theory. Sobolev norms, variational principle and weak solutions of PDE:s.	
Course Work	Introduction to stochastic differential equations.	
Evaluation	Lectures 21 h, exercises 14 h, 2nd period. Exam.	
Course Material	0 – 5. Exam 100 %.	
	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.	
	Curtain, R.F., Pritchard, A.J.: Functional analysis in modern applied mathematics, Academic Press, 1977.	
	Rao, R.M., Bopardikar, A.S.: Wavelet transforms, Introduction to theory and applications, Addison-Wesley, 1998.	
Prerequisites	Ti5414700 Linear Algebra and Normed Spaces. Recommended Ti5413300 Complex Analysis, Ti5413600 Numeerinen analyysi I, Ti5416100 Integral Transforms.	
Ti5417400	FUZZY DATA ANALYSIS	6 ECTS cr
	Data-analyysiä sumeassa ympäristössä	
	Lectured every second year only, next time 2007 - 2008.	
Year and Period	DI 2, Period 3	
Lecturer	Ph.D. Jari Kortelainen	
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. Evaluation of methods.	
Course Work	Lectures 28 h, exercises 14 h, 3rd period. Practical assignment. Exam.	
Evaluation	0 – 5. Exam 100 %. Practical assignment.	
Course Material	Bandemer, H., Näther, W.: Fuzzy Data Analysis, Kluwer Academic Publ., 1992.	
Prerequisites	Recommended Ti5414500 Sumeat menetelmät, Ti5416600 Fuzzy Sets and Fuzzy Logic.	
Ti5417500	FUZZY DECISION MAKING	6 ECTS cr
	Päätöksenteko sumeassa ympäristössä	
	Lectured every second year only, next time 2007 - 2008.	
Year and Period	DI 2, Period 2	
Lecturer	Professor, Ph.D. Jorma K. Mattila	
Aims	To introduce decision making in a fuzzy environment. The student will learn approximate reasoning, fuzzy neural networks, fuzzy clustering, fuzzy screening systems and some perspectives on fuzzy decision making.	
Contents	The central methods of fuzzy inference and decision making.	
Course Work	Lectures 28 h, exercises 14 h, 2nd period. Practical assignment. Exam.	
Evaluation	0 – 5. Exam 100 %. Practical assignment.	
Course Material	Fullér, R.: Introduction to Neuro-Fuzzy Systems, Physica-Verlag, 2000.	
Prerequisites	Recommended Ti5414500 Sumeat menetelmät, Ti5416600 Fuzzy Sets and Fuzzy Logic.	
Ti5417600	ADVANCED MATHEMATICAL METHODS	3 - 6 ECTS cr
	Matemaattisten menetelmien erikoiskurssi	
Year and Period	DI 1, Period 1-4	
Lecturer	Lecturer, Ph.D. Matti Heiliö	
Aims	Student will obtain theoretical and operational skills in some specific area of applied mathematics.	

Contents	This elective course will demand reading literature and working on exercises and practical projects which can be individually chosen according to students interests and research challenge. The topic may be for example optimization, numerical methods, PDE:s, stochastics, theory of algorithms, wavelet theory, etc.
Course Work	Self study material, exam and/or report.
Evaluation	0 – 5. Exam and/or report 100 %.
Prerequisites	Recommended Ti5413200 Vektorikentät, Ti5413600 Numeerinen analyysi I, Ti5413700 Matriisilaskenta.

Ti5417700	MODELLING METHODOLOGY IN PROCESS ENGINEERING	5 ECTS cr
	Mallinnus prosessiteknikassa	
Year and Period	DI 1, Period 1-2	
Lecturer	Professor, Ph.D. Heikki Haario	
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.	
Course Work	Lectures 21 h, exercises 14 h, 1st period.	
Evaluation	Lectures 21 h, exercises 14 h, 2nd period. Practical assignment. Exam.	
Course Material	0 – 5. Exam 100 %. Practical assignment. Giordano, F., Weir, M., Fox, W.: A First Course in Mathematical Modelling, Brooks/Cole Publishing, 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	Matematiikka A and B. Recommended Ti5413500 Tilastomatematiikka I, Ti5413600 Numeerinen analyysi I, Ti5413700 Matriisilaskenta, Ti5414300 Differential Equations.	

Ti5417800	CASE STUDY SEMINAR	6 ECTS cr
	Sovelletun matematiikan erikoistyöt	
Year and Period	DI 1, Period 1-4	
Lecturer	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.	
Course Work	Exercises 14 h, 1st period. Exercises 14 h, 2nd period. Exercises 14 h, 3rd period. Exercises 14 h, 4th period.	
Evaluation	Extended project work. Seminar is held in each period. Passed/failed. To pass the course student must attend 7 weeks and present his/her project work.	
Prerequisites	Matematiikka A and B. Recommended Ti5413600 Numeerinen analyysi I, Ti5413700 Matriisilaskenta, Ti5417700 Modelling Methodology in Process Engineering.	

5 Master's Degree Programme in Electrical Engineering

The Master's Degree Programme in Electrical Engineering is a higher university degree programme in English designed to educate international experts in the field of power and automation technologies and forest and energy market industry.

5.1 The aim of the 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.

5.2 The structure of the programme

Depending 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 an individual study program.** The International Master's Degree Programme in Electrical Engineering is structured of following subject blocks:

of Master Science (Technology)	Major Subject (incl. Major Studies and Master's Thesis) and Minor subject			Minor subject
	Master's Thesis on major subject 30 ECTS credits			
	Electrical Engineering Major subject Industrial Electronics	Electrical Engineering Major subject Electricity Distribution and Market	Electrical Engineering Major subject Physics	
	Select a major subject			

One major and one minor subject have to be chosen from the technology fields in electrical engineering (industrial electronics, electricity distribution or physics). Economics and languages must be chosen as a minor subject only.

5.3 Course Descriptions

Sa2710201	POWER EXCHANGE GAME FOR ELECTRICITY MARKETS	3 ECTS cr
Year and Period	Sähkökaupan pörssipeli DI 1, Period 2-3	
Lecturer	Lecturer 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.	
Course Work	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.	
Evaluation	0 - 5, final report in writing 100%	
Course Material	Material to be distributed during the lectures.	
Prerequisites	Sa2710400 Electricity Market.	
Sa2710401	ELECTRICITY MARKET	5 ECTS cr
Year and Period	Sähkömarkkinat DI 1, Period 1	
Lecturer	Professor, D.Sc. (Tech) Jarmo Partanen	
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 distribution business.	
Course Work	28 h of lectures, 14 h of tutorials, 1st period. Independent studies. Written examination.	
Evaluation	0 - 5, examination 100%.	
Course Material	Material to be distributed during the lectures.	

Sa2710501	ELECTRICITY DISTRIBUTION TECHNOLOGY	8 ECTS cr
	Sähköjälkitekniikka	
Year and Period	DI 1, Period 2-3	
Lecturer	Lecturer 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.	
Course Work	42 h of lectures, 28 h of tutorials, 2nd and 3rd period. Assignment. Written examination.	
Evaluation	0 - 5, examination 100%. Satisfactorily completed assignment required.	
Course Material	Lakervi, Holmes: Electricity distribution network design (where applicable). Lakervi: Sähköjälkiverkkojen suunnittelu, Otatiето.	
Prerequisites	Students are required to have completed Sa2710700 Introduction to Electrical Power Systems, Sa2710600 Electrical Power Transmission, and have attended the lectures of Sa2710400 Electricity Markets.	
Sa2710601	ELECTRICAL POWER TRANSMISSION	5 ECTS cr
	Sähkösiirtotekniikka	
Year and Period	DI 1, Period 2	
Lecturer	Lecturer 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.	
Course Work	24 h of lectures, 14 h of tutorials, 2nd period. Written examination.	
Evaluation	0 - 5, examination 100%.	
Course Material	Mörsky: Voimalaitosten yhteiskäytön tekniikka (Otatiето Moniste 549). Mörsky: Relesuojaustekniikka. (Otatiето, moniste 540).	
Prerequisites	Students are required to have completed Sa2720000 Electric Circuits and attended the lectures of Sa2710700 Introduction to Electrical Power Systems.	
Sa2720400	DESIGN OF AN ELECTRICAL MACHINE	6 ECTS cr
	Sähkökoneen suunnittelu	
	Suomenkielinen opetusmoniste sekä suomenkieliset harjoitustehtävät ovat saatavilla.	
Year and Period	DI 2, Period 1	
Lecturer	Professor, D.Sc. (Tech) Juha Pyrhönen	
Aims	The course will give the student a basic knowledge of the thorough calculation of an electric machine as well as the skills required in finding structural solutions based on desired machine characteristics. Further, the students are trained to compare these solutions by calculating, to utilise mathematical software in calculation, and to analyse the machine characteristics by measurements. The students are also acquainted with simulations as well as with the mechanical aspects of the machine design.	
Contents	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, effective value-phasor diagrams for different machine types, principles of electric machine design (induction motor).	
Course Work	28 h of lectures, 28 h of tutorials, 1st period.	
Evaluation	The design assignment of an electric machine. Written examination.	
Course Material	0 - 5, written examination 100%. Satisfactorily completed assignment required. Pyrhönen: Design of a rotating electric machine (Pyörivän sähkökoneen suunnittelu). Pyrhönen: Magneettiset materiaalit (where applicable). C.B. Gray: Electrical Machines and Drive Systems (where applicable).	
Prerequisites	Students are recommended to have completed Sa2720000 Electric Circuits, Sa2700100 Basics of Electric Engineering, and Sa2720200 Laboratory Course in Electrical Engineering and attended the lectures of Sa2720300 Electromagnetism.	

Sa2720600	POWER ELECTRONICS	6 ECTS cr
	Tehoelektroniikka	
Year and Period	DI 1, Period 1-2	
Lecturer	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.	
Course Work	14 h of lectures, 14 h of tutorials, 1st period 14 h of lectures, 14 h of tutorials, 2nd period. Written examination	
Evaluation	0 - 5, written examination 100%	
Course Material	Mohan, Undeland, Robbins: Power Electronics, converters, applications, and design, where applicable.	
Prerequisites	Sa2720000 Electric Circuits. Sa2720900 Power Electronics Components. Integration and derivation (esp. sine and cosine functions). FFT. Laplace transforms.	
Sa2721010	SEMINAR COURSE IN ELECTRICAL DRIVES	4 ECTS cr
	The course is designed for students of the international Master's degree programme 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	DI 1, Period 1	
Lecturer	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. The course is an essential prerequisite for those involved in the CDMC co-operation.	
Contents	Theory, operation and equivalent circuits of electrical motor drives. Fundamentals of space vector theory. Synchronous drive. Asynchronous drive. DC drive. Torque production mechanisms in different machines. Power electronic connections for motor control. Scalar control, vector control. Direct flux linkage control and direct torque control (DTC).	
Course Work	Intensive course. 3 sessions of 6 h lectures, 1 session of 6 h seminar, 1 session of 6 h tutorials, 1st period. Seminar work.	
Evaluation	0 - 5, seminar work 100%.	
Prerequisites	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.	
Sa2721300	NUMERICAL METHODS OF ELECTROMAGNETISM	4 ECTS cr
	Sähkömagnetismin numeeriset menetelmät	
Year and Period	DI 2, Period 3	
Lecturer	Researcher/Teacher, D.Sc. (Tech) Janne Nerg	
Aims	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.	
Course Work	28 h of supervised tutorials. 3rd period. Course requirements: participation in tutorials and a satisfactorily completed assignment.	
Evaluation	0 - 5, assignment 100%	
Prerequisites	Sa2720500 Introduction to Electrical Drives and Sa2720400 Design of an Electrical Machine	

Sa2731100	REAL-TIME OPERATING SYSTEMS AND PROGRAMS	5 ECTS cr
	Reaaliaikakäyttöjärjestelmät ja -ohjelmistot	
Year and Period	DI 2, Period 1-2	
Lecturer	Researcher/Teacher, D.Sc. (Tech) Julius Luukko	
Aims	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.	
Course Work	21 h of lectures, 14 h of tutorials, 1st period. 21 h of lectures, 14 h of tutorials, 2nd period. Written examination.	
Evaluation	0 - 5, examination 100%.	
Course Material	Labrosse, J.J.: MicroC/OS-II The Real-Time Kernel (2nd Edition).	
Prerequisites	Sa2731000 Embedded Microprocessor Systems	
Sa2731200	EMBEDDED SYSTEM PROGRAMMING	4 ECTS cr
	Laiteläheinen ohjelmointi	
Year and Period	DI 1, Period 1-2	
Lecturer	Researcher/Teacher, D.Sc. (Tech) Tuomo Lindh	
Aims	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.	
Course Work	14 h of lectures, 14 h of tutorials, 1st period. 14 h of lectures, 14 h of tutorials, 2nd period. Assignment. Written examination.	
Evaluation	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, knowledge of the basic structure of microprocessors.	
Sa2731300	DIGITAL CONTROL DESIGN	4 ECTS cr
	Digitaalisäädön suunnittelu	
Year and Period	DI 1, Period 1-2	
Lecturer	Professor, D.Sc. (Tech) Olli Pyrhönen	
Aims	Compilation of a discrete model, design and programming of a simple digital controller, simulation of a digital control circuit.	
Contents	State feedback, state estimator, design of a state-space controller, polynomial control design. Fundamentals of a 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.	
Course Work	14 h of lectures, 14 h of tutorials, 1st period. 6 h of demonstration lectures, 14 h of tutorials in computer class, 2nd period. Assignment. Written examination.	
Evaluation	0 - 5, examination 100%. Satisfactorily completed assignment required.	
Prerequisites	Sa2730200 Control Systems, Introduction. Sa2730500 Digital Control, an Introduction.	
Sa2810600	APPLIED OPTICS	6 ECTS cr
	Sovellettu optiikka	
Year and Period	DI 1, Period 2	
Lecturer	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. Colour optics. Optical measurement instruments. Interferometry. Polarisation. Diffraction. Fourier optics. The optical properties of materials.	

Course Work	42 h of lectures, 28 h of tutorials, 2nd period. Written examination.
Evaluation	0 - 5, examination 100%.
Course Material	Pertti Silfsten, Sovellettu optiikka
Prerequisites	Students are recommended to have completed Sa2810110 Physics, Sa2810210 Physics L, or Sa2810010 and Sa2810020 Physics T.

Sa2811100	SEMICONDUCTOR PHYSICS	6 ECTS cr
	Puolijohdefysiikka	
Year and Period	DI 1, Period 3-4	
Lecturer	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.	
Course Work	28 h of lectures, 14 h of tutorials, 3rd period. 14 h of lectures, 14 h of tutorials, 4th period. Written examination.	
Evaluation	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.	

Sa2811200	SUPERCONDUCTOR PHYSICS	6 ECTS cr
	Suprajohdefysiikka	
Year and Period	DI 1, Period 1-2	
Lecturer	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.	
Course Work	14 h of lectures, 14 h of tutorials, 1st period. 28 h of lectures, 14 h of tutorials, 2nd period. Written examination.	
Evaluation	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.	

Sa2910300	ADVANCED COURSE IN ELECTRONICS	6 ECTS cr
	Elektroniikan erikoiskurssi	
Year and Period	DI 1, Period 3-4	
Lecturer	Professor, D.Sc. (Tech) Pertti Silventoinen	
Aims	During this course, the student will obtain a deep knowledge of a new topic in electronics. The course can also be included in post-graduate studies.	
Contents	The course contents are subject related and will be specified during the introductory lectures.	
Course Work	2h of introductory lectures 2 h, 12 h of seminar presentations, 3rd period. 14 h of seminar presentations, 4th period. No written examination.	
Evaluation	0 - 5, seminar presentation 100%.	

Sa2920700	ELECTROMAGNETIC COMPATIBILITY IN POWER ELECTRONICS	2 ECTS cr
	Tehoelektroniikan häiriösuojatekniikka	
Year and Period	DI 1, Period 1	
Lecturer	Professori, TKT 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.	
Contents	Power electronics as an interference source, network harmonics, reflection phenomena of cables, conductive RF interference, interference radiation of power electronics, filtering	

Course Work	techniques of conductive interferences. 14 h of lectures, 1st period.
Evaluation	An assignment to be completed as pair work. Written examination. 0 - 5, written examination 100%. Satisfactorily completed assignment required.
Sa2930200	MICROELECTRONICS 6 ECTS cr
	Mikroelektroniikka
	The course will be lectured in English if required.
Year and Period	DI 1, Period 3
Lecturer	Professor, Ph.D. Tuure Tuuva, Assistant, M.Sc. (Tech) Tanja Palviainen
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.
Course Work	3rd period: 28 h of lectures, 28 h of tutorials. Assignment and its presentation. Written examination.
Evaluation	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 Sa293000 Basic Course on Microelectronics, Sa2930100 Analog Electronics, and Sa2910100 Digital Electronics.
Sa2930300	COMPUTER ARCHITECTURE 6 ECTS cr
	Tietokonearkkitehtuurit
	The course will be lectured in English if required.
Year and Period	DI 1, Period 1
Lecturer	Professor, Ph.D. Tuure Tuuva
Aims	To acquaint students with the components of a computer and the design aspects of different types of computers.
Contents	The fundamentals of computer design and performance measurements. The Central Processing Unit (CPU), pipelining and multiprocessor systems, memory hierarchies. I/O, a look at the latest commercial processors as well as their applications and technologies.
Course Work	14 h of lectures, 1st period. Independent study and assignments. Written examination.
Evaluation	0 - 5, examination 100%. Satisfactorily completed assignment required.
Course Material	Patterson, D.A., Hennessy, J.L.: Computer Architecture: A Quantitative Approach. Morgan Kaufmann, San Mateo, CA, 3. painos, 2002.
Prerequisites	Students are recommended to have completed the courses Sa2940000 Basic Digital Circuits and Sa2910210 Microprocessors A.
Sa2930400	PHYSICS OF SEMICONDUCTOR DEVICES 6 ECTS cr
	Puolijohdekomponenttien fysiikka
Year and Period	DI 1-2
Lecturer	Professor, Ph.D. Tuure Tuuva
Aims	To provide the student with an in-depth knowledge of semiconductor devices and their operation.
Contents	Structure, operation and physics of semiconductor devices.
Course Work	Special assignment.
Evaluation	0 - 5, special assignment 100%.
Course Material	Sze, Physics of Semiconductor Devices.
Sa2930500	CMOS ANALOG CIRCUIT DESIGN 6 ECTS cr
	CMOS-piirien suunnittelu
Year and Period	DI 1-2
Lecturer	Professor, Ph.D. Tuure Tuuva
Aims	To provide the student with a knowledge of the IC design and characterization.
Contents	CMOS circuit technology, analog IC design and device modelling.
Course Work	Special assignment

Evaluation	0 - 5, special assignment 100%.	
Course Material	Allen, Holberg, CMOS Analog Circuit Design	
Sa2930600	<i>ANALOG CIRCUIT DESIGN</i>	<i>6 ECTS cr</i>
	Erikoispiirien suunnittelu	
Year and Period	DI 1-2	
Lecturer	Professor, Ph.D. Tuure Tuuva	
Contents	Special circuit applications, VCO, DA/AD converters and Chopper amplifiers	
Course Work	Special assignment.	
Evaluation	0 - 5, special assignment 100%.	
Course Material	Williams, Analog Circuit Design	
Prerequisites	Sa2930200 Microelectronics	
Sa2930700	<i>SILICON VLSI TECHNOLOGY</i>	<i>6 ECTS cr</i>
	IC-piirien prosessointi	
Year and Period	DI 1-2	
Lecturer	Professor, Ph.D. Tuure Tuuva	
Aims	To provide students with a knowledge of the IC manufacturing techniques. Simulation of the manufacturing process or/and integrated circuit processing as a special assignment.	
Contents	Cleaning of semiconductor materials. Production of silicon wafers. Epitaxy. Diffusion. Ion implantation. Oxidization. Etching. Photolithography. Component manufacturing.	
Course Work	Special assignment or alternatively a written examination.	
Evaluation	0 - 5, examination or alternatively special assignment 100%.	
Course Material	Silicon VLSI Technology: Fundamentals, Practice and Modelling, James D.Plummer, Michael D.Deal, Peter B.Griffin	

6 Master's Degree Programme in Chemical and Process Engineering

The Master's degree programme, titled as "Innovative Process and Product Engineering", 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.

6.1 Objectives 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 postgraduate 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.

6.2 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 in either 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.

6.3 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.

6.4 The Degree Structure

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

6.4.1 General Studies (obligatory)

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.

<i>Communication Skills (9 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ke3600900	Cross-Cultural Communication for Working Life	DI 1	3-4	2
Ko4000300	Introduction to M.Sc. Studies	DI 1	1-2	1
Ki71X 6EC [*]	Language and Communication Studies			6

^{*} The course Ki7131200 Teknisk svenska is obligatory for Finnish students who have not attained proficiency in Swedish in their previous degree.

6.4.2 Major Subject (70 ECTS cr)

Sustainable Process Engineering

<i>Obligatory Studies (62 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ke3110500	Chemical Engineering Unit Operations II	DI 1	1	4
Ke3110600	Chemical Engineering Unit Operations III	DI 1	2	4
Ke3130400	Project on Process and Plant Design	DI 2	1-2	11
Ke3140100	Product Design	DI 1	4	5
Ke3330801	Chemical Separation Methods	DI 1	3-4	8
Thesis	Master's Thesis			30

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

<i>List of Selectable Courses</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ke3110900 ¹	Treatment Processes of Industrial Discharges	TkK 3	3-4	5
Ke3111101	Advanced Course in Environmental Technology	DI 1	3-4	6
Ke3111200	Filtration and Mixing	DI 1	3-4	6
Ke3250200	Chemical Pulping Technology: Chemical Recovery	DI 1	1-2	4
Ke3250300	Chemical Pulping Technology: Fiberline Operations	DI 1	3-4	6
Ke3250400	Fiber Technology; Personal Assignment		1-4	6
Ke3320300	Transport Phenomena	DI 1	2	3
Ke3600600	Process Control Systems in Pulp and Paper Industry	DI 2	1-2	3
Ke3601000	Pulp and Paper Technology	DI 1	1-2	5

¹ The course will be studied in the 4th year (DI 1).

6.4.3 Minor Subject (20 ECTS cr)

Advanced Design Methodology

<i>Min. 20 ECTS credits should be selected</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ke3130600	Computational Fluid Dynamics in Chemical Engineering	DI 2	2	6
Ke3131100	Process Intensification	DI 1	2	2
Ke3131300	Process Simulation	DI 1	3-4	6
Ke3140000	Creative Design	DI 1	1	3
Ke3600200	Dynamics and Control of Chemical Processes	DI 2	1-2	4
Ti5417700	Modelling Methodology in Process Engineering	DI 1	1-2	5

6.4.4 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.

6.5 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 Sari Damstén (room 2355, sari.damsten@lut.fi).

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.

Further information: senior assistant Harri Niemi (room 2120, harri.niemi@lut.fi).

Contact Information

Programme Coordinator:

Professor, Ph.D. Andrzej Kraslawski (room 2362, andrzej.kraslawski@lut.fi), programme content

Programme Secretary:

Piia Vahvanen (room 2318, piia.vahvanen@lut.fi), practical issues

Programme web pages: www.lut.fi/ippe

6.6 The Courses Offered in English

<i>Department of Chemical Technology</i>		<i>ECTS cr</i>
Ke3000000	Laboratory Work Course in Chemical Technology	10 - 20

<i>Laboratory of Separation Technology</i>		<i>ECTS cr</i>
Ke3110500	Chemical Engineering Unit Operations II	4
Ke3110600	Chemical Engineering Unit Operations III	4
Ke3110900	Treatment Processes of Industrial Discharges	5
Ke3111101	Advanced Course in Environmental Technology	6
Ke3111200	Filtration and Mixing	6

<i>Laboratory of Product and Process Development</i>		<i>ECTS cr</i>
Ke3130400	Project on Process and Plant Design	11
Ke3130600	Computational Fluid Dynamics in Chemical Engineering	6
Ke3131100	Process Intensification	2
Ke3131300	Process Simulation	6

<i>Laboratory of Systems Engineering</i>		<i>ECTS cr</i>
Ke3140000	Creative Design	3
Ke3140100	Product Design	5

<i>Laboratory of Membrane Technology and Technical Polymer Chemistry</i>		<i>ECTS cr</i>
Ke3220400	Membraanitekniikan ja teknillisen polymeerikemian syventävä opintojakso / Advanced Course in Membrane Technology and Technical Polymer Chemistry*	10
Ke3220500	Synteettiset polymeerit: Liimat ja hartsit / Synthetic Polymers: Glues and Resins*	5
Ke3220601	Proteiinien kemia ja mikrobiologia / Protein Chemistry and Microbiology*	4

* The course will be given in English if required.

<i>Laboratory of Fiber Technology</i>		<i>ECTS cr</i>
Ke3250200	Chemical Pulping Technology: Chemical Recovery	4
Ke3250300	Chemical Pulping Technology: Fiberline Operations	6
Ke3250400	Fiber Technology; Personal Assignment	6

<i>Laboratory of Physical Chemistry</i>		<i>ECTS cr</i>
Ke3320300	Transport Phenomena	3
Ke3320900	Properties of Gases and Liquids	5

<i>Laboratory of Technical Chemistry</i>		<i>ECTS cr</i>
Ke3330200	Teknillinen kemia / Industrial Chemistry*	10
Ke3330400	Catalysis	4
Ke3330700	Industrial Biotechnology	2
Ke3330801	Chemical Separation Methods	4 - 8
Ke3330901	Separation Methods in Food Industry	3
Ke3331000	Nutritional and Food Biotechnology	3

* The lectures will be given in English.

<i>Master's Degree Programme in Chemical Technology (IPPE)</i>		<i>ECTS cr</i>
Ke3600000	Latest Developments in CAPE	6
Ke3600100	Production Planning	4
Ke3600200	Dynamics and Control of Chemical Processes	4
Ke3600400	R&D Methodology	3
Ke3600600	Process Control Systems in Pulp and Paper Industry	3
Ke3600900	Cross-Cultural Communication for Working Life	2
Ke3601000	Pulp and Paper Technology	5

6.6.1 Course Descriptions

Ke3000000	LABORATORY WORK COURSE IN CHEMICAL TECHNOLOGY	10 - 20 ECTS cr
	Kemiantekniikan laboratoriotyökurssi	
	The course is mainly intended for foreign visiting students. The students register for the course by contacting the supervisor.	
Lecturer	N. N. Lecturer 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.	
Course Work	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.	
Evaluation	Pass - Fail	
Course Material	Literature related to the project.	
Ke3110500	CHEMICAL ENGINEERING UNIT OPERATIONS II	4 ECTS cr
	Kemiantekniikan yksikköoperaatiot II	
Year and Period	DI 1, Period 1	
Lecturer	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 Ke3110400 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.	
Course Work	Lectures 12 h, exercises 28 h, 1st period.	
Evaluation	0-5, written examination 100 %.	
Course Material	Lecture notes.	
Prerequisites	Ke3110400 Kemiantekniikan yksikköoperaatiot I and Ke3320100 Johdanto kemiälliseen termodynamiikkaan passed.	
Ke3110600	CHEMICAL ENGINEERING UNIT OPERATIONS III	4 ECTS cr
	Kemiantekniikan yksikköoperaatiot III	
Year and Period	DI 1, Period 2	
Lecturer	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 Ke3110400 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.	
Course Work	Lectures 12 h, exercises 28 h, 2nd period. Laboratory work and reports.	
Evaluation	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	Ke3110400 Kemiantekniikan yksikköoperaatiot I and Ke3320100 Johdanto kemiälliseen termodynamiikkaan passed.	
Ke3110900	TREATMENT PROCESSES OF INDUSTRIAL DISCHARGES	5 ECTS cr
	Teollisuuden päästöjen käsittelyprosessit	
Year and Period	TkK 3, Period 3-4	

Lecturer	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.
Course Work	Lectures and exercises 21 h, 3rd period. Lectures and exercises 21 h, 4th period.
Evaluation	0-5, written examination 100 %.
Course Material	Peavy, H.S., Rowe, D.R., Tchobanoglous, G., Environmental Engineering, McGraw-Hill, 1st ed., 1985.
Prerequisites	Recommended Ke3110000 Nesteiden, kaasujen ja kiintoaineiden käsittely, Ke3110100 Mekaaniset erotusmenetelmät and Ke3110400 Kemiaantekniikan yksikköoperaatiot I osa 2 attended.

Ke3111101	ADVANCED COURSE IN ENVIRONMENTAL TECHNOLOGY 6 ECTS cr
	Ympäristötekniikan jatkokurssi
	Replaces the course Ke3111100 Advanced Course in Environmental Technology.
Year and Period	DI 1, Period 3-4
Lecturer	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.
Course Work	Lectures 6 h, exercises 8 h, 3rd period. Lectures 6 h, exercises and seminars 16 h, 4th period. Literature work, report and seminar presentation.
Evaluation	0-5, written examination 50 %, report and seminar 50 %.
Course Material	Lecture notes.

Ke3111200	FILTRATION AND MIXING	6 ECTS cr
	Suodatus ja sekoitus	
Year and Period	DI 1, Period 3-4	
Lecturer	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.	
Course Work	Lectures 14 h, exercises 14 h, 3rd period. Lectures 14 h, exercises 14 h, 4th period. Laboratory work and reports.	
Evaluation	0-5, written examination 100 %, reports passed.	
Course Material	Additional material will be informed at lectures.	
Prerequisites	Ke3110100 Mekaaniset erotusmenetelmät passed.	

Ke3130400	PROJECT ON PROCESS AND PLANT DESIGN	11 ECTS cr
	Suunnitteluprojekti	
	HUOM! Suomenkielisille työryhmille opintojakso opetetaan suomeksi.	
Year and Period	DI 2, Period 1-2	
Lecturer	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	

Course Work	main equipment), lay-out, cost and profitability estimation. Different aspects are emphasized in different projects, depending on the topic. 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.
Evaluation	0-5, design reports 100 %.
Prerequisites	Ke3110000 Nesteiden, kaasujen ja kiintoaineiden käsittely Ke3130101 Ideasta tuotantoon
Ke3130600	COMPUTATIONAL FLUID DYNAMICS IN CHEMICAL ENGINEERING 6 ECTS cr
Year and Period	DI 2, Period 2
Lecturer	Docent, D.Sc. (Tech.) Zuoliang Sha Assistant, N. N.
Aims	Lecturer responsible: Professor, D.Sc. (Tech.) Ilkka Turunen 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.
Course Work	Lectures 28 h, 2nd period. Exercises with CFD software 120 h, 2nd period. Seminar presentation. No examination.
Evaluation	0-5, seminar presentation 70 %, exercise report 30 %. At least 90 % presence at lectures required.
Course Material	To be announced later.
Ke3131100	PROCESS INTENSIFICATION 2 ECTS cr
	Prosessien intensifointi
Year and Period	DI 1, Period 2
Lecturer	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.
Course Work	Lectures 21 h, exercises arranged as brainstorming sessions 9 h, 2nd period.
Evaluation	0-5, written examination 100 %.
Ke3131300	PROCESS SIMULATION 6 ECTS cr
	Prosessisimulointi
	Replaces the course Ke3600500 Process Simulation.
Year and Period	DI 1, Period 3-4
Lecturer	D.Sc. (Tech.) Kari Keskinen Ph.D. Sakari Kajaluoto Lecturer responsible: Professor, D.Sc. (Tech.) Ilkka Turunen
Aims	To make students familiar with process simulation as a tool in development, design and operation in chemical and pulp and paper industry.
Contents	Basics of process simulation. Steady-state and dynamic simulation. Introduction to ASPEN and BALAS-software. Examples of industrial simulation cases for process design.
Course Work	Intensive course. Lectures 28 h, 3rd and/or 4th period. Simulation exercises as guided individual assignments.
Evaluation	0-5, written examination 100 %.
Prerequisites	Ke3110300 Prosessisimuloinnin perusteet.
Ke3140000	CREATIVE DESIGN 3 ECTS cr
	Luova suunnittelu
	Replaces the course Ke3130200 Creative Design.
Year and Period	DI 1, Period 1
Lecturer	Professor, Ph.D. Andrzej Kraslawski
Contents	Types of innovation. Product, process, service innovation. Innovations in process engineering.

Course Work Evaluation Course Material	Models of creativity. Enhancement of creativity (brainstorming, synectics, morphological analysis, case-based reasoning, quality function deployment, TRIZ). Lectures and exercises 56 h, 1st period. 0-5, written examination 50 %, exercises and presence at the lectures 50 %. Lecture notes.
Ke3140100	PRODUCT DESIGN 5 ECTS cr
Year and Period Lecturer Contents Course Work Evaluation Course Material	Tuotesuunnittelu Replaces the course Ke3111300 Product Design. DI 1, Period 4 Professor, Ph.D. Andrzej Kraslawski 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. Lectures 15 h, exercises 20 h, 4th period. 0-5, written examination 50 %, exercises and presence at the lectures 50 %. Lecture notes.
Ke3220400	MEMBRAANITEKNIIKAN JA TEKNILLISEN POLYMEERIKEMIAN SYVENTÄVÄ OPINTOJAKSO 10 op
Ajankohta Opettaja Tavoitteet Sisältö Suoritustavat Arviointi	Advanced Course in Membrane Technology and Technical Polymer Chemistry The course will be given in English if required. DI 2, periodi 1-2 Professori, FT Marianne Nyström Opiskelijan perehdyttäminen membraanitekniikan, teknillisen polymeerikemian ja puukemian erityisaloihin. Polymeeriluonteisten raaka-aineiden jalostaminen, polymerointi ja tutkiminen eri määritysmenetelmiä käyttäen. Membraaniprosessit. Luentoja ja seminaareja 21 h, 1. periodi. Luentoja ja seminaareja 21 h, 2. periodi. Oma tutkimusprojekti 165 h, 1. - 2. periodi. Luennot, laboratoriotyöt, seminaariesitelmät ja mahdollinen tentti. Seminaaritulaisuuksiin osallistuminen pakollista. 0-5, laboratoriotyöt 40 %, seminaarit 60 %.
Ke3220500	SYNTEETTISET POLYMEERIT: LIIMAT JA HARTSIT 5 op
Ajankohta Opettaja Tavoitteet Sisältö Suoritustavat Arviointi	Synthetic Polymers: Glues and Resins Luennoidaan joka toinen vuosi, seuraavan kerran lukuvuonna 2007 - 2008. The course will be given in English if required. Opintojakso järjestetään yhdessä konetekniikan osaston kanssa. DI 1-2, periodi 1-2 Professori, FT Marianne Nyström Professori, TkT Ilkka Pöyhönen Tuntiopettaja, TkL Jouni Rainio Tuntiopettaja, N. N. Syventää opiskelijan tietämystä synteettisten polymeerien kemiasta, määritysmenetelmistä ja käytöstä teollisuudessa. Hartsien ja liimojen valmistus ja niiden käyttö teollisuudessa, erikoisesti puunjalostusteollisuudessa. Synteettisten polymeerien valmistus. Homopolymeerit, kopolymeerit ja polymeerien silloitus. Polymeerien kemialliset reaktiot ja analyysimenetelmät. Polymeerien käyttökohteet. Hartsit ja liimat. Soveltuu myös jatko-opiskelukurssiksi. Intensiivikurssi. Luentoja 35 h ja seminaarityö, 1. ja/tai 2. periodi. Pakollinen seminaarityö, pakolliset harjoitukset, tehdaskäynti ja tentti. hyväksytty - hylätty, harjoitustyöt 50 %, tentti 50 %.

Ke3220601	PROTEIINIEN KEMIA JA MIKROBIOLOGIA	4 op
	Protein Chemistry and Microbiology	
	Korvaa kurssin Ke3220600 Proteiinien kemia ja mikrobiologia. The course will be given in English if required.	
Ajankohta	DI 1, periodi 3-4	
Opettaja	Professori, FT Marianne Nyström Dosentti, FT Sinikka Parkkinen Tuntiopettaja N.N.	
Tavoitteet	Syventää opiskelijan tietämystä proteiinien kemiasta ja polyelektrolyyttien kemiasta. Opintojakso antaa myös tietoa proteiinien hyödyntämisestä sekä mikrobiologian perustietoa, varsinkin elintarviketekniikassa esiintyvistä mikrobeista.	
Sisältö	Proteiinien rakenne ja kemialliset reaktiot. Proteiinien karakterisointimenetelmät. Proteiinien erotus ja fraktiointi käyttämällä kromatografisia menetelmiä ja suodatusmenetelmiä. Elintarvikkeiden tärkeät proteiinit. Mikrobin luokitus, kemia, analysointi ja viljelymenetelmät. Soveltuu myös jatko-opiskelukurssiksi.	
Suoritustavat	Luentoja 28 h, laboratoriotöitä 40 h, 3. ja/tai 4. periodi. Luennot (80 % pakollisia) ja laboratoriotyöt (pakollisia).	
Arviointi	0-5, tentti 100 %.	

Ke3250200	CHEMICAL PULPING TECHNOLOGY: CHEMICAL RECOVERY	4 ECTS cr
	Selluloosatekniikka: Talteenotto	
	Replaces the course Ke3250110 Module A: Chemical Recovery.	
Year and Period	DI 1, Period 1-2	
Lecturer	Professor, M.Sc. (Tech.) Kaj Henricson Lecturer, N. N.	
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.	
Course Work	Lectures, exercises and seminars 14 h, 1st period. Lectures, exercises and seminars 14 h, 2nd period. WebCT - support.	
Evaluation	Lectures, personal assignment and seminars. 0-5, written examination 70 %, personal assignment 30 %.	
Course Material	Gullichsen, J., Paulapuro, H. (eds), Papermaking Science and Technology, Fapet Oy, vol. 1 (1998), vol. 3 (1999), vol. 6A (2000), vol. 6B (2000) specified sections. Adams, Terry N. et. al., Kraft Recovery Boilers, Tappi Press (1997) specified sections. Vakkilainen, E., Kraft recovery boilers - Principle and practice, Suomen Soodakattilayhdistys, (2005) specified sections. WebCT course material, handouts and other specified reading.	
Prerequisites	Ke3250000 Selluloosatekniikan perusteet attended or corresponding knowledge of forest industry.	

Ke3250300	CHEMICAL PULPING TECHNOLOGY: FIBERLINE OPERATIONS	6 ECTS cr
	Selluloosatekniikka: Kuitulinja	
	Replaces the course Ke3250120 Module B: Fiberline Operations.	
Year and Period	DI 1, Period 3-4	
Lecturer	Professor, M.Sc. (Tech.) Kaj Henricson Lecturer, N. N.	
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.	
Course Work	Lectures, exercises and seminars 21 h, 3rd period.	

Evaluation	Lectures, exercises and seminars 21 h, 4th period. WebCT - support.
Course Material	Lectures, personal assignment and seminars. 0-5, written examination 70 %, personal assignment 30 %. Gullichsen, J., Paulapuro, H. (eds), Papermaking Science and Technology, Fapet Oy, vol. 1 (1998), vol. 3 (1999), vol. 6A (2000), vol. 6B (2000) specified sections. Dence, C., Reeve, D. (eds), Pulp Bleaching - Principles and Practice, Tappi Press (1996) specified sections. WebCT course material, handouts and other specified reading.
Prerequisites	Ke3250000 Selluloosatekniikan perusteet attended or corresponding knowledge of forest industry.

Ke3250400	FIBER TECHNOLOGY; PERSONAL ASSIGNMENT	6 ECTS cr
	Kuitutekniikan erikoistyö	
	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	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.	
Course Work	As agreed with the instructor. The number of students accepted for the course will be limited.	
Evaluation	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.	

Ke3320300	TRANSPORT PHENOMENA	3 ECTS cr
	Kuljetusominaisuudet	
Year and Period	DI 1, Period 2	
Lecturer	Professor, D.Sc. (Tech.) Matti Lindström	
Aims	To understand the theoretical basis of transport phenomena in gas and liquid phase and to be able to apply calculation methods in solving problems concerning transport.	
Contents	Diffusion, migration and convection of molecules and ions in gas and liquid phase. Calculation of transport controlled by diffusion or migration in catalysis and electrochemistry. Kinetic theory and transport properties of gases.	
Course Work	Lectures and seminars 21 h, exercises 14 h, 2nd period. Active participation in lectures and exercises.	
Evaluation	0-5, written examination 100 %.	
Course Material	Lindström, M., Transport Phenomena, Lecture Notes, LUT, 2005. Atkins, P. & de Paula, J., Atkins' Physical Chemistry (8th ed.), Oxford University Press, 2006, Chapter 21.	
Prerequisites	Sa2810310 Fysiikka L(B), osa 1, Sa2810320 Fysiikka L(B), osa 2, Sa2810430 Fysiikan laboratoriotyöt (Ke, Ko) and Ke3310000 Epäorgaaninen kemia I (lectures attended).	

Ke3320900	PROPERTIES OF GASES AND LIQUIDS	5 ECTS cr
	Kaasujen ja nesteiden fysikaalis-kemiallisten ominaisuuksien arviointi	
	The course will be lectured 1st time during the academic year 2008 - 2009.	
Year and Period	DI 1, Period 3-4	
Lecturer	Professor, D.Sc. (Tech.) Matti Lindström	
Aims	To be able to estimate physico-chemical properties of pure gases and liquids and their mixtures.	
Contents	The estimation of physical properties, pure component constants, thermodynamic properties of gases, pressure-volume-temperature relationships of pure gases and liquids, pressure-volume-temperature relationships of mixtures, thermodynamic properties of pure components and mixtures.	
Course Work	Lectures 21 h, exercises and seminars 14 h, 3rd and 4th period. Active participation in lectures and exercises.	
Evaluation	0-5, written examination 100 %.	

Course Material	Poling, B. E., Prausnitz, J. M. And O'Connell, J. P., The Properties of Gases and Liquids, 5th ed., McGraw-Hill, Boston, 2001, Chapters 1-6.	
Prerequisites	Ke3320100 Johdanto kemialliseen termodynamiikkaan and Ke3320200 Kemiallisten tasapainotilojen termodynamiikka passed.	
Ke3330200	TEKNILLINEN KEMIA	10 op
	Industrial Chemistry, Teknisk kemi	
	The lectures will be given in English and they are the same as in the course Ke3330801 Chemical Separation Methods.	
Ajankohta	DI 1, periodi 3-4	
Opettaja	Professori, TkT Erkki Paatero Yliassistentti, TkT Kimmo Klemola	
Tavoitteet	Syventää tietoja kemiaa soveltavilta teollisuuden eri aloilta sekä kehittää opiskelijan teknistieteellistä suullista ja kirjallista esityskykyä.	
Sisältö	Henkilökohtainen harjoitustyö, joka liittyy laboratorion tutkimukseen reaktiotekniikan tai erotustekniikan alalta. Osa harjoitustöistä on elintarviketekniikan piiristä. Luennot tukevat tutkimusaiheita.	
Suoritustavat	Luentoja ja seminaareja 21 h, 3. periodi. Luentoja ja seminaareja 21 h, 4. periodi. Kirjallisuustyö ja seminaarit, opintoretkeä sekä laboratorioharjoitustöitä n. 165 h. Luennot ja seminaarit sekä hyväksytyt harjoitustyöt ja suullinen tentti.	
Arviointi	0-5, tentti 25 %, kirjallisuustyö 25 %, laboratoriotyöt 50 %.	
Esitiedot	Ke3330000 Kemianteollisuuden prosessit Ke3330100 Kemiallinen reaktiotekniikka Ke3330300 Teknillisen kemian laboratoriotyöt	
Ke3330400	CATALYSIS	4 ECTS cr
	Katalyyssi, Katalys	
Year and Period	DI 1, Period 1	
Lecturer	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.	
Course Work	Lectures and exercises 28 h, 1st period. Homework.	
Evaluation	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	Ke3330000 Kemianteollisuuden prosessit.	
Ke3330700	INDUSTRIAL BIOTECHNOLOGY	2 ECTS cr
	Teollinen biotekniikka, Industriell bioteknik	
	Lectured every 1.5 year, next time autumn 2006.	
Year and Period	DI 1-2, Period 1-2	
Lecturer	D.Sc. (Tech.) Heikki Ojamo	
Contents	What is industrial biotechnology? Basics of biocatalysts. Fermentation and enzyme technology. Downstream processing. Specific features of mass and heat transfer in biotechnology. Aseptic processing. Enzyme applications.	
Course Work	Lectures 14 h, in three intensive days. A written literature survey on a specific subject. Homework on calculations.	
Evaluation	0-5, written examination 80 %, literature survey 20 %.	
Course Material	Aittomäki, E. et. al., BIOprosessitekniikka, WSOY 2002 (where applicable). Literature surveys.	
Prerequisites	Ke3310300 Teknillisen biokemian perusteet.	
Ke3330801	CHEMICAL SEPARATION METHODS	4/8 ECTS cr
	Kemialliset erotusmenetelmät, Kemiska separationsmetoder	

	Replaces the course Ke3330800 Chemical Separation Methods. The lectures are included as a part in Ke3330200 Teknillinen kemia.
Year and Period	DI 1, Period 3-4
Lecturer	Professor, D.Sc. (Tech.) Erkki Paatero
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.
Course Work	Lectures and seminars 21 h, 3rd period. Lectures and seminars 14 h, 4th period. Oral examination. The students of the Master's Degree Programme in Chemical and Process Engineering (IPPE): the course also includes laboratory work approximately 100 h, the extent of the course will then be 8 ECTS cr.
Evaluation	4 ECTS cr: 0-5, examination 100 %. 8 ECTS cr: 0-5, examination 50 %, laboratory work 50 %.
Prerequisites	Ke3330000 Kemianteollisuuden prosessit.

Ke3330901	SEPARATION METHODS IN FOOD INDUSTRY	3 ECTS cr
	Elintarviketeollisuuden erotusmenetelmät, Separationsmetoder i livsmedelsindustri	
	Replaces the course Ke3330900 Separation Methods in Food Industry.	
Year and Period	DI 1, Period 4	
Lecturer	Professor, D.Sc. (Tech.) Erkki Paatero Docent, D.Sc. (Tech.) Marjatta Louhi-Kultanen Senior assistant, D.Sc. (Tech.) Harri Niemi Assistant, D.Sc. (Tech.) Arto Pihlajamäki	
Aims	The course is tailored for students who want to specialize in food technology.	
Contents	The most important separation technologies used in food industry are described. The course starts with an introduction part and then the individual technologies (chromatographic separation, membranes, filtration, crystallization etc.) are described.	
Course Work	Intensive course. Lectures and laboratory demonstrations 26 h, 4th period.	
Evaluation	0-5, written examination 100 %.	

Ke3331000	NUTRITIONAL AND FOOD BIOTECHNOLOGY	3 ECTS cr
	Ravitsemus- ja elintarvikebiotekniikka, Närings- och livsmedelsbioteknologi, Nahrungs- und Lebensmittelbiotechnologie	
	Replaces the course Ke3330600 Ravitseemus- ja elintarvikebiotekniikka. Lectured every 1.5 year, the next time spring 2007.	
Year and Period	DI 1-2, Period 4	
Lecturer	Professor (University of Kuopio), Ph.D. Atte von Wright	
Aims	The aim is to give an introduction to food biotechnology, with a special emphasis on nutrition, hygiene and food safety.	
Contents	The starter cultures and micro-organisms used in food industry, hygienic and safety aspects. Health, nutritional and safety concerns related to genetic modification, functional foods and novel foods.	
Course Work	Intensive course. Lectures 20 h, 4th period.	
Evaluation	0-5, written examination 100 %.	
Prerequisites	Ke3310300 Teknillisen biokemian perusteet	

Ke3600000	LATEST DEVELOPMENTS IN CAPE	6 ECTS cr
	Tietokoneavusteisen prosessitekniikan nykysuuntauokset	
	The course will be lectured last time in autumn 2006.	
Year and Period	DI 2, Period 1-2	
Lecturer	Professor (University College London), Ph.D. David Bogle Professor (Technical University of Denmark), Ph.D. Rafiqul Gani Professor (Université de Liege), Ph.D. Georges Heyen Professor, Ph.D. Andrzej Kraslawski (contact person)	

Contents	1. New Perspectives in CAPE in Biology and Biological Processes: Types of bioproducts. Fermentation processes. Metabolic engineering. Purification. Process synthesis. Lectures 10 h, exercises 10 h. Individual assignments and project work.
	2. Chemical Process-Product Design through ICAS: Introduction into Integrated Computer Aided System (ICAS) modelling, simulation, synthesis/design, control and analysis features. Pure component property estimation. Mixture property estimation and model library. Types of phase diagrams. Solubility calculations of organic solids. Batch operation modelling and simulation. Lectures 10 h, exercises 10 h. Individual assignments and project work.
Course Work	3. Data Reconciliation: Quality of process control. Basic concepts of reconciliation. Selection of the control parameters. Dynamic reconciliation. Sensor network design. Lectures 10 h, exercises 10 h. Individual assignments and project work.
Evaluation	Intensive course. Lectures 30 h, exercises 30 h, 1st and/or 2nd period. Individual assignments and project work.
Course Material	0-5, written examination 100 %. Lecture notes, ICAS documentation.

Ke3600100	PRODUCTION PLANNING	4 ECTS cr
	Tuotannonsuunnittelu	
	The course will be lectured last time in autumn 2006.	
Year and Period	DI 2, Period 2	
Lecturer	Professor (College of Industrial Engineering of Barcelona), Dr. Moisés Graells Professor, Ph.D. Andrzej Kraslawski (contact person)	
Contents	Types of production processes. Production planning of continuous and semi-continuous processes. Modelling and optimisation of batch processes. Batch process scheduling. Cycle time reduction and de-bottlenecking. The role of intermediate storage.	
Course Work	Intensive course. Lectures 10 h, exercises 10 h, 2nd period. Individual assignments and exercises.	
Evaluation	0-5, written examination 100 %.	
Course Material	Lecture notes.	

Ke3600200	DYNAMICS AND CONTROL OF CHEMICAL PROCESSES	4 ECTS cr
	Kemiallisten prosessien dynamiikka ja säätö	
Year and Period	DI 2, Period 1-2	
Lecturer	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.	
Course Work	Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h, 2nd period. Project work.	
Evaluation	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.	

Ke3600400	R&D METHODOLOGY	3 ECTS cr
	Prosessitutkimuksen ja -kehityksen menetelmät	
	The course will be lectured last time in autumn 2006.	
Year and Period	DI 2, Period 2	
Lecturer	Docent, D.Sc. (Tech.) Pekka Oinas	

Aims	Professor, Ph.D. Andrzej Kraslawski (contact person)
Contents	To make students familiar with modern industrial methodology in process R&D. Classification and origin of data, information and knowledge in process technology. Project initiatives: ideas, markets, customer needs, technology breakthroughs. Inventions and patents. Experimental research: laboratory, pilot plant and mock-up experiments. Direct and indirect measurements in process development. Computational research: modeling, experiment planning, parameter estimation, optimization. Scale-up.
Course Work	Intensive course. Lectures 14 h, exercises 14 h, individual assignments, 2nd period.
Evaluation	0-5, written examination 100 %.
Ke3600600	PROCESS CONTROL SYSTEMS IN PULP AND PAPER INDUSTRY 3 ECTS cr
Year and Period	Prosessiautomaatiojärjestelmät massa- ja paperiteollisuudessa DI 2, Period 1-2
Lecturer	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.
Course Work	Lectures 16 h, 1st period. Lectures 12 h, 2nd period. Individual or team project work with supervision 12 h, 2nd period.
Evaluation	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, N. J., Process Control Fundamentals for the Pulp and Paper Industry, Tappi Press, 1995, Atlanta, USA, 612 p., ISBN 0-89852-294-3.
Ke3600900	CROSS-CULTURAL COMMUNICATION FOR WORKING LIFE 2 ECTS cr
Year and Period	Viestintä kansainvälisessä työyhteisössä DI 1, Period 3
Lecturer	B.Sc. James Nimmo 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.
Course Work	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).
Evaluation	Pass - Fail. Active participation in lectures and exercises.
Ke3601000	PULP AND PAPER TECHNOLOGY 5 ECTS cr
Year and Period	Selluloosa- ja paperiteknikka DI 1, Period 1-2
Lecturer	M.Sc. (Tech.) Heikki Siitonen Professor, Ph.D. Andrzej Kraslawski (contact person)
Contents	The course gives a general description of pulp and paper technology. Different raw materials are

Course Work Evaluation	covered, as well as the main features of chemical and mechanical pulping. Paper technology, including approach flow systems, short circulation and process stability are studied. Lectures 28 h, 1st and/or 2nd period. 0-5, written examination 100 %.
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7 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.

7.1 The Aims of the Master's Degree Programme

Particular emphasis in this programme 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.

7.2 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.

7.3 The Structure of the Programme

Master's Thesis 30 ECTS cr	
Major Subject 40-41 ECTS cr Structural and Machine Design 40 ECTS cr or Production Technologies 41 ECTS cr	Minor Subject 20 ECTS cr
General Studies 13-15 ECTS cr	Elective Studies 14-17 ECTS cr

General Studies (13-15 ECTS credits):

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 (40-41 ECTS credits):

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 2nd period of the first year.

Structural and Machine Design

The person responsible for major in Structural and Machine Design is professor, D.Sc. (Tech.) Gary Marquis.

Students who elect to specialise in Structural and Machine Design study both the theory and practice of developing mechanical engineering systems for performance, strength and durability. Students 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 senior assistant, Lic.Sc. (Tech.) Raimo Suoranta.

Students of Production Technologies 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. As lasers are increasingly being used in high technology manufacturing, 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 (30 ECTS credits):

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

Minor Subject (20 ECTS credits):

Students can choose any minor subject taught in English at LUT. The minor subject in Structural and Machine Design consists of 20 ECTS credits of taught courses from the equivalent major subject area. Likewise, the minor subject in Production Technologies includes 20 ECTS credits of taught courses from the equivalent major subject area.

Elective Studies (14-17 ECTS credits):

To attain the full 120 ECTS credits, the students may need 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.

General Studies 13-15 ECTS credits

<i>General Studies</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ki7119000	Academic Seminar for International Programs	1	1-3	6
Ki7131200 ^(*)	Teknisk svenska	1	1, 2, 3, 4	2
Ki7189100 ^(**)	Finnish for Foreigners 1	1	1,3	2
Ko4000300	Introduction to M.Sc. Studies	1	1-2	1
Ko4110100	Materials Science	1	1-2	6

^(*) For Finnish students who need to attain proficiency in Swedish

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

Major in Structural and Machine Design (40 ECTS credits) Students should select a minimum of 40 ECTS credits from the above courses:

<i>Major in Structural and Machine Design</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ko4000100 ^(*)	Individual Project Work	2	1-4	6
Ko4000200 ^(*)	Research Seminar	2	4	2
Ko4210300	Servo Control Engineering	1	3-4	6
Ko4240500 ^(**)	Advanced Strength of Materials	2	1-2	7
Ko4241000	Design of Steel Structures	1	3-4	6
Ko4241200 ^(*)	FE-analysis course	1	3-4	5
Ko4241400	Fatigue Design	1	1-2	6
Ko4241600	FE-analysis seminar in advanced topics	2	1-4	3
Ko4250400	Introduction to Multibody Dynamics	1	3	4

^(*) A required course

^(**) Will be lectured in English in 2006-2007

Major in Production Technologies (41 ECTS credits)

<i>Major in Production Technologies</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ko4000100	Individual Project Work	2	1-4	6
Ko4000200	Research Seminar	2	4	2
Ko4110400	Modern Welding Technology	1	1-2	7
Ko4111100	Virtual Welding	1	3-4	3
Ko4180700	Advanced Production Engineering	2	1-2	7
Ko4190100	Laser Processes	1	1-2	6
Ko4190200	Product Design for Laser Processing	1	3-4	4
Ko4530000	Wood Processing Machinery	2	3	6

7.4 Additional Information**Personal Study Plans:**

In 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 major subject, minor subject, general studies, elective studies, credit transfer from previous degree and possible complementary studies.

Complementary Studies (20-60 ECTS credits):

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.

Further Information:

International Officer Minna Loikkanen

Phone (05) 621 2444, room 1215D, minna.loikkanen@lut.fi

www.lut.fi/kote/international_studies/

7.5 The Courses Offered in English

		ECTS
Ko4000100	Individual Project Work	6
Ko4000200	Research Seminar	2
Ko4000300	Introduction to M.Sc. Studies	1

<i>Section of Production Technology</i>		ECTS
Ko4110100	Materials Science	6
Ko4110400	Modern Welding Technology	7
Ko4111100	Virtual Welding	3
Ko4180700	Advanced Production Engineering	7
Ko4190100	Laser Processes	6
Ko4190200	Product Design for Laser Processing	4

<i>Section of Engineering Design</i>		ECTS
Ko4210300	Servo Control Engineering	6
Ko4240500	Advanced Strength of Materials	7
Ko4240900	Structural Analysis	6
Ko4241000	Design of Steel Structures	6
Ko4241200	FE-Analysis Course	5
Ko4241400	Fatigue Design	6
Ko4241600	FE-Analysis Seminar in Advanced Topics	3
Ko4250400	Introduction to Multibody Dynamics	4

<i>Section of Wood Technology</i>		ECTS
Ko4530000	Wood Processing Machinery	6
Ko4530100	Measuring Technology at Mechanical Wood Processes	4

7.5.1 Course Descriptions

Ko4000100	INDIVIDUAL PROJECT WORK	6 ECTS cr
	Kv -maisteriohjelman erikoistyö	
	Only for the students of Master's degree programmes of the Department of Mechanical Engineering.	
Year and Period	DI 1, Period 1-4	
Lecturer	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.	
Course Work	10 h of lectures, 1st-4th period.	
Evaluation	150 h of tutorials and independent projects, 1st-4th period.	
Prerequisites	Passed/not passed, based on written report and oral presentation.	
	Consent of supervising professor.	

Ko4000200	RESEARCH SEMINAR	2 ECTS cr
	Tutkimusseminaari	
Year and Period	DI 2, Period 4	
Contents	International students will present and defend their own diploma project thesis work as well as serve as opponents and listen to other presentations.	
Course Work	Exercises 10 h, 4th period.	
Evaluation	Simulation work 40 h.	
	Passed/not passed grade based on participation.	

Ko4000300	INTRODUCTION TO M.SC. STUDIES	1 ECTS cr
	Johdatus englanninkielisten maisteriohjelmien opintoihin	
Year and Period	DI 1, Period 1-2	
Lecturer	Professor, Dr. Tech (Eng) Gary Marquis, Information Specialist, M.Sc. Marja Talikka	
Contents	This course will help orient international students to the basics of study at LUT. Orientation week activities, information gathering, and essay.	
Course Work	Lectures 8 h, 1st-2nd period. Exercices 10 h Independent work 8 h	
Evaluation	Passed/not passed grade based on participaton, exercises and essay.	
Course Material	LUT Web.	
Ko4110100	MATERIALS SCIENCE	6 ECTS cr
	Materiaalioppi	
Year and Period	DI 1, Period 1-2	
Lecturer	Senior assistant, Lic.Sc.(Tech.) Raimo Suoranta Assistant, Lic.Sc.(Tech.) Pekka Rajamäki	
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 selectin materials.	
Course Work	28 h of lectures, 1st-2nd period. 42 h of independent work, 1st-2nd period.	
Evaluation	0-5, examination 75 %, tutorials 25 %.	
Ko4110400	MODERN WELDING TECHNOLOGY	7 ECTS cr
	Nykyaikainen hitsaustekniikka	
Year and Period	DI 2, Period 1-2	
Lecturer	Professor, D.Sc. (Tech) Jukka Martikainen Senior assistant, Lic.Sc.(Tech.) Raimo Suoranta	
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 equipments 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.	
Course Work	4 h of lectures, 3rd-4th period. 14 h of laboratory tutorials. 28 h of laboratory- and seminar presentations	
Evaluation	0-5, examination 80 %, laboratory- and seminar prentations 20 %.	
Course Material	WebCT material. Lecture notes.	
Ko4111100	VIRTUAL WELDING	3 ECTS cr
	Virtuaalihitsaus	
Year and Period	DI 1, Period 3-4	
Lecturer	Part-time 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.	
Course Work	2 h of lectures, 3rd period. 12 h of controlled tutorials, 3rd-4st period.	
Evaluation	0-5, examination 100 %.	

Course Material	WebCT.	
Ko4180700	ADVANCED PRODUCTION ENGINEERING	7 ECTS cr
	Tuotantotekniikka, jatkokurssi	
Year and Period	DI 1, Period 1-2	
Lecturer	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.	
Course Work	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.	
Evaluation	0-5, examination 60 %, satisfactorily completed tutorials 20 %, project work 20 %.	
Course Material	Materials to be announced during lectures.	
Ko4190100	LASER PROCESSES	6 ECTS cr
	Lasertyöstöprosessit	
Year and Period	DI 1, Period 1-2	
Lecturer	Professor, D.Sc (Tech) Veli Kujanpää Part-time teacher, 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.	
Course Work	28 h of lectures, 1st-2nd period. 16 h of tutorials, 1st-2nd period.	
Evaluation	0-5, examination 90 %, seminar 10 %.	
Course Material	Steen W., Laser material processing. Material presented during lectures.	
Ko4190200	PRODUCT DESIGN FOR LASER PROCESSING	4 ECTS cr
	Lasertekniikan tuotesuunnittelu	
Year and Period	DI 1, Period 3-4	
Lecturer	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.	
Course Work	28 h of lectures, 3rd-4th period. 14 h of tutorials, 3rd-4th period.	
Evaluation	0-5, examination 50%, seminar 50%.	
Course Material	Kujanpää V. et al., Lasertyöstö. Steen W., Laser material processing.	
Prerequisites	Ko4190000 Sädettyöstö or Ko4190100 Laser Processes	

Ko4210300	SERVO CONTROL ENGINEERING	6 ECTS cr
	Servotekniikka	
Year and Period	TkK 3, Period 3-4	
Lecturer	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.	
Course Work	Ability to design and control of different types of servodrives. Ability to evaluate the achievable properties of different servodrives. 42 h of lectures, 3rd-4th period. 42 h of tutorials, 3rd-4th period. 30 h of exercises, 4th period.	
Evaluation	0-5, examination 100 %.	
Course Material	Lecture notes.	
Prerequisites	The student must have completed Ko4210000 Mekatroniikan peruskurssi. Recommended Ko4210100 Hydrauliteknikka (not required from International Master's Programme students).	
Ko4240500	ADVANCED STRENGTH OF MATERIALS	7 ECTS cr
	Lujuusoppi II	
	Alternate years lectures in Finnish/English	
Year and Period	TkK 3, Period 1-2	
Lecturer	Professor, Dr. Tech (Eng) Gary Marquis Lecturer-researcher, D.Sc (Tech) Tapani Halme Senior assistant, Dr. Tech (Eng) 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.	
Course Work	42 h of lectures, 1.-2. period. 42 h of tutorials, 1.-2. period. 1 h of laboratory work. 8 h of independent work.	
Evaluation	0-5, examination or two mid-course examinations 100 % (85 %), laboratory work (5 %), exercises (10 %).	
Course Material	Lecture notes.	
Prerequisites	Ugural A.C. and Fenster S.K., Advanced strength and applied elasticity. -4th ed. Ko4240300 Lujuusoppi I harjoitukset suoritettuina or registration in International masters degree program.	
Ko4240900	STRUCTURAL ANALYSIS	6 ECTS cr
	Rakenneanalyysi	
Year and Period	TkK 2, Period 1-2	
Lecturer	Professor, Dr. Tech (Eng) Gary Marquis Part-time 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.	
Course Work	42 h of lectures, 1st-2nd period. 18 h of tutorials, 1st-2nd period. 20 h of laboratory works.	
Evaluation	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 Ko424000 Statiikka and Ko4240300 Lujuusoppi I.	
Ko4241000	DESIGN OF STEEL STRUCTURES	6 ECTS cr
	Teräsrakenteiden suunnittelu	
Year and Period	DI 1, Period 3-4	
Lecturer	Professor, Dr. Tech (Eng) Gary Marquis	
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.	
Course Work	42 h of lectures, 3rd-4th period. 10 h of tutorials 3rd-4th period. 5 h of laboratory works, 3rd-4th period.	
Evaluation	0-5, examination 60 %, laboratory projects and reports 40 %.	
Course Material	Niemi E., Levyrakenteiden suunnittelu, 2003.	
Prerequisites	Ko4241100 FE-analyysin peruskurssi or Ko4241200 FE-analysis course	
Ko4241200	FE-ANALYSIS COURSE	5 ECTS cr
	FE-analyysi	
Year and Period	TkK 3, Period 3-4	
Lecturer	Lecturer-researcher, 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 the 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.	
Course Work	28 h of lectures, 3rd-4th period. 28 h of tutorials, 3rd-4th period.	
Evaluation	0-5, examination 50 %, exercises 50 %.	
Course Material	The material is to be specified during lectures.	
Ko4241400	FATIGUE DESIGN	6 ECTS cr
	Väsymismitoitus	
Year and Period	DI 1, Period 1-2	
Lecturer	Professor, Dr. Tech (Eng) Gary Marquis	
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.	
Course Work	42 h of lectures, 1st-2nd period. 40 h of tutorials, 1st-2nd period.	
Evaluation	0-5, examination 60 %, exercises 40 %.	
Course Material	Dowling N.E., Mechanical Behavior of Materials 2nd ed., Prentice Hall.	
Prerequisites	Ko4240500 Advanced Strength of Materials or Ko4110100 Materials Science.	
Ko4241600	FE-ANALYSIS SEMINAR IN ADVANCED TOPICS	3 ECTS cr
	FE-analyysin syventävä seminaarikurssi	
	Course registrations directly to the lecturer, WebOodi not in use.	
Year and Period	TkK 3, Period 1-4	
Lecturer	Lecturer-researcher, 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., solving stability and dynamic eigenvalue problems, sub-modeling and sub-structure techniques, and nonlinear analysis.	

Course Work	Lectures 14 h, 1st-4th period.
Evaluation	0-5, excercises 100 %.
Course Material	The material is to be specified during lectures.
Prerequisites	Ko4241200 FE-analysis course.
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Ko4250000	<i>SIMULATION OF A MECHATRONIC MACHINE</i> 6 ECTS cr
	Mekatronisen koneen simulointi
Year and Period	TkK 3, Period 3-4
Lecturer	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, pneumatically or electronically actuated. The student will also obtain knowledge to utilize static, kinematic and dynamic analysis in a machine design process.
Contents	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.
Course Work	28 h of lectures, 3rd-4th period. 28 h of supervised tutorials, 3rd-4th period.
Evaluation	0-5, examination or mid-course examinations 90 %, simulation work 10 %.
Course Material	Lecture notes.
Prerequisites	Students are recommended to have completed Ko4210000 Mekatroniikan peruskurssi, Ko4240000 Statiikka, Ko4240100 Dynamiikka I Ko4240200 Dynamiikka II (not required from International Master's Programme students).
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Ko4250400	<i>INTRODUCTION TO MULTIBODY DYNAMICS</i> 4 ECTS cr
	Monikappaledynamiikan perusteet
Year and Period	TkK 3, Period 3
Lecturer	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.
Course Work	Lectures of 14 h, 3rd period. Excercises of 14 h, 3rd period.
Evaluation	0-5, examination 90 %, simulation work 10 %.
Course Material	Lecture notes.
Prerequisites	Students are recommended to have completed Ko4240000 Statiikka, Ko4240100 Dynamiikka I, Ko4240200 Dynamiikka II (not required from International Master's Programme students).
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Ko4530000	<i>WOOD PROCESSING MACHINERY</i> 6 ECTS cr
	Sahakoneet
Year and Period	TkK 3, Period 3
Lecturer	Professor, Dr. Tech (Eng) Jaakko Vuorilehto, Researcher, M.Sc. (Tech) Kimmo Piispa
Aims	Comprehensive insight on machinery used in the primary wood processing industry. Basic knowledge of cutting processes, saws, debarking, chipping, sorting, drying, planing and grading machines. Practical knowledge of sawmills.
Contents	Primary wood processing technologies and machinery. Production planning, wood as raw material, maintenance, environment and labour safety. Background for measurement and control.
Course Work	28 h of lectures, 3rd period. 32 h of excercises, 3rd period. 24 h of independent projects, 3rd period.
Evaluation	0-5, examination 80 %, seminars 20 %.
Course Material	Vuorilehto J., Wood Processing Machinery, Course Book.

Ko4530100	MEASURING TECHNOLOGY AT MECHANICAL WOOD 4 ECTS cr PROCESSES
	Sahateollisuuden mittaustekniikka
Year and Period	DI 1, Period 4
Lecturer	Professor, Dr. Tech (Eng) Jaakko Vuorilehto, Researcher, M.Sc. (Tech) Kimmo Piispa
Aims	Comprehensive insight on equipment used in the primary and secondary wood processing industry. Basic knowledge of scanners, measuring devices, optimisation and statistical control. Practical knowledge of measuring techniques in sawmills.
Contents	Measuring and control techniques in mechanical wood industry. Structure and physics of measuring devices and techniques. Economic aspects of control activities.
Course Work	32 h of lecturers, 4. period. 32 h of excersises, 4. period. 20 h of independent project.
Evaluation	0-5, examination 80 %, seminars 20 %.
Course Material	Vuorilehto J., Measuring Technology at Mechanical Wood Processes, Course Book.
Prerequisites	Ko4530000 Wood Processing Machinery suoritettuna.

8 Master's Degree Programme "New Packaging Solutions"

The Master's degree programme "New Packaging Solutions" is a part-time programme leading to the degree of Master of Science in Technology. 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.

8.1 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.

8.2 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.

8.3 The Structure of the Programme

Master's Thesis 30 ECTS cr	
Major Subject 40 ECTS cr Packaging Technologies	Minor Subject 20 ECTS cr Industrial Management
General Studies 20 ECTS cr	Elective Studies 10 ECTS cr

General Studies (20 ECTS credits):

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 MSc studies.

Major Subject (40 ECTS credits):

The person responsible for major subject in Packaging Technologies is professor, M.Sc. (Tech.) Matti Salste. Major subject Packaging Technologies is common to all the students in the programme. 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 (30 ECTS credits):

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 credits):

The minor subject Industrial Management is offered by the Department of Industrial Engineering and Management. It is specially designed to support the major subject in Packaging Technologies and it will be offered on a part-time basis once a year.

Choices of other minor subjects will be treated on a case-by-case basis.

Elective Studies (10 ECTS credits):

To attain the full 120 ECTS credits, the students may need 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. Foreign students are recommended to study Finnish for Foreigners courses.

General Studies (20 ECTS credits)

<i>General Studies (20 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ko4000700	Introduction to M.Sc. Studies in Packaging	1	1	1
Ko4000300	Introduction to M.Sc. Studies	1	1-2	1
Ko4000800	Interaction of the Package and the Content	1	3-4	3
Ko4000900	Packaging Materials	1	1-2	4
Ki71X11EC*	Language and Communication Studies 11 ECTS cr			11

* Ki713200 Teknisk svenska for Finnish students who need to attain proficiency in Swedish. The following studies of English language will be offered on a part-time basis:

Ki7116400 English for Negotiating 3 ECTS cr, year 1, per. 1-2

Ki7113200 Writing for Business 2 ECTS cr, year 1, per. 3-4

Ki7113800 Aspects of Culture 2 ECTS cr, year 2, per. 1-2

Ki7117001 Scientific and Technical English Writing Course 4 ECTS cr, year 2, per. 1-4

Major Subject in Packaging Technologies (40 ECTS credits)

<i>Major Subject in Packaging Technologies (40 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ko4000100	Individual Project Work	1	1-4	6
Ko4000200	Research Seminar	2	4	2
Ko4001000	Machine Design for Packaging Technology	1	3-4	2
Ko4001100	Converting and Forming of Fibre Based Packaging	2	1-2	5
Ko4001200	Laser in Converting and Packaging	2	1-2	2
Ko4001300	Packaging Lines and Machinery	2	2-4	8
Ko4001400	Coating and Lamination of Fibre Based Packaging Materials	1	1-3	5
Ko4001500	Printing and Varnishing	1	2-3	2
Ko4001600	Functions of Package and Packaging Formats	2	1-2	4
Ko4001700	Legislation on Packaging and Environmental Issues Related to Packaging	2	1-3	4

Minor Subject Industrial Management (20 ECTS credits)

<i>Minor Subject Industrial Management (20 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Tu6206000	Supply Chain Management	1	int.	6
Tu6206050	Decision-making in Supply Chain	1	int.	5
Tu6306000	Technology Management	1	int.	3
Tu6366000	Information & Knowledge Management in Innovative Enterprises	1	int.	6

8.4 Additional Information**Personal Study Plans:**

In 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 major subject, minor subject, general studies, elective studies, credit transfer from previous degree and possible complementary studies.

Complementary Studies (20-60 ECTS credits):

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.

Further Information:

International Officer Minna Loikkanen

Phone (05) 621 2444, room 1215D, minna.loikkanen@lut.fi

www.lut.fi/kote/international_studies/

8.5 Courses offered in English

		ECTS
Ko4000100	Individual Project Work	6
Ko4000200	Research Seminar	2
Ko4000300	Introduction to M.Sc. Studies	1
Ko4000700	Introduction to M.Sc. Studies in Packaging	1
Ko4000800	Interaction of the Package and the Content	3
Ko4000900	Packaging Materials	4
Ko4001000	Machine Design for Packaging Technology	2
Ko4001100	Converting and Forming of Fibre Based Packaging (in 2007-2008)	5
Ko4001200	Laser in Converting and Packaging (in 2007-2008)	2
Ko4001400	Coating and Lamination of Fibre Based Packaging Materials	5
Ko4001500	Printing and Varnishing	2
Ko4001600	Functions of Package and Packaging Formats (in 2007-2008)	4
Ko4001700	Legislation on Packaging and Environmental Issues Related to Packaging (in 2007-2008)	4
Tu6206000	Supply Chain Management	6
Tu6206050	Decision-Making in Supply Chain	5
Tu6306000	Technology Management	3
Tu6366000	Information & Knowledge Management in Innovative Enterprises	6

8.5.1 Course Descriptions

Ko4000100	INDIVIDUAL PROJECT WORK	6 ECTS cr
	Kv -maisteriohjelman erikoistyö	
	Only for the students of Master's degree programmes of the Department of Mechanical Engineering.	
Year and Period	DI 1, Period 1-4	
Lecturer	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.	
Course Work	10 h of lectures, 1st-4th period. 150 h of tutorials and independent projects, 1st-4th period.	
Evaluation	Passed/not passed, based on written report and oral presentation.	
Prerequisites	Consent of supervising professor.	
Ko4000200	RESEARCH SEMINAR	2 ECTS cr
	Tutkimusseminaari	
Year and Period	DI 2, Period 4	
Contents	International students will present and defend their own diploma project thesis work as well as serve as opponents and listen to other presentations.	
Course Work	Exercises 10 h, 4th period. Simulation work 40 h.	
Evaluation	Passed/not passed grade based on participation.	
Ko4000300	INTRODUCTION TO M.SC. STUDIES	1 ECTS cr
	Johdatus englanninkielisten maisteriohjelmien opintoihin	
Year and Period	DI 1, Period 1-2	
Lecturer	Professor, Dr. Tech (Eng) Gary Marquis, Information Specialist, M.Sc. Marja Talikka	
Contents	This course will help orient international students to the basics of study at LUT. Orientation week activities, information gathering, and essay.	
Course Work	Lectures 8 h, 1st-2nd period.	

Evaluation	Exercises 10 h Independent work 8 h Passed/not passed grade based on participation, exercises and essay.
Course Material	LUT Web.
Ko4000700	INTRODUCTION TO M.SC. STUDIES IN PACKAGING 1 ECTS cr
	Johdatus paperin ja kartongin jatkojalostuksen kansainvälisen maisteriohjelman opintoihin
	Only for the students of the Master's degree programme "New Packaging Solutions".
Year and Period	DI 1, Period 1
Lecturer	Professor, M.Sc. (Tech) Matti Salste International officer, M.A. Minna Loikkanen
Aims	To provide understanding of packaging branch and the study program.
Contents	The course will introduce the packaging branch and packaging businesses and the main features of this study program. Student will compile the individual study plan.
Course Work	8 h lectures, 1st period. 18 h exercises and the individual study plan, 1st period.
Evaluation	Passed/not passed
Course Material	Orientation days. Handouts.
Ko4000800	INTERACTION OF THE PACKAGE AND THE CONTENT 3 ECTS cr
	Pakkauksen ja sen sisällön vuorovaikutus
	Only for the students of the department of Mechanical Engineering.
Year and Period	DI 1, Period 3-4
Lecturer	Visiting lecturers N.N. Lecturer responsible: Professor, M.Sc. (Tech) Matti Salste
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.
Course Work	Lectures total 24 h, 3rd-4th period. Exercises total 12 h, 3rd-4th period.
Evaluation	0-5, examination 70 %, exercises 30 %.
Course Material	Will be announced later.
Ko4000900	PACKAGING MATERIALS 4 ECTS cr
	Pakkausmateriaalit
	Only for the students of the Department of Mechanical Engineering.
Year and Period	DI 1, Period 1-2
Lecturer	Visiting lecturer, professor, Jurkka Kuusipalo Lecturer responsible: Professor, M.Sc. (Tech) Matti Salste
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.

Course Work	Lectures total 16 h, 1st-2nd period. Exercises total 7 h, 1st-2nd period.
Evaluation	0-5, examination 70 %, exercises 30 %.
Course Material	Course material, lecturers' comments, FAPET. Book 12. ed. A.Savolainen et al.

Ko4001000	MACHINE DESIGN FOR PACKAGING TECHNOLOGY	2 ECTS cr
	Koneensunnittelu pakkausteknologiaa varten	
	Only for the students of the department of Mechanical Engineering.	
Year and Period	DI 1, Period 3-4	
Lecturer	Lecturer-researcher, 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.	
Course Work	Lectures total 14 h, 2nd-3rd period. Exercises total 26 h, 2nd-3rd period. Seminar 2nd-3rd period.	
Evaluation	0-5, examination 70 %, exercises and seminar 30 %	
Course Material	Erdman A.G., Mechanism Design. Norton R.L., Design of Machinery.	

Ko4001100	CONVERTING AND FORMING OF FIBRE BASED PACKAGING	5 ECTS cr
	Kuitupohjaisen materiaalin jalostus pakkaukseksi	
	The course will be first time lectured during the academic year 2007-2008. Only for the students of the department of Mechanical Engineering.	
Year and Period	DI 2, Period 1-2	
Lecturer	Professor, D.Sc (Tech) Juha Varis Visiting lecturer, professor, Jurkka Kuusipalo Visiting lecturers N.N.	
Aims	Lecturer responsible: Professor, M.Sc. (Tech) Matti Salste 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.	
Course Work	Will be announced in 2007-2008 study guide.	
Evaluation	Written examine 60 %, seminar 40 %	
Course Material	Laboratory works; passed/not passed Will be announced later	

Ko4001200	LASER IN CONVERTING AND PACKAGING	2 ECTS cr
	Laser pakkausten valmistuksessa ja pakkaamisessa	
	The course will be first time lectured during the academic year 2007-2008. Only for the students of the department of Mechanical Engineering.	
Year and Period	DI 2, Period 1-2	

Lecturer	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.
Course Work	Will be announced in 2007-2008 study guide.
Evaluation	0-5, examination 90 %, tutorials 10 %.
Course Material	Will be announced later.

Ko4001300	PACKAGING LINES AND MACHINERY	8 ECTS cr
	Pakkauslinjat ja pakkauskoneet	
	The course will be first time lectured during the academic year 2007-2008. Only for the students of the Department of Mechanical Engineering.	
Year and Period	DI 2, Period 2-4	
Lecturer	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.	
Course Work	Will be announced in 2007-2008 study guide.	
Evaluation	0-5, examination 100 %.	
Course Material	Will be informed later.	

Ko4001400	COATING AND LAMINATION OF FIBRE BASED PACKAGING MATERIALS	5 ECTS cr
	Kuitupohjaisten pakkausmateriaalien päällystys ja laminointi	
	Only for the students of the department of Mechanical Engineering.	
Year and Period	DI 1, Period 1-3	
Lecturer	Visiting lecturer, professor, Jurkka Kuusipalo Lecturer responsible: Professor, M.Sc. (Tech) Matti Salste	
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 printing) 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.	
Course Work	Lectures total 18 h, 1st-3rd period. Exercises total 8 h, 1st-3rd period. Seminar 1st-3rd period.	
Evaluation	0-5, examination 70 %, exercises 30 %.	
Course Material	Course material. Lecturers' comments. Savolainen A. et al., FAPET. Book 12. ed.	

Ko4001500	PRINTING AND VARNISHING	2 ECTS cr
	Painatus ja lakkaus	
	Only for the students of the department of Mechanical Engineering.	
Year and Period	DI 1, Period 2-3	
Lecturer	Visiting lecturer, D.Sc (Tech) Johanna Lahti Lecturer responsible: Professor, M.Sc. (Tech) Matti Salste	
Aims	To provide understanding of printing methods used in packaging industry.	
Contents	Pre-press operations. The main printing technologies and their use in packaging industry. Printing of various substrates. The main advantages and disadvantages of main printing technologies in various packaging applications. 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. Capability to select a proper printing method for a certain packaging solution. Capability to solve printing problems and to control print quality.	
Course Work	Lectures total 12 h, 2nd-3rd period. Exercises total 6 h, 2nd-3rd period.	
Evaluation	0-5, examination 70 %, exercises 30 %.	
Course Material	Course material. Lecturers' comments. Saarelma, H., Oittinen P., Printing, Papermaking Science and Technology, Book 13, Fapet, Helsinki 1999.	
Ko4001600	FUNCTIONS OF PACKAGE AND PACKAGING FORMATS	4 ECTS cr
	Pakkauksen tehtävät ja pakkausmuodot	
	The course will be first time lectured during the academic year 2007-2008. Only for the students of the department of Mechanical Engineering.	
Year and Period	DI 2, Period 1-2	
Lecturer	Visiting lecturers N.N. Lecturer responsible: Professor, M.Sc. (Tech) Matti Salste	
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. Requirements of packaging and packages in various end uses. Understanding of role of package throughout the whole value chain. Understanding of the main opportunities of various packaging formats in specific end uses when developing new solutions.	
Course Work	Will be announced in 2007-2008 study guide.	
Evaluation	0-5	
Course Material	Will be announced later.	
Ko4001700	LEGISLATION ON PACKAGING AND ENVIRONMENTAL ISSUES RELATED TO PACKAGING	4 ECTS cr
	Pakkaukseen liittyvä lainsäädäntö sekä pakkaus ja ympäristöasiat	
	The course will be first time lectured during the academic year 2007-2008. Only for the students of the department of Mechanical Engineering.	
Year and Period	DI 2, Period 1-3	
Lecturer	Visiting lecturers N.N.	

Aims	Lecturer responsible: Professor, M.Sc. (Tech) Matti Salste To provide understanding of packaging related legislation and its impact in the packaging business.
Contents	The main content of the packaging related legislation. 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. Opportunities to implement new features of packaging. Capability to incorporate the relevant aspects dealt in this section in the packaging business.
Course Work Evaluation	Will be announced in 2007-2008 study guide. 0-5
Course Material	Will be announced later.

Tu6206000	SUPPLY CHAIN MANAGEMENT	6 ECTS cr
	Toimitusketjun hallinta	
	Only for the students of the Master's degree programme "New Packaging Solutions".	
Year and Period	DI 1, Period int.	
Lecturer	Senior Lecturer, Janne Huiskonen Assistant, N. N.	
Aims	Relevant supply chain concepts. Basic principles and methods for planning and control of material flows in supply chains. Understanding of inter-company effects and needs for coordination and collaboration. Key performance indicators of supply chain management.	
Contents	The role and tasks of supply chain management (SCM) in a firm. Principles and basic methods of planning and control of material flows in supply chain. Supply chain dynamics and coordination. Structural design of supply chains. Inter-company relationships and collaboration. Performance measurement.	
Course Work	Lectures 24 h as intensive teaching in April to June, teaching includes exercises and case assignments. Written examination. Accepted assignments.	
Evaluation	Grade: 0-5. Examination 80%, assignments 20%.	
Course Material	Literature will be announced later.	

Tu6206050	DECISION-MAKING IN SUPPLY CHAIN	5 ECTS cr
	Päätöksenteko toimitusketjussa	
	Only for the students of the Master's degree programme "New Packaging Solutions".	
Year and Period	DI 1, Period int.	
Lecturer	Senior assistant, Petri Niemi Assistant, N. N.	
Aims	Ability to manage strategic supply chain decision-making processes and support them with quantitative supply chain analysis techniques.	
Contents	Quantitative supply chain analysis techniques utilization in strategic supply chain decision-making process. Strategic supply chain decision-making as a process. Presentations for decision-making support.	
Course Work	Lectures and group work guidance 26 h as intensive teaching in April to June. Accepted case assignments.	
Evaluation	Grade: 0-5. Case assignments oral presentations and written reports 100%.	
Course Material	Literature will be announced later.	
Prerequisites	Tu6206000 Supply Chain Management.	

Tu6306000	TECHNOLOGY MANAGEMENT	3 ECTS cr
	Teknologiajohtamisen perusteet	
	Only for the students of the Master's degree programme "New Packaging Solutions".	
Year and Period	DI 1, Period int.	

Lecturer	D.Sc. (Tech.) Ville Ojanen
Contents	Must know: Sources and Areas of Industrial Innovation. Technology Management Taxonomies and Tools. Technology and Product Strategies. Innovation Management Taxonomies. From Idea to Product Process. Management of R&D and New Product Development Projects. Assessment Methods for Decision-making in Technology Management. New Technology-based Start-ups. Should know: Product Lifecycle Management. Marketing of New Products. Collaboration in Innovation and Technology Management. Special Issues, e.g. Intellectual Property Rights.
Course Work	Lectures and exercises 18 h as intensive teaching in April to June. Written examination and case study reports.
Evaluation	0-5, examination 70 %, written and oral case/research article reports 30 %.
Course Material	Lecture notes. M. Baker & S. Hart (1999): Product Strategy and Management. Articles and Case Studies Other literature announced later.

Tu6366000	INFORMATION & KNOWLEDGE MANAGEMENT IN 6 ECTS cr INNOVATIVE ENTERPRISES
	Tietojohtaminen uudistuvassa yrityksessä
	Only for the students of the Master's degree programme "New Packaging Solutions".
Year and Period	DI 1, Period int.
Lecturer	Professor, Hannu Kärkkäinen Senior Lecturer, Jorma Papinniemi
Aims	To clarify how various systematic approaches, tools and methods of information & knowledge management can be utilized as well in product innovation as in business process re-engineering to improve the innovativeness and competitiveness of enterprises.
Contents	Must know: Challenges, needed skills and systematic approaches for the development of new innovations. Process innovation and the role of IT. Management of process information and knowledge. Design of business processes. Automation of B2B processes. Should know: How people perceive, gather, select, organize and create information and knowledge for the development of novel types of innovations. Modeling tools in BPR. Process-aware information systems (ERP, CRM, SCM, PLM).
Course Work	Lectures 32 hrs as intensive teaching in April to June. Written seminar report and its presentation and opponent report.
Evaluation	0 - 5, seminar report 70%, presentation 10%, opponent report 20%.
Course Material	Selection of articles. Becker-Kugeler-Rosemann: Process Management. A Guide for the Design of Business Processes. Springer-Verlag 2003.

9 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 Department of Business Administration, the Department of Industrial Engineering and 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 is 1.6. and 1.11. for the spring semester.

More information on schedule and courses can be found at the following Web site:
http://www.lut.fi/en/prospective_students/exchange_students/ibat_management.html

Inquiries should be addressed to the following E-mail address:
ibtm@lut.fi

9.1 Autumn Semester 2006

August 30 – December 22

1st period/August 30 - October 27

2nd period/October 30 - December 22

Orientation Day, August 30

Course number	Course	ECTS cr
Ka6520350	Emerging Market Finance	4
Ka6520401	Project Work in Finance, page 23	4
Ka6610500	Management Consulting	6
Ka6610900	Cross-Cultural Management	6
Ka6619000	Organizational Culture and Gender Aspects in Management	5
Ka6620020	Introduction to Knowledge Management	4
Ka6620450	Foundations of Knowledge Management and Organization	5
Ka6620500	Activity Theoretical Approach to Knowledge Creation and Innovation	4
Ka6720050	Cross-Cultural Marketing Strategies	5
Ka6720400	Research in Marketing Seminar Course	5
Ka6720460	Key Account Management	5
Ka6720550	Services Marketing and Management	5
Ka6720600	International Distribution Strategies	5
Ka6729000	Introduction to International Business and Planning	3
Tu6100300	Business Forecasting	4
Tu6100550	International Business Methods	7
Tu6100650	The Transformation of the Business Management in Russia	5
Tu6100800	The Basics of Doing Business in Russia	5
Tu6107000	The Economies of the Baltic States	3
Tu6307000	Technology Management in Japan	3
Tu6307050	Technology, Values and Society	3
Tu6307100	Management of Technology	5
Tu6340350	Strategic Entrepreneurship in Age of Uncertainty	5
Ki7189100	Finnish for Foreigners 1	2
Ki7189200	Finnish for Foreigners 2	2
Ki7189900	Finnish Society and Culture	2

Subject to alterations

9.1.1 Course Descriptions for Autumn 2006

Ka6520350	EMERGING MARKET FINANCE	4 ECTS cr
	Language of instruction is English	
Year and Period	Course for 4 th year students at the Master level , Period 2	
Lecturer	Professor, D.Sc. (Econ.) Mika Vaihekoski Visiting lecturers	
Aims	The aim of the course is to introduce various emerging markets and their special characteristics as well as to deepen student's knowledge of the special issues of corporate finance and asset pricing related to emerging markets.	
Contents	Emerging stock and commodity markets. Especially markets in Russia and other Eastern Europe, Latin America, South East Asia and Africa. Electricity and other commodity markets. Recent development and future directions.	
Course Work	Lectures 14 h, 2nd period. Visiting speakers. Written term paper. Exam. Elective advanced studies -level course in Finance.	
Evaluation	Graded 0-5 on the basis of the exam (80%) and term paper (20%).	
Course Material	1. Reading package 2. Handouts in the class and all additional material required by the lecturer.	
Prerequisites	Basic studies in Finance required except Bachelor's thesis.	
Ka6610500	MANAGEMENT CONSULTING	6 ECTS cr
	Language of instruction is English	
	NOTE: The course group is restricted to 30 students. All those registered for the course will be informed about the selection procedure in September 2006.	
Year and Period	Course for 3 rd year students at the Bachelor level , Period 2	
Lecturer	Professor, D.Sc. (Econ. & Bus. Adm.) Janne Tienari D.Sc. (Econ.) Olli Kuivalainen Professor, D.Sc. (Econ.) Sami Saarenketo	
Aims	The objective of the course is to present students with a theoretically and practically grounded, research-based understanding of management consulting as 1) a global industry, 2) a business for firms, and 3) professional work of individuals and teams in client projects. The course views consulting as professional and knowledge-based advice. Selected case examples present the functioning of the consultancy firm as well as the work consultants carry out with particular methodologies (tools and techniques) in client projects. The course enables students to form a substantiated view of management consulting as potential buyers of consulting services, as managers or employees working with consultants, and/or as recruits for consultancy firms.	
Contents	Thematic sessions include 1) management consulting as an advice industry (history and dynamics); overview and organization of course work, 2) knowledge-intensive consultancy firms (strategies, organization and project management), 3) consulting "change" in large client companies, 4) marketing of consultancy services, 5) growth and internationalization in consulting, 6) students' presentations of group work; course summary; preparation for the exam, 7) course exam.	
Course Work	The course requires active participation in all sessions: Thematic course sessions 7 x 3 hours (including exam). Group work and exam. Elective course in Management and Organization and International Marketing subject studies.	
Evaluation	Grading 0-5; Group work (written report and oral presentation; 30 % of course grade) and exam (70 % of course grade).	
Course Material	A selected set of articles is compiled for course reading, which will be available for purchase at the LUT bookshop (details are announced later).	
Prerequisites	Basic knowledge of management and organization studies is required.	
Ka6610900	CROSS-CULTURAL MANAGEMENT	6 ECTS cr
	Language of instruction is English	

	NOTE: The course group is restricted to 30 students. All those registered for the course will be informed about the selection procedure in September 2006.
Year and Period	Intensive course for 4 th year students at the Master level , Period 1
Lecturer	Professor, D.Sc. (Econ. & Bus. Adm.) Janne Tienari
Aims	The objective of the course is to present students with a theoretically and practically grounded, research-based understanding of how multinational firms operate and can be managed. The course pays particular attention to questions related to managing and organizing a cross-cultural workforce. Case examples are presented from multinationals operating in the Finnish and Nordic context. The course enables students to form a substantiated view of the functioning of the multinational firm, and to critically scrutinize notions of cross-cultural management therein.
Contents	Thematic sessions include 1) the multinational firm and its functioning; overview and organization of course work, 2) cross-border mergers and acquisitions as basis for contemporary multinationals (the case for socio-cultural integration), 3) managing the cross-cultural firm, 4) diversity management, 5) students' presentations of group work, 6) course summary and preparation for the exam, 7) course exam.
Course Work	Intensive course (October 23-27, 2006 & exam November 1, 2006), which requires active participation in all sessions. Thematic course sessions 6 x 4 hours (including exam). Group work and exam. Elective course in Management and Organization and International Marketing advanced studies.
Evaluation	Grading 0-5; Group work (written report and oral presentation; 30 percent of course grade) and exam (70 percent of course grade).
Course Material	Søderberg, Anne-Marie and Vaara, Eero (Editors): Merging Across Borders: People, Cultures and Politics. Copenhagen: Copenhagen Business School Press, 2003. Other course material will be announced in the first course session.
Prerequisites	Knowledge of management and organization is required.

Ka6619000	ORGANIZATIONAL CULTURE AND GENDER ASPECTS IN MANAGEMENT	5 ECTS cr
	Language of instruction is English	
Year and period	Course for 4 th year students at the Master level , Period 2	
Lecturer	Professor, Ph.D. Albert J. Mills, Saint Mary's University, Halifax Professor, D.Sc. (Econ.) Iiris Aaltio	
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	<ol style="list-style-type: none"> 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. 	
Course Work	Intensive course (November 27 - December 1). 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.	
Evaluation	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	

Ka6620020	INTRODUCTION TO KNOWLEDGE MANAGEMENT	4 ECTS cr
Language of instruction is English		
Year and Period	Course for 4 th year students at the Master level , Period 1	
Lecturer	Researcher educand N.N.	
Aims	To gain an overall view of knowledge management, to understand key elements of knowledge management and the related functional principles and tools.	
Contents	The focus will be on knowledge creation related process and development.	
Course Work	Independent study of assigned literature and a written exam.	
Evaluation	Grading 0-5	
Course Material	I. Nonaka, I. - Takeuchi, H.: The knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation, Oxford University Press, New York 1995. II. More reading materials to be announced on the course web page	
Ka6620450	FOUNDATIONS OF KNOWLEDGE MANAGEMENT AND ORGANIZATION	5 ECTS cr
Language of instruction is English		
Year and Period	Course for 4 th year students at the Master level , Period 2	
Lecturer	Senior Lecturer, Ph.D. (Psych.) Jianzhong Hong Researcher educand N.N.	
Aims	To explore the fundamental theories and concepts surrounding knowledge management and organization, and to get to know knowledge management practices and approaches in modern organizations.	
Contents	The literature study consists of three parts: 1) seminar works in knowledge management; 2) classic works in organization; and 3) selected readings in currently emerging issues on knowledge management and organization. This includes knowledge management and human resource development, knowledge management and organizational communication, and organizational knowledge and strategic management.	
Course Work	Orientation lecture at the beginning of the study + Independent study of assigned literature and a written exam. There will be a question and answer session before the exam. 2. period.	
Evaluation	Elective in Knowledge Management advanced studies. Grading 0-5	
Course Material	1. Morgan, Gareth (1997). Images of Organization. Sage Publications. 2. More reading materials to be announced on the course web page	
Ka6620500	ACTIVITY THEORETICAL APPROACH TO KNOWLEDGE CREATION AND INNOVATION	4 ECTS cr
Language of instruction is English		
Year and Period	Course for 5 th year students at the Master level , Period 2	
Lecturer	Senior Lecturer, Ph.D. (Psych.) Jianzhong Hong, Guest lectures	
Aims	To provide a systemic approach to knowledge creation and innovation based on cultural-historical activity theory. In this approach, actual business, technology and work systems are emphasized for conducting research analyses and for facilitating knowledge creation and innovation activities in organizations.	
Contents	The course will focus on a basic understanding of activity theory and its application with the help of case studies. The lectures and discussions will be around the following topics: 1) key concepts, principles and tools of activity theory in terms of knowledge creation and innovation; 2) knowledge management and competence laboratory; 3) dynamic interplay of multiple levels of learning and collaboration: case of inter-firm networks; and 4) critical transition from developers to users: studies of interaction and learning in the innovation process.	
Course Work	Intensive lectures & small group discussion + student individual project. 2 period. Elective in Knowledge Management advanced studies.	
Evaluation	Grading 0-5; lecture participation & small discussion 40%, individual/group project 60%.	
Course Material	Selected articles and book chapters (to be announced on the course web page)	

Ka6720050	CROSS-CULTURAL MARKETING STRATEGIES	5 ECTS cr
	Language of instruction is English	
Year and Period	Course for 2 nd year students at the Bachelor level , Period 2	
Lecturer	Senior Lecturer, D.Sc. (Econ.) 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: e.g. sense of time and space, communication and negotiation styles. Using the concepts to analyse how firms adapt their marketing strategies in foreign cultures.	
Course Work	10 hours of lectures, group assignments, oral group exam, term paper.	
Evaluation	Obligatory course in International Marketing basic studies. Grading 0-5; oral group exam 40 %, term paper 40 %, case report 20 %.	
Course Material	1. Selected chapters of Usunier (2000): Marketing Across Cultures, Prentice Hall. 2. Assigned reading.	
Prerequisites	090208000 Introduction to International Marketing or Ka6720000 Markkinoinnin ja hankintatoimen perusteet	
Ka6720400	RESEARCH IN MARKETING SEMINAR COURSE	5 ECTS cr
	Language of instruction is 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	Course for 4 th year students at the Master level , Period 1-2	
Lecturer	Professor, D.Sc. (Econ.) Olli Kuivalainen	
Aims	To familiarize the students with the scientific writing: writing process, finding references and analyzing their quality. To learn the basics of scientific critique. To provide the students with knowledge and skills to formulate, analyze and critically evaluate scientific research.	
Contents	To familiarize students with marketing classics (theories and research). Lectures on conducting the literature review and doing scientific research. Scientific writing skills. Analytical thinking. Finding research gap. Also the latest developments and the classics in international marketing, e.g. buyer behavior, competitive advantages, innovation management, e-business strategies, business models, internationalization models.	
Course Work	Pre-exam. 8 h of lectures in the 1st period. 16 h of seminar working in the 2nd period. Active participation, analyzing and preparing for assignments, written report, oral presentation, written evaluations of other students' research projects. Obligatory course in International Marketing advanced studies.	
Evaluation	Grading 0-5; Research project 40%, Extended research proposal 15%, Participation 15%, Presentation 15%, and Evaluations 15%	
Course Material	1. Assigned reading.	
Prerequisites	Basic knowledge of international marketing	
Ka6720460	KEY ACCOUNT MANAGEMENT	5 ECTS cr
	Language of instruction is English	
	Note! The course will not be lectured in English during the academic year 2006-2007. Independent study of assigned literature and a written exam.	
Year and Period	Course for 2 nd year students at the Bachelor level , Period 2	
Lecturer	M.Sc. (Econ.) Hanna Salojärvi	
Aims	To familiarize the students with the principles of managing large customers and customers of strategic importance in the business-to-business market. To provide both strategic and operational level views on the issue.	
Contents	Central aspects of key account management, e.g. key relationship development,	

Course Work	defining and selecting key accounts, key account analysis, planning for key accounts, organizing for key account management, the key account manager. The reading, group assignments, active participation in seminars consisting of 3 intensive seminar days in the 2nd period, seminars include lecturing and group assignments.
Evaluation	Elective course in International Marketing subject studies. Grading 0-5; written exam, completed group assignments will compensate 0..40% of the exam.
Course Material	1. McDonald, Malcolm, Beth Rogers & Diana Woodburn. Key Customers: How to Manage Them Profitably. Butterworth-Heinemann Limited, 2000. 2. Articles and other material distributed during the course.
Prerequisites	Basic knowledge in marketing.

Ka6720550	SERVICES MARKETING AND MANAGEMENT	5 ECTS cr
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	Language of instruction is English
Year and Period	Course for 4 th year students at the Master level , Period 1
Lecturer	Professor, D.Sc. (Econ.) Olli Kuivalainen Assistant, M.Sc. (Econ.) Hanna Salojärvi
Aims	To familiarize the students with the concept of service and special characteristics of services in today's marketing and service competition. To provide the students with understanding of the role and importance of relationship marketing and customer relationship management (CRM) in marketing and management of services. To provide the students with strategic views on integration of a deep customer focus and knowledge across the organization. To familiarize the students with the challenges of services marketing and management in international markets.
Contents	Special characteristics of services and service quality, customer expectations and perception of services, relationship marketing and customer relationship management (CRM), internal marketing and management of service culture, characteristics of relationship-driven organization.
Course Work	14 h of lectures including some group work in the 1st period. A written term-paper and written examination.
Evaluation	Obligatory course in International Marketing advanced studies Grading 0-5; Written examination 70 % of the final grade, Evaluation of the term paper: 30 % of the final grade.
Course Material	1. Zeithaml, Valerie A and Mary Jo Bitner, 2003. Services Marketing, Integrating Customer Focus Across the Firm. 3rd or 2nd edition. McGraw-Hill. 2. Grönroos, Christian, 2000. Service Marketing and Management. A Customer Relationship Management Approach. England: John Wiley & Sons. 3. Fitzsimmons, James A. & Fitzsimmons, Mona J., 2004. Service Management: Operations, Strategy, and Information Technology. International edition. 4th edition. McGraw – Hill
Prerequisites	Bachelor level marketing studies

Ka6720600	INTERNATIONAL DISTRIBUTION STRATEGIES	5 ECTS cr
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	Language of instruction is English
Year and Period	Course for 4 th year students at the Master level , Period 2
Lecturer	Docent, D.Sc. (Econ.) Mika Gabrielsson D.Sc. (Econ.) Olli Kuivalainen
Aims	To familiarize the students with the role of distribution in the global economy and to provide them with the practical techniques for the selection of the optimal distribution system for the firm during the international market entry and penetration and along the globalization. To provide the students with the skills necessary for managing the chosen distribution system and for maintaining a mutually beneficial relationship with the channel members.
Contents	The role of the distribution system in international business and marketing context. Key concepts, tools and best practices in international marketing channel design and management. Channel structural dimensions and decision-making as to alternative routes to foreign markets and different types of middlemen available. The criteria for the selection of the appropriate channel and channel member depending on the internationalization/globalization phase and development. Legal and other factors

	affecting the choices and the relationship. Role of internet and opportunities it offers. Establishment of a suitable relationship and management of the distribution channel along the development of the firm, especially with respect to the following aspects: marketing, motivation, and conflict resolution. Characteristics and trends of distribution in various markets.
Course Work	12 h of lectures as intensive teaching in the 2nd period. 4 hours of exercises in the 2nd period. Written examination. Oral and written project work. See the course web page for further information.
Evaluation	Elective course in International Marketing advanced studies. Grading 0-5 Active class participation Written exam (has to be passed, 70% of final grade)
Course Material	Assignment: oral and written project work (30% of final grade)
Prerequisites	Assigned reading to be announced on the course web page. Basic understanding of international marketing.

Ka6729000	INTRODUCTION TO INTERNATIONAL BUSINESS AND PLANNING	3 ECTS cr
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	Language of instruction is English
Year and Period	Course for 2 nd -3 rd year students at the Bachelor level , Period 1
Lecturer	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.
Course Work	Intensive course (September 7-8 & 13-15). 25 hours of lectures and case exercises.
Evaluation	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

Tu6100300	BUSINESS FORECASTING	4 ECTS cr
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	Language of instruction is English
Year and Period	Course for 4 th year students at the Master level , Period 1
Lecturer	Professor 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.
Course Work	Lectures 28 h, exercises 14 h 1. period.
Evaluation	Grading 0-5; a written examination 80 - 100 %, exercise report 0 - 20 %.
Course Material	Will be distributed to the participants.
Prerequisites	Basic skills in statistics (hypothesis testing, etc.), matrix algebra and elementary differential calculus. Recommended: A course dealing with economics/business decision making, or marketing research.

Tu6100550	INTERNATIONAL BUSINESS METHODS	7 ECTS cr
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	Language of instruction is English
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Year and Period	Course for 4 th year students at the Master level , Period 1-2
Lecturer	Professor, Ph.D. Tauno Tiusanen Assistant Anna Mikkola
Aims	Students know the advantages and disadvantages of different entry modes, and are able to evaluate risks and opportunities in the global markets.
Contents	Must know: The course reviews the various trade theories and the usefulness of them in practice. It explores the main features of international trading and business relations since the Second World War. Various types of markets and methods to evaluate them will be discussed. Modes of international operations will be introduced; special attention will be paid to exporting, contractual arrangements and foreign direct investment (FDI). Theoretical approaches which explain international factor mobility are analysed and practical examples discussed. Different currency regimes will be discussed. Should know: Trade agreements between nations, risks in international business. Nice to know: International financial markets, cultural factors in international business.
Course Work	Lectures 42 h 1. period, exercises 14 h 1. period and 14 h 2. period.
Evaluation	Grading 0-5; a written examination 50 %, exercises 25 %, research report 25 %.
Course Material	Lecture handouts. Taggart, James - McDermott, Michael C.: The Essence of International Business, London - New York 1993. Luostarinen, Reijo - Welch, Lawrence: International Business Operations. Helsinki 1990.
Prerequisites	Tu6100050 Introduction to International Business.

Tu6100800	THE BASICS OF DOING BUSINESS IN RUSSIA	5 ECTS cr
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	Language of instruction is English
Year and Period	Course for 2 nd -3 rd year students at the Bachelor level , Period 2
Lecturer	Professor, M.Sc. (Tech.) Juha Väättänen
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.
Course Work	Lectures 35 h, presentation 10 h, seminar work 40 h, 2. period.
Evaluation	Grading 0-5; examination.
Prerequisites	No prerequisites.

Tu6107000	THE ECONOMIES OF THE BALTIC STATES	3 ECTS cr
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	Language of instruction is English
Year and Period	Course for 4 th year students at the Master level , Period 2
Lecturer	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?
Course Work	Intensive course (October 30 - November 3). 20 hours of lectures and case studies.
Evaluation	Graded 0-5 on the basis of active class participation, group case studies and an essay
Course Material	1. Nielsen, Jorgen Ulf-Moller, Erik Strojer Madsen, Kurt Pedersen, <i>International Economics. The wealth of open nations</i> . Berkshire: McGraw-Hill Book Company, First print 1994. 2. Purju, Alari, 2004, "The institutional framework and trade pattern of the Baltic states after EU membership in trade with the CIS ", <i>Turku School of Economics and Business Administration, Series C Discussion, ISSN 1456-4793, 20 p.</i>

Prerequisites	3. Case studies of enterprises, material http://www.hex.com/tallinn/riga/vilnius Basic courses in international economy and marketing
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Tu6307000	TECHNOLOGY MANAGEMENT IN JAPAN	3 ECTS cr
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	Language of instruction is English	
Year and Period	Course for 4 th year students at the Master level , Period 1	
Lecturer	Professor, D.Sc. (Tech.) Takaya Ichimura Nihon University, Tokyo	
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	Lectures on the following: 1. The role of technology management and its contribution to industrial development 2. What is technology management? - the purpose of technology management - kind of technology - technology and management 3. Technology management system in the innovation management - innovation management system - the function of technology management 4. The characteristics of Japanese industry - the historical and cultural background of Japanese industry - traditional culture and modern industry of Japan - causes of development of Japanese industry - an overview of technology management in Japan - the role of technology and its management in Japanese industry - new dilemma of Japanese industry 5. Aspects of technology management - R & D management - new product development and product improvement - management technology and its application - computer technology and industrial technology - production management and technology management 6. Future problem on technology management	
Course Work Evaluation	Intensive course (September 18-21). 16 hours of lectures and class discussions. Graded 0-5 on the basis of active participation in classes and a written assignment	
Course Material	Written material will be distributed during lectures	
Prerequisites	Basic knowledge of management	

Tu6307050	TECHNOLOGY, VALUES AND SOCIETY	3 ECTS cr
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	Language of instruction is English	
Year and Period	Course for 4 th year students at the Master level , Period 1	
Lecturer	Professor, D.Sc. (Tech.) Jorma Heinonen Concordia International University Estonia	
Aims	The primary objective of the course is to introduce the students a wider view to technology including the contemporary thinking of technology management principles. The society views technology basically as a source of welfare and prosperity. This view will be put in perspective in presenting alternative approaches to technology evaluation. In that context issues related to values, moral philosophy as well as ethical studies about technology will be referred.	
Contents	The course will cover the up to date view on technology, its evolution and certain basic management issues. Philosophical aspects, ethical studies and moral principles concerning technology will be reviewed and discussed. The role of technology in society will be looked as a generator of social changes the consequences of which can be two kinds: 1. It can create new opportunities 2. It can create new problems for individuals and societies	
Course Work	Intensive course (October 9-13). 20 hours of lectures, case exercises and reporting in English	

Evaluation	Graded 0-5 on the basis of active class participation, individual assignments and a written examination
Course Material	Written material will be distributed during lectures
Prerequisites	Basic knowledge in international business or marketing

Tu6307100	MANAGEMENT OF TECHNOLOGY	5 ECTS cr
	Language of instruction is English	
Year and Period	Course for 4 th year students at the Master level , Period 1-2	
Lecturer	D.Sc. (Tech.) Tuomo Kässi, Professor LUT/Department of Industrial Engineering and 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	
Course Work	28 hours of lectures in English	
Evaluation	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 planning	

Tu6340350	STRATEGIC ENTREPRENEURSHIP IN AGE OF UNCERTAINTY	5 ECTS cr
	Language of instruction is English	
Year and Period	Course for 5 th year students at the Master level , Period 1	
Lecturer	Professor, D.Sc. (Tech.) Marko Torkkeli	
Contents	Must know: This course examines issues related entrepreneurship and entrepreneurial mind-set. Entrepreneurial mindset. Identifying opportunities. Management of market and technology uncertainty.	
Course Work	Lectures 28 h, 1. period.	
Evaluation	Grading 0-5; a written report.	
Course Material	Lectures. McGrath Rita and MacMillan Ian, (2000). The Entrepreneurial Mindset. Harvard Business School Pr.	

9.2 Spring Semester 2007

January 11 - May 18

3rd period/January 11 - March 9

4th period/March 12 - May 18

Orientation Day, January 11

Course number	Course	ECTS cr
Ka6520301	Theory of Corporate Finance	7
Ka6520401	Project Work in Finance	4
Ka6520451	Venture Capital and Private Equity Investing	4
Ka6520501	Financial Modeling Using Excel	5
Ka6620300	Organizational Learning and Competence Management	6
Ka6639000	Small and Medium Size Enterprise Management and Business Development	3
Ka6710460	Innovation and Competitiveness	5
Ka6720100	Integrated Marketing Communication	5
Ka6720150	Internationalization of the Firm	5
Ka6720200	Sales Management and Personal Selling	5
Ka6720350	Corporate Social Responsibility	5
Ka6720450	High Technology Marketing	5
Ka6720500	International Entrepreneurship	5
Ka6729100	Cross-Cultural Encounters	3
Tu6100050	Introduction to International Business	4
Tu6100500	Consumer Behavior	4
Tu6100600	Doing Business in Transitional Economies	7
Tu6100650	The Transformation of the Business Management in Russia, page 23	5
Tu6100750	Enterprises and Competition in Russia	5
Tu6100850	Transitional Countries Integration with the European Union – Trade, Manufacturing and Labour Perspective	5
Tu6107050	Business Environment in Transitional Economies	4
Tu6301550	Transportation Systems	5
Tu6340450	Technology Commercialization and Corporate Venturing	5
Ki7189100	Finnish for Foreigners 1	2
Ki7189200	Finnish for Foreigners 2	2
Ki7189900	Finnish Society and Culture	2

Subject to alterations

9.2.1 Course Descriptions for Spring 2007

Ka6520301	THEORY OF CORPORATE FINANCE	7 ECTS cr
Year and Period	Language of instruction is English	
Lecturer	Course for 4 th year students at the Master level , Period 4	
Aims	Professor, D.Sc. (Econ.) Minna Martikainen	
Contents	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.	
Course Work	Specific issues of corporate finance include dividends, valuation, mergers and acquisitions, listings, IPOs, ownership structures, corporate governance, asymmetric information and international finance.	
	Lectures / seminar 21 h, 4. period. Term paper (In written form, paper is presented by students in the seminar). Exam.	
	Compulsory advanced studies -level course in Finance.	

Evaluation	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	Basic studies in Finance required except Bachelor's thesis.	
Ka6520451	VENTURE CAPITAL AND PRIVATE EQUITY INVESTING	4 ECTS cr
	Language of instruction is English	
	Lectured intensively every other year. Next time during academic year 2006-2007.	
Year and Period	Course for 4 th year students at the Master level , Period 3	
Lecturer	LL.Lic. Jari Lauriala	
Aims	Lecturer responsible: Professor, D.Sc. (Econ.) Eero Pätäri The objective of the course is to give the participants an understanding of the key areas of VC and PE investing through lectures and real life cases that are solved in small groups and presented and discussed during seminar sessions.	
Contents	The course introduces fund structures (limited partnerships), investment process, due diligence, valuation, instrumentation of debt and equity, formulating and drafting investment agreements, exit strategy and risk management through the investment cycle.	
Course Work	Intensive lecturing 14 h + case exercises, Spring 2007. Exam. Elective advanced studies -level course in Finance.	
Evaluation	Graded 0–5 on the basis of written exam and case exercises.	
Course Material	1. Lauriala, Jari: Pääomasijoittaminen, Edita, 2004. 2. Gladstone, David - Gladstone, Laura: Venture Capital Handbook: An Entrepreneur's Guide to Raising Venture Capital, 1988 or newer edition, selected parts. 3. Gladstone, David - Gladstone, Laura: Venture Capital Investing: The Complete Handbook for Investing in Private Businesses for Outstanding Profits, 2003 or newer edition, selected parts. 4. Handouts in the class and all additional material required by the lecturer.	
Prerequisites	Basic studies in Finance required except Bachelor's thesis.	
Ka6520501	FINANCIAL MODELING USING EXCEL	5 ECTS cr
	Language of instruction is English	
Year and Period	Course for 4 th year students at the Master level , Period 4	
Lecturer	Professor, D.Sc. (Econ.) Mika Vaihekoski	
Aims	The aim is to teach students how to model and solve financial problems independently using spreadsheet programs (mainly Excel).	
Contents	Advanced Excel use; building models in corporate finance, investments, bonds, stocks, portfolio management, and derivatives. Basics of Excel's Visual Basic for Applications-macro language.	
Course Work	Lectures 21 h, 4th period. Elective advanced studies -level course in Finance.	
Evaluation	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. 2. Handouts in the class and all additional material required by the lecturer.	
Prerequisites	Basic studies in Finance required except Bachelor's thesis.	
Ka6620300	ORGANIZATIONAL LEARNING AND COMPETENCE MANAGEMENT	6 ECTS cr
	Language of instruction is English	
Year and Period	Course for 4 th year students at the Master level , Period 4	
Lecturer	Senior Lecturer, Ph.D. (Psych.) Jianzhong Hong Researcher educand N.N.	
Aims	The aim of this virtual course is to familiarize students to the state of the art knowledge, and to facilitate a basic understanding of the key elements of the concerned topic and the related functional principles and supporting tools	
Contents	The course consists of three parts of virtual participation and interaction:	

Course Work	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 supposed to be accomplished with the guide of the problem-based learning method. Reading summaries, online exam, group assignment and discussion through WebCT, 4. period. There will be an info-meeting at the beginning of the course, and a guiding session before the start of the group work, 4. period.
Evaluation	Obligatory in Knowledge Management advanced studies. Elective in Management and Organization subject studies.
Course Material	Grading 0-5; individual literature study 40%, group work 60% 1. Argyris, C. & Schön, D.A. (1996). Chapters from the book Organizational learning II: Theory, method, and practice. Reading Mass.: Addison Wesley. 2. Prahalad, C.K. & Hamel, G. (1990). The Core Competence of the Corporation, Harvard Business Review, May/June, 79-91. 3. More to be announced.

Ka6639000	SMALL AND MEDIUM SIZE ENTERPRISE MANAGEMENT AND BUSINESS DEVELOPMENT	3 ECTS cr
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Year and Period	Language of instruction is English
Lecturer	Course at the Master level , Period 4 Professor, D.Sc. (Econ.) Timo Pihkala LUT/Department of Business Administration
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.
Course Work	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.
Evaluation	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

Ka6710460	INNOVATION AND COMPETITIVENESS	5 ECTS cr
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Year and Period	Language of instruction is English
Lecturer	Course for 1 st -2 nd year students at the Bachelor level , Period 3 Dr. Hannes Toivanen
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.
Course Work	21 h of lectures. Exam. Obligatory course in Technology Research subject studies.
Evaluation	Grading 0-5
Course Material	Will be announced later, see web-pages.

Ka6720100	INTEGRATED MARKETING COMMUNICATION	5 ECTS cr
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	Language of instruction is English
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Year and Period	Course for 3 rd year students at the Bachelor level , Period 4
Lecturer	Senior Lecturer, D.Sc. (Econ.) Liisa-Maija Sainio
Aims	To familiarize the student to the concept and process of marketing communication. To give the students basic skills in the design, implementation and managing 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 managing of advertising, sales promotion and public relations. The introduction of electronic and print media, media choice, creative process and execution of promotion campaign. The services in campaign planning, advertising business and advertiser-agency relationship. Legal and ethical issues in advertising. The course is focused especially in mass-communication, because there is a separate course available in personal selling and sales management.
Course Work	28 hours of lectures, 14 hours of exercises, groupwork and individual ad analysis report, 4th period. Written exam.
Evaluation	Obligatory course in International Marketing subject studies. Grading 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	090208000 Introduction to International Marketing, Tu6100000 Markkinoinnin peruskurssi or Ka6720000 Markkinoinnin ja hankintojen perusteet

Ka6720150	INTERNATIONALIZATION OF THE FIRM	5 ECTS cr
	Language of instruction is English	
Year and Period	Course for 3 rd year students at the Bachelor level , Period 3	
Lecturer	Professor, D.Sc. (Econ.) Sami Saarenketo Senior Lecturer, D.Sc. (Econ.) Liisa-Maija Sainio	
Aims	To familiarize the students with the characteristics of international market environment and theories of internationalization. To provide strategic views on market choice and market entry.	
Contents	Internationalization theories: e.g. Uppsala model. Network Model and Born Globals. Growth strategies of the firm. Characteristics and risks of the international economic, political and sociocultural environment. International market selection process and market entry modes. Implementation and coordination of international marketing program with supporting market research and analyses.	
Course Work	21 hours of lectures and 14 hours of practical exercises. Obligatory course in International Marketing subject studies.	
Evaluation	Grading 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 Market Responsive Approach, 2001. 2. Assigned reading.	
Prerequisites	Ka6720000 Markkinoinnin ja hankintojen perusteet or 090208000 Introduction to International Marketing. Ka6720010 Vienti- ja tuontitoiminta is recommended.	

Ka6720200	SALES MANAGEMENT AND PERSONAL SELLING	5 ECTS cr
	Language of instruction is English	
Year and Period	Course for 3 rd year students at the Bachelor level , Period 3-4	
Lecturer	N. N.	
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.	
Course Work	24 h of lectures in 3rd period. 14 h of exercises in 4th period. Written exam. Elective course in International Marketing subject studies.	
Evaluation	Grading 0-5; Written examination 60 %, 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. A Reading package	

Prerequisites	Ka6720000 Markkinoinnin ja hankintatoimen perusteet (Ka6720010 Vienti- ja tuontitoiminta recommended).	
Ka6720350	CORPORATE SOCIAL RESPONSIBILITY	5 ECTS cr
	Language of instruction is English	
Year and Period	Course for 2 nd year students at the Bachelor level , Period 3-4	
Lecturer	M.Sc. (Econ.) Riikka Lammi	
Aims	To familiarize students with concepts of Corporate Social Responsibility, Corporate Citizenship and Sustainable Development and with their relevance to business activities. To give students practice in implementing the concepts in real life like situations and in taking a view of different stakeholders.	
Contents	Concepts of CSR, SD and Corporate Citizenship; emerging management issues (ecology and environment, health and well-being, diversity and human rights, communities); impacts on business activities (company and industry level); standards and guidelines, different implementation models.	
Course Work	15hrs of lectures, intensive teaching (3rd period) Group assignments (4th period) WebCT assignments (4th period) Written exam.	
Evaluation	Elective course in International Marketing subject studies Grading 0-5; Written exam 50 %, Group assignments 30 %, Learning diary 20 %.	
Course Material	Grayson & Hodges (2002), Everybody's Business – Managing risks and opportunities in today's global society, DK Publishing, London. Klein (2000), No Logo – Taking Aim at the Brand Bullies, Flamingo, London. Other material distributed during the course.	
Prerequisites	090208000 Introduction to International Marketing or Ka6720000 Markkinoinnin ja hankintatoimen perusteet	
Ka6720450	HIGH TECHNOLOGY MARKETING	5 ECTS cr
	Language of instruction is English	
	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.	
Year and Period	Course for 4 th year students at the Master level , Period 4	
Lecturer	Professor, D.Sc. (Econ.) Olli Kuivalainen	
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.	
Course Work	28 h of interactive lectures in the 4th period. Active participation. In- and out-class assignments. Exam.	
Evaluation	Obligatory course in International Marketing advanced studies. Elective course in Technology Research advanced studies. Grading 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	

Prerequisites	Products and Innovations. Second Edition. Pearson Prentice Hall. 2. Assigned reading. Basic knowledge of international marketing.
Ka6720500	INTERNATIONAL ENTREPRENEURSHIP 5 ECTS cr
	Language of instruction is 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	Course for 4 th year students at the Master level , Period 3-4
Lecturer	Professor, D.Sc. (Econ.) Sami Saarenketo D.Sc. (Econ.) 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.
Course Work	12 h of lectures including guest entrepreneurs as lecturers, 3.-4. period. 12 h of field project presentations, 3.-4. period. Group tutorials.
Evaluation	Obligatory course in International Marketing advanced studies. Grading 0-5 Active class and tutorial participation
Course Material	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)
Prerequisites	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 Basic understanding of international business. Entrepreneurship studies are recommended.
Ka6729100	CROSS-CULTURAL ENCOUNTERS 3 ECTS cr
	Language of instruction is English
Year and Period	Course for 2 nd year students at the Bachelor level , Period 3
Lecturer	N.N.
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.
Course Work	24 hours of lectures and case exercises in English
Evaluation	Graded 0-5 on the basis of activity, exercises, a completed lecture diary and an essay
Course Material	Reading material for the course provided by the lecturer
Prerequisites	Active participation and 80 % attendance
Tu6100050	INTRODUCTION TO INTERNATIONAL BUSINESS 4 ECTS cr
	Language of instruction is English
Year and Period	Course for 2 nd year students at the Bachelor level , Period 4
Lecturer	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

Course Work Evaluation Prerequisites	<p>will be paid to foreign trade theories and alternatives in export business. Balance of payments on current account will be overviewed.</p> <p>Should know: Different trade policy alternatives are overviewed. Currency issues, especially exchange rates will be discussed. Evaluation of export markets and communicating across cultures.</p> <p>Lectures 21 h 4. period. Grading 0-5; examination. Lecture handouts.</p> <p>Root, Franklin: Entry Strategies: for International Markets. 1994. Three first chapters.</p>
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Tu6100500	CONSUMER BEHAVIOR	4 ECTS cr
Year and Period Lecturer Aims Contents Course Work Evaluation Course Material Prerequisites	<p>Language of instruction is English</p> <p>Course for 3rd year students at the Bachelor level, Period 3 Professor, TTL Seppo Pitkänen</p> <p>Basic skills to understand consumption and buying decisions.</p> <p>Must know: Consumption and buying behavior explained by economical, psychological and sociological factors at the individual, as well as organizational level. Should know: Some cultural differences in national, individual, and organizational behavior. Nice to know: Understanding the meaning of behavioral factors for those who are purely technically oriented.</p> <p>Lectures 28 h, 3. period. Grading 0-5; a written examination.</p> <p>In the examination: Solomon, Michael R. & Bamossy, Gary & Askegaard, Søren: Consumer Behaviour - A European Perspective. Prentice Hall Europe, 1999.</p> <p>Tu610050 Introduction to International Business.</p>	

Tu6100600	DOING BUSINESS IN TRANSITIONAL ECONOMIES	7 ECTS cr
Year and Period Lecturer Aims Contents Course Work Evaluation Course Material Prerequisites	<p>Language of instruction is English</p> <p>Course for 4th year students at the Master level, Period 3-4 Professor, Ph.D. Tauno Tiusanen Assistant Anna Mikkola</p> <p>Students are able to evaluate the emerging markets and choose the right modes of operations in TEs.</p> <p>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.</p> <p>Lectures 42 h 3. period, exercises 14 h 3. period and 14 h 4. period. Grading 0-5; examination 50 %, exercises 25 %, research report 25 %. Lecture handouts.</p> <p>Tiusanen, Tauno - Kinnunen, Jatta - Kallela, Sami: EU's Enlargement Process: Investment Climate in 10 Transitional Economies, Northern Dimension Research Centre, Publication n:o 7, Lappeenranta University of Technology 2004. Tiusanen Tauno: The Baltic States - Successful Transition in Estonia, Latvia and Lithuania, Northern Dimension Research Centre, Publication n:o 5, Lappeenranta University of Technology 2004. Tiusanen Tauno: Poland, the Largest New EU Country., Northern Dimension Research Centre, Publication n:o 4, Lappeenranta University of Technology 2004. Tiusanen Tauno: Development of the Russian Rouble - The Crisis of 1998 and Its Aftermath, Northern Dimension Research Centre, Publication n:o 3, Lappeenranta University of Technology 2003.</p> <p>Tu6100550 International Business Methods.</p>	

Tu6100750	ENTERPRISES AND COMPETITION IN RUSSIA	5 ECTS cr
	Language of instruction is English	

Year and Period	Course for 4 th year students at the Master level , Period 3
Lecturer	Professor, M.Sc. (Tech.) Juha Väättänen
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.
Course Work	Lectures 35 h, presentations 20 h, seminar work 40 h, 3. period.
Evaluation	Grading 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. Väättänen, Juha. Ivanova, Oksana. Kyrki, Anna. Lindqvist, Jani. Case Study on Russian Offshore Software Development - Strategy in the Making. LUT. 2005.
Prerequisites	Tu6100800 The Basics of Doing Business in Russia, not required from foreign exchange students.

Tu6100850	TRANSITIONAL COUNTRIES INTEGRATION WITH THE EUROPEAN UNION - TRADE, MANUFACTURING AND LABOUR PERSPECTIVE	5 ECTS cr
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	Language of instruction is English
Year and Period	Course for 4 th year students at the Master level , Period 4
Lecturer	Professor, M.Sc. (Tech.) Juha Väättänen
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.
Course Work	Lectures 35 h, presentations 20 h, seminar work 40 h, 4. period.
Evaluation	Grading 0-5; examination.
Course Material	Literature will be announced on lectures.
Prerequisites	No prerequisites.

Tu6107050	BUSINESS ENVIRONMENT IN TRANSITIONAL ECONOMIES	4 ECTS cr
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	Language of instruction is English
Year and Period	Course for 4 th year students at the Master level , Period 4
Lecturer	Professor, D.Ph. Tauno Tiusanen
Aims	To familiarize the students with various aspects of post-communist market, including development trends in internal and external economy. Special attention will be paid to the problem of how transitional economies (TEs) will integrate themselves into the global economy and how western companies react to this development.
Contents	The most important details of the communist legacy in TEs will be covered in order to familiarize the students with the problems of transition. The role of certain outside organizations in the transitional process will be described (IMF, EC, World Bank etc.). Special features of individual TEs are outlined and examples of business operations in Western companies provided.
Course Work	Intensive course. 28 hours of lectures in English
Evaluation	Graded 0-5 on the basis of active class participation and successful participation on case exercise
Course Material	1. Tiusanen Tauno, Kinnunen Jatta, Kallela Sami: EU's Enlargement Process: Investment Climate in 10 Transitional Economies, Lappeenranta University of Technology, Northern Dimension Research Centre, Publication No 7/2004 2. Tiusanen, Tauno: Poland, the Largest New EU Country, Lappeenranta University of Technology, Northern Dimension Research Centre, Publication No 4/2004 3. Tiusanen, Tauno: Development of the Russian Rouble - The Crisis of 1998 and its Aftermath, Lappeenranta University of Technology, Northern Dimension Research Centre, Publication No

	3/2003 4. Tiusanen Tauno, Kinnunen Jatta: EU's Eastern Enlargement and the Future Expansion of the Eurozone, Lappeenranta University of Technology, Northern Research Centre, Publication No 23/2005 5. Tiusanen Tauno: Foreign Investors in Transitional Economies: Cases in Manufacturing and Services, Lappeenranta University of Technology, Northern Research Centre, Publication No 27/2006
Prerequisites	Good command in English and in business methods

Tu6301550	TRANSPORTATION SYSTEMS	5 ECTS cr
	Language of instruction is English	
Year and Period	Course for 4 th -5 th year students at the Master level , Period 4	
Lecturer	Professor, D.Sc. (Econ.) 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.	
Course Work	Lectures 14 h and cases 12 h as intensive teaching in the 4 th period	
Evaluation	Grading 0-5; Exam (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%20Dissertation%20Woxenius.pdf 3. Laine, Jouni (2005). Redesign of Transfer Capabilities – Studies in Container Shipping Services. Helsinki School of Economics, A-254 (Doctoral Diss.). Available at URL: http://helecon3.hkkk.fi/pdf/diss/a254.pdf 4. 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.	

Tu6340450	TECHNOLOGY COMMERCIALIZATION AND CORPORATE VENTURING	5 ECTS cr
	Language of instruction is English	
Year and Period	Course for 4 th -5 th year students at the Master level , Period 4	
Lecturer	Professor, D.Sc. (Tech.) Marko Torkkeli	
Aims	Guest lectures 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.	
Course Work	Lectures and guest speakers 28 h as intensive teaching in the 4th period. Written report.	
Evaluation	Grading 0-5; a 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.	

9.3 Courses offered in the Autumn and Spring semesters

<i>Ki7189100</i>	<i>FINNISH FOR FOREIGNERS 1</i>	<i>2 ECTS cr</i>
	Language of instruction is English	
Period	Course for beginners, Period 1 and 3	
Lecturer	M.A. Raija Hietaranta	
Aims	To give the students the ability - to cope orally in very simple everyday situations - to understand very simple spoken Finnish - to read very simple texts with the help of a dictionary	
Contents	The phonetic, intonation and orthographic systems of the Finnish language, basic structures, notions and vocabulary.	
Course Work	The course will begin with an intensive period using the Silent Way teaching/learning method. Pronunciation, listening and speaking will be practised by means of pair and group work plus other similar activities. 28 hours of lessons, homework 26 hours.	
Evaluation	Grading 0-5; Active class attendance and participation. A written examination.	
Course Material	Handouts provided by the teacher	
Prerequisites	No previous knowledge of the Finnish language is expected	
<i>Ki7189200</i>	<i>FINNISH FOR FOREIGNERS 2</i>	<i>2 ECTS cr</i>
	Language of instruction is English	
Period	Course for beginners, Period 2 and 4	
Lecturer	M.A. Raija Hietaranta	
Aims	To give the students the ability - to communicate orally in everyday situations - to understand simple spoken Finnish - to read simple texts with the help of a dictionary - to write simple Finnish	
Contents	The course will broaden the already learnt grammar and increase the vocabulary (for example expressions).	
Course Work	Simple literary texts will be studied both in class and as homework. In the classroom the newly learnt language material will be practised by means of pair and group work plus other similar activities. 28 hours of lessons, homework 26 hours.	
Evaluation	Grading 0-5; Active class attendance and participation. A written examination.	
Course Material	Handouts provided by the teacher	
Prerequisites	Finnish for Foreigners 1 or corresponding knowledge	
<i>Ki7189900</i>	<i>FINNISH SOCIETY AND CULTURE</i>	<i>2 ECTS cr</i>
	Language of instruction is English	
Period	Period 1-2 and 3-4	
Lecturer	Dr. Kalle Michelsen, Professor (Finnish History, Political Culture, Social and Economic System) M.A. Kristiina Korjonen-Kuusipuro, Reseacher (Finnish Culture)	
Aims	Dr. Mika Tonder, Senior lecturer, (Landscapes, mentalities) 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).	
Course Work	24 h lectures in English. The course is divided in following parts: A) Finnish history (4 lectures) B) Finnish political culture (4 lectures) C) Finnish economic systems (4 lectures) D) Finnish culture (4 lectures) E) Finnish society (4 lectures) G) Finnish landscape and mentality (4 lectures)	
Course Material	Portraying Finland. Facts and Insights. Otava 2005. (Available in the library)	
Evaluation	Passed on the basis of participation 60%, final report or presentation 40%.	

Ka6520401	PROJECT WORK IN FINANCE	4 ECTS cr
	Language of instruction is English	
Year and Period	Course for 4 th year students at the Master level , Period 1-4	
Lecturer	Professor, D.Sc. (Econ.) Eero Pätäri	
Aims	Develop student's abilities to apply finance theory in practice to solve problems faced by companies.	
Contents	Learning and understanding client company's financial problem and presenting a solution to the problem.	
Course Work	Written project report (20-30 pages). Students can choose freely the timing of project work. Professor's approval to the subject of the project has to be asked beforehand.	
Evaluation	Elective advanced studies -level course in Finance. Graded 0-5 on the basis of written report.	
Prerequisites	Basic studies in Finance required except Bachelor's thesis.	

LITERATURE EXAMS - Independent study of assigned literature

Tu6100650	THE TRANSFORMATION OF THE BUSINESS MANAGEMENT IN RUSSIA	5 ECTS cr
Year and Period	Course for 4 th -5 th year students at the Master level	
Lecturer	Professor, M.Sc. (Tech.) Juha Väättänen	
Aims	To know the key phases of the transformation of the business management in Russia.	
Contents	Must know: Key issues of organisational and managerial transformation in Russia. Should know: Decision making in Russia, cultural characteristics. Management transformation in state owned and private companies. Nice to know: Managerial comparison between Russia, former Soviet Union, and western countries. Transition of leadership and management in different business sectors.	
Course Work	Literature exam.	
Evaluation	Grading 0-5; examination.	
Course Material	Holden, Nigel - Cooper, Cary - Carr, Jennifer: Dealing with the New Russia, Management Cultures in Collision. John Wiley & Sons, Chichester, 1998. Liuhto, Kari: Ex-Soviet Enterprises and Their Managers Facing the Challenges of the 21st Century, Lappeenranta University of Technology, Lappeenranta, 2001. Collection of Articles.	
Prerequisites	Tu6100800 The Basics of Doing Business in Russia.	

10 Language Centre Courses 2006 – 2007

Further instructions on registering for language courses are provided in the Language Centre study guide and on the Internet at www.lut.fi/kike.

Remember to register for courses and exams separately.

English

		<i>ECTS</i>
Ki7110100	Technical English Reading Course 1	2
Ki7110200	Technical English Reading Course 2	2
Ki7110300	Business English Reading Course	2
Ki7110401	Activation of English Skills	3
Ki7112000	Information Technology	2
Ki7112200	Energy Issues	3
Ki7112400	Technology and the Environment	3
Ki7112601	Machines and Processes	3
Ki7112800	Financial English	2
Ki7113000	English for Marketing	3
Ki7113201	Writing for Business	2
Ki7113400	English for Academic Seminars	3
Ki7116000	Aspects of Work	3
Ki7116200	Technical and Current Issues	2
Ki7116400	English for Negotiating	3
Ki7116600	English for Presentations	2
Ki7116800	Going International and Intercultural Communication	3
Ki7117001	Scientific and Technical English Writing Course	4
Ki7119000	Academic Seminar for International Programs	6

German

		<i>ECTS</i>
Ki7124400	Finnland als Partner	3
Ki7125001	Die Alpenländer	2
Ki7125200	Kultur und Geschichte	3
Ki7125400	Interkultureller Kurs	1
Ki7125600	Aktuelle Themen	1
Ki7125801	Finnische Industrie	2
Ki7126000	Chemie und Papier	2
Ki7126200	Maschinenbau	2
Ki7126400	Energietechnik	2
Ki7126600	Wald und Holz	2
Ki7126800	Wirtschaftsprache Deutsch	3
Ki7127000	Kommunikation im Unternehmen	2
Ki7128200	Makroökonomie ganz einfach	3
Ki7128400	Verhandlungssprache Deutsch	2

Russian

		<i>ECTS</i>
Ki7145200	Suggestopedic Course in Business Russian	3

French

		<i>ECTS</i>
Ki7153200	Français de l'entreprise	3
Ki7155200	Suggestopedic French Course	1
Ki7155400	Suggestopedic Course in Business French	1
Ki7156400	France et francophonie	3

Spanish

		<i>ECTS</i>
Ki7163400	Datos sobre América Latina	3

Finnish

		<i>ECTS</i>
Ki7189100	Finnish for Foreigners 1	2
Ki7189200	Finnish for Foreigners 2	2
Ki7189300	Finnish for Foreigners 3	2
Ki7189800	German-Finnish Lingual and Cultural Tandem	1

Chinese

		<i>ECTS</i>
Ki7190100	Beginning Chinese 1	3
Ki7190200	Beginning Chinese 2	3
Ki7190300	Beginning Chinese 3	3
Ki7190400	Beginning Chinese 4	3

10.1 Course descriptions

<i>Ki7110100</i>	<i>TECHNICAL ENGLISH READING COURSE 1</i>	<i>2 ECTS cr</i>
Year and Period	Period 1, 2, 3, 4	
Lecturer	Jukka Taipale Mauri Mustonen	
Aims	To learn and master general technical vocabulary through reading general technical texts and be able to read quickly and effectively.	
Contents	The course will be taught at a B2/B2+ level according to the Common European Framework. Vocabulary exercises, skimming, scanning and affixes, reading comprehension exercises, individual, pair or group work.	
Course Work	The languages of instruction are both Finnish and English. 28 contact hours, with 24 hours required for homework and self-study 1. period: group A, 2. period: group B, 3. period: group C, 4. 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.	
Evaluation	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 course Technical English Reading Course 2 or Business English Reading Course are not eligible for this course.	

<i>Ki7110200</i>	<i>TECHNICAL ENGLISH READING COURSE 2</i>	<i>2 ECTS cr</i>
Year and Period	Period 1, 2, 3, 4	
Lecturer	Jukka Taipale Mauri Mustonen	
Aims	To learn and master different types of text material, to utilise a variety of skills necessary for critical and creative reading, to develop the process of understanding not only what a writer says but why he says it and on what basis.	
Contents	The course will be taught at a B2/B2+ level according to the Common European Framework. General technical reading texts. Activities which require both oral and written work in addition to reading. Vocabulary exercises, skimming, scanning	
Course Work	The languages of instruction are both Finnish and English. 28 contact hours, with 24 hours required for homework and self-study. 1. period: group A, 2. period: group B, 3. period: group C, 4. 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.	
Evaluation	0–5	
Course Material	Provided by the teacher.	
Prerequisites	Students with a matriculation exam grade of M, E or L may enroll for the course. Students who have taken course Technical English Reading Course 1 or Business English Reading Course are not eligible for this course.	

Ki7110300	BUSINESS ENGLISH READING COURSE	2 ECTS cr
Year and Period	KTM 1, Period 1, 2, 3	
Lecturer	Jukka Taipale	
Aims	To learn and master general business vocabulary through reading general business texts, and to be able to read quickly and effectively.	
Contents	The course will be taught at a B2/B2+ level according to the Common European Framework. Vocabulary exercises, skimming, scanning and affixes, reading comprehension exercises, individual, pair or group work.	
Course Work	The languages of instruction are both Finnish and English. 28 contact hours, with 24 hours required for homework and self-study. 1. period: group A, 2. period: group B, 3. period: group C. Attendance: 50% of the lessons	
Evaluation	Marks are based on a reading comprehension test (duration 90 minutes). Students must do all the assignments to be eligible for the examination.	
Course Material	0–5	
Prerequisites	Provided by the teacher. Students who have taken course Technical English Reading Course 1 or Technical English Reading Course 2 are not eligible for this course.	

Ki7110401	ACTIVATION OF ENGLISH SKILLS	3 ECTS cr
Year and Period	Period 1–2, 3–4	
Lecturer	Mauri Mustonen	
Aims	During the course, students will: - work on and improve their active listening skills - both listening for general understanding and for specific information, - work on their oral communication skills and coping mechanisms, - work on improving basic writing skills, - work on grammar that causes difficulties, - expand their active vocabulary both in general English as well as in more specific areas, such as business and engineering, - work on pronunciation, both on common problems as well as those specific to the individual.	
Contents	Using topics that they mainly decide on themselves, students go through a variety of exercises to help them gain confidence in their English skills and to prepare them for self-directed learning, as well as other, more difficult English language courses in the future.	
Course Work	Language of instruction: English 56 hours of contact, with 22 hours required for homework and self-study. 1. –2. period: group A, 3. –4. period: group B Completion of the course will be determined through continuous assessment both in class and through assignments. Thus, a minimum active attendance of 75 percent is required. This course is open to students from all disciplines. Please note that it will no longer be accepted as part of the compulsory language requirement.	
Evaluation	Pass/Fail.	
Course Material	There is no specific book requirement. There will be various sources of information used including textbooks, the Internet, possibly journals and magazines as well as material provided by the teacher and the students themselves.	
Prerequisites	B1 according to the Common European Framework. Students must assess their level of English before applying for the course using an online diagnostic tool called Dialang. It can be found at www.dialang.org . Students who have a B2 or higher are not eligible for this course as a rule.	

Ki7112000	INFORMATION TECHNOLOGY	2 ECTS cr
Year and Period	Period 1, 2, 4	
Lecturer	Jukka Taipale	
Aims	To learn and master the language needed to read and talk about issues connected with information technology and to develop and amaster the study skills needed to follow lectures given in English.	
Contents	The course will be taught at a B2/B2+ level according to the Common European Framework. 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.	

Course Work	28 contact hours, with 24 hours required for homework and self-study. 1. period: group A, 2. period: group B, 4. period: group C. Continuous assessment of the student's participation in class, resulting in an oral mark, and written exercises approved by the teacher.
Evaluation	0–5, oral mark 50%, written exercises 50%
Course Material	Provided by the teacher and the students.

Ki7112200	ENERGY ISSUES	3 ECTS cr
Year and Period	Period 3–4	
Lecturer	Peter Jones	
Aims	To develop speaking, listening and reading skills based on the theme of energy. CEF Level: B2 and above	
Contents	Language practice and exercises based on various energy issues – ranging from technological challenges to economic and environmental considerations. Language of instruction: English	
Course Work	Contact hours: 48 (24+24) Homework 30+ 3.–4. period: Groups A and B Attendance required. Written test and continuous assessment/oral test.	
Evaluation	0–5, written test (50%), continuous assessment/oral test (50%)	
Course Material	Provided by the Language Centre	

Ki7112400	TECHNOLOGY AND THE ENVIRONMENT	3 ECTS cr
Year and Period	Period 1-2	
Lecturer	Hwei-Ming Boey	
Aims	To develop the student's speaking, listening and reading skills. CEF level: B2 and above	
Contents	Issues concerning the environment. Language of instruction: English	
Course Work	48 contact hours + 30 hours independent study 1. –2. period (groups A and B) 75% attendance required A listening comprehension and an oral expression test or continuous assessment of speaking ability.	
Evaluation	0–5, listening comprehension 50 % of final mark, oral expression/continuous assessment 50 %	
Course Material	Provided by the teacher.	

Ki7112601	MACHINES AND PROCESSES	3 ECTS cr
Year and Period	TkK 1–3, Period 1–2	
Lecturer	Kati Pulli	
Aims	During the course, students will: <ul style="list-style-type: none"> • work on oral communication, active listening and writing skills, • review, reactivate and expand their technical vocabulary, • review grammar structures that are found in technical writing , as well as those that are causing some difficulty. 	
Contents	Using technically-oriented materials, students will mainly work on their oral communication skills, with some concentration on active listening skills and writing. Students will be required to give a variety of presentations and though there will be no in depth teaching of presentation skills, a basic overview will be given.	
Course Work	48 hours, with at least 30 hours required for homework and self-study. 1. –2. period: Groups A and B. This class is oriented towards students in engineering and they will be given priority. If there are spaces available, students from other disciplines will be welcome. Student marks 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.	
Evaluation	0–5	
Course Material	Materials will be provided by the students and the teacher.	
Prerequisites	B1+/B2 level according to the Common European Framework. Students must assess their level of English before the course using an online diagnostic tool	

	<p>called Dialang. It can be found at www.dialang.org. Students at levels of B1 and lower should consider taking the course Ki7110400 Activation of English Skills before applying to Machines and Processes</p> <p>Students are also expected to know the following before coming to class:</p> <ul style="list-style-type: none"> • the names of basic shapes and their adjective forms, • how to read numbers and decimals in English. <p>Self study materials are available online and in the self-access room (1410B) for review.</p>
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Ki7112800	FINANCIAL ENGLISH	2 ECTS cr
Year and Period	Period 1, 4	
Lecturer	Peter G. Jones	
Aims	To improve English skills in the field of financial management. CEF Level: B2 and above	
Contents	The language of finance, including business finance, taxation, investment etc. Language of instruction: English	
Course Work	Contact hours: 24 Homework: 15+ 1. period: Group A, 4. period: Group B Attendance required. Written test.	
Evaluation	0–5, written test (100%)	
Course Material	Provided by the Language Centre.	

Ki7113000	ENGLISH FOR MARKETING	3 ECTS cr
Year and Period	KTK 1–3, Period 1–2, 3–4	
Lecturer	Kati Pulli	
Aims	During the course, students will: <ul style="list-style-type: none"> • work on oral communication, active listening and writing skills • learn phrases to use in more specific scenarios such as negotiations, presentations and customer service, • work towards expanding their marketing vocabulary. 	
Contents	Through role plays, case studies and small group work, students will work towards increasing their oral fluency, written accuracy and active listening ability. Students will also have the opportunity for autonomous study through the group project and self-study exercises meant to help students prepare for discussions and exercises. The language of instruction is English.	
Course Work	48 hours, with at least 30 hours required for homework and self-study. 1. –2 period: Groups A and B This class is oriented towards students in business and marketing and they will be given priority. If there is space available, students from other disciplines will be welcome. Student marks 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. Please note: Some assignments from Ka6720100 Integrated Marketing Communication can be used in this course as well. Therefore it is of some advantage to the student to either do these courses together or complete English for Marketing first. If you wish to do these courses concurrently, please mention it when applying to the course in the section "Lisätietoja/Additional information". This in no way guarantees acceptance into the course. Please note: Some assignments from Ka6720100 Integrated Marketing Communication can be used in this course as well. Therefore it is of some advantage to the student to either do these courses together or complete English for Marketing first. If you wish to do these courses concurrently, please mention it when applying to the course in the section "Lisätietoja/additional information". This in no way guarantees acceptance into the course.	
Evaluation	0–5	
Course Material	Materials will be provided by the teacher.	
Prerequisites	B1+/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 found at www.dialang.org . Students at levels of B1 and lower should consider taking the course Ki7110400 Activation of English Skills before applying to English for Marketing.	

Ki7113201	WRITING FOR BUSINESS	2 ECTS cr
Year and Period	Period 3, 4, 5	
Lecturer	Paula Haapanen	
Aims	During the course, students will: <ul style="list-style-type: none"> • learn set phrases to help them correspond in a number of professional situations. • learn to differentiate between formal, less-formal and informal business correspondence. • learn how to find sources of reference in connection with writing. • learn to critically read and constructively comment on other students' work through peer review 	
Contents	Using a variety of sources and scenarios, and with guidance from the teacher, students will help each other to learn how to deal with a wide range of business correspondence: from requests and complaints to internal memos and reports. The language of instruction is English.	
Course Work	This class is based on Web Enhanced Language Learning. The course will mainly use the WebCT platform so that students can share ideas, critique each other's work and receive feedback from the teacher in small groups, which the teacher will assign at the beginning of the course. There will be two face-to-face tutor sessions of 2 hours and they will be used to address problems that students have encountered during individual study and virtual group work. 4 hours of contact + 48 hours of individual study, virtual group work and peer evaluation. 3. period: Group A (intensive group, meant for NPS students) 4. period: Groups B and C 5. period: Group D Students of all disciplines are welcome. The marks are based on a portfolio and a learning journal.	
Evaluation	Pass/Fail	
Course Material	There is no specific book requirement. However, students are advised to obtain Andrew Littlejohn's book <i>Company to Company</i> , published by Cambridge University Press (CUP). Students will also be required to research materials on their own from other sources of information, including other textbooks, the Internet, and possibly journals and magazines.	
Prerequisites	B1+ according to the Common European Framework. Students must assess their level of written English before the course using an online diagnostic tool called Dialang. It can be found at www.dialang.org . Students at levels of B1 and lower should consider taking Activation of English Skills before applying to Writing for Business.	
Ki7113400	ENGLISH FOR ACADEMIC SEMINARS	3 ECTS cr
Year and Period	Period 1–2	
Lecturer	Peter G. Jones	
Aims	To learn and practise basic skills needed to research and give an academic seminar in English. CEF Level: B2 and above	
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	
Course Work	Contact course: 24 (Period 1) Homework: 55+ Seminar: Period 2 Attendance required. Seminar paper and presentation. Students who have attended Ki717000 Scientific and Technical Writing Course or Ki7119000 Academic Seminar for International Programs are not eligible for this course.	
Evaluation	0–5, seminar paper and presentation (100%)	
Course Material	Provided by the Language Centre.	
Prerequisites	The course is primarily meant for students of chemical technology. The course is compulsory for students majoring in Applied Chemistry. Students of other departments will be accepted if place is available.	
Ki7116000	ASPECTS OF WORK	3 ECTS cr
Year and Period	Period 1–2, 3–4	
Lecturer	Hwei-Ming Boey	
Aims	<ul style="list-style-type: none"> • To develop the student's speaking, listening and reading skills • To discuss various types of CVs and letters of application 	
Contents	CEF level: B2 and above Issues concerning work. Language of instruction: English	

Course Work	48 contact hours + 30 hours independent study 1.–2.period (group A), 3.–4. period (group B) 75% attendance required. A reading comprehension and writing test and an oral expression test or continuous assessment of speaking ability.
Evaluation	0–5, reading comprehension and writing test 50 %, oral expression or continuous assessment 50 %
Course Material	Provided by the teacher.

Ki7116200	TECHNICAL AND CURRENT ISSUES	2 ECTS cr
Year and Period	Period 1–2,3–4	
Lecturer	Peter G. Jones Jukka Taipale	
Aims	To increase and/or maintain the fluency in English. To improve understanding of spoken discourse, both technical and general. CEF Level: B2 and above	
Contents	Language practice and exercises based on audio and video material from a variety of sources concerning topics of interest, both technical and general.	
Course Work	Language of instruction: English Contact hours: 26 Homework: 25+ 1.–2. period: Groups A and B, 3.–4. period: Group C and D Listening comprehension test. Continuous assessment/speaking test. 75% attendance required	
Evaluation	Students who have attended the course Current Issues are not eligible for this course. 0–5, listening comprehension test (50%), continuous assessment/speaking test (50%).	
Course Material	Provided by the Language Centre.	

Ki7116400	ENGLISH FOR NEGOTIATING	3 ECTS cr
Year and Period	Period 1–2, 3–4	
Lecturer	Hwei-Ming Boey Lecturer, N. N.	
Aims	To practise the language needed for participating in negotiations. CEF level: B2 and above	
Contents	Discussion and practice of the language for effective negotiating, participation in simulations of negotiations.	
Course Work	Language of instruction: English 48 contact hours + 30 hours independent study 1.–2. period: group A group B (intensive group, meant for NPS students) 3.–4. period: group C Continuous assessment. 80% attendance required.	
Evaluation	0–5	
Course Material	Provided by the teacher.	

Ki7116600	ENGLISH FOR PRESENTATIONS	2 ECTS cr
Year and Period	Period 1, 2	
Lecturer	Peter G. Jones	
Aims	To improve the ability to construct and deliver spoken presentations in English. CEF Level: B2 and above	
Contents	<ul style="list-style-type: none"> The language of presentations – starting a presentation, controlling the flow, the language of diagrams, summing up, handling questions etc. Delivering presentations in a supportive context. Analysing one's own performance and establishing areas in need of further development. 	
Course Work	Language of instruction: English Contact hours: 24 Homework: 25+ 1. period: group A, 2. period: groups B and C Presentation. 75% attendance required.	
Evaluation	0–5, evaluated presentation (100%)	
Course Material	Provided by the Language Centre.	

Ki7116800	GOING INTERNATIONAL AND INTERCULTURAL COMMUNICATION	3 ECTS cr
Year and Period Lecturer Aims	Period 3–4 Barbara Miraftabi By using theories of experiential learning and general interculturalist theory, students will analyze their own cultures, practice observation of culture by using Finnish situations, and learn more about self as a cultural being. Students will write responses regarding different aspects of the course. Negotiation between the instructor and students will decide how much time will be spent on the do's and don'ts of individual cultures.	
Contents	The language of instruction is English. By using theories of experiential learning and general interculturalist theories, students will analyze their own cultures, practise observation of culture by using Finnish situations, 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. Negotiation between the instructor and students will decide how much time will be spent on the do's and don'ts of individual cultures.	
Course Work	48 h contact lessons, 30 h independent study Periods 3.–4, groups A and B, taught once in the academic year. NOTE: This is a special language course which is non-traditional and uses the language for studying content, in this case culture. Students will be expected to communicate in English at all times during the course and many activities will involve students in activities outside of the classroom. Students (with a level of at least B2) from all departments are welcome. Preference will be given to students applying to be exchange students or planning to work abroad. Continuous assessment based on 75% attendance, active class participation, the papers, and group and individual presentations. Alternatively students may take writing and oral tests given after all required class assignments are completed. 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.	
Evaluation Course Material	Pass/Fail No required book; handouts will be given and Internet sources used.	

Ki7117001	SCIENTIFIC AND TECHNICAL ENGLISH WRITING COURSE	4 ECTS cr
Year and Period Lecturer Aims	Period 3–4 Barbara Miraftabi To write a draft of a research paper or some other acceptable paper (related to the fields of study offered at LUT) negotiated with the instructor, and to present the paper orally.	
Contents	The draft of the paper 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.	
Course Work	The language of instruction is English. 48 hours contact lessons, 56 hours independent study 3.–4. period (1 group) The course is offered once every year and a limited number are accepted. The course is meant for DI 1–2/KTM 1–2 level and post graduate students, i.e. those who need to use written English in the course of their higher studies in economics, science, engineering and / or research. Students should have a B2 or C1 level of English and some piece of factual material related to their field of study to develop for writing a paper. Younger students may be accepted for the course if there is room.	
Evaluation Course Material	Pass or Fail No book required; there will be handouts from various books, including materials developed by the teacher. Information on the Internet will also be referenced.	

Ki7119000	ACADEMIC SEMINAR FOR INTERNATIONAL PROGRAMS	6 ECTS cr
Year and Period Lecturer	Period 2–4 Barbara Miraftabi	

Aims	To practice listening skills related to lectures given by departmental instructors; to practice speaking skills so that one's own English language accent can be understood by others; to develop skills for participating in seminar discussions as presenters, questioners and listeners; to write an acceptable seminar paper; to 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, including writing practice subject to 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 is English.
Course Work	72 hours contact lessons, 84 hours independent study 2.–4. periods: groups A and B The course is offered once during the academic year for the departmental international master degree programs. Students should have a B2 or C1 level according to the Common European Framework. 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.
Evaluation	Pass or Fail.
Course Material	No required book; handouts from various books, material developed by language teachers, and Information on the Internet will all be used.
Prerequisites	Acceptance by a department of LUT into an International Master Degree program.

Ki7124400	FINNLAND ALS PARTNER	3 ECTS cr
	Facts about Finland and Germany	
Period	1 - 2, 3 - 4	
Lecturer	Jörg Wunderlich Theodor Steidel	
Aims	Knowledge of the differences and similarities between Finland and Germany. Basic oral communication skills needed in business and at work.	
Contents	Students learn to use expressions and vocabulary needed in oral communication situations. Small talk about Finland.	
Course Work	Lessons 48 (24+ 24), appr. 30 hours independent study Periods I and II (groups A and B), Periods III and IV (groups C and D) Language of instruction: German Work in pairs and groups, role play, listening comprehension exercises. Active participation in lessons required. Oral communication and listening comprehension skills are evaluated based on continuous assessment and listening assignments or a conversation and listening comprehension test. Continuous assessment based on 75% attendance and active class participation.	
Evaluation	0-5	
Literature	Handouts given by the lecturer.	
Prerequisites	The course Työelämän saksaa or equivalent skills. CEF-level: A2	

Ki7125000	DIE ALPENLÄNDER	1 ECTS cr
	Getting to Know Austria and Switzerland	
Period	4	
Lecturer	Jörg Wunderlich	
Aims	Students learn about the people, culture and geographic characteristics of Austria and Switzerland.	
Contents	Students find out about where the stereotypes related to Austria and Switzerland come from. The history, culture, society and economic life of the countries are discussed with the help of different texts, videos and the Internet.	
Course Work	Lessons 24, appr. 28 hours of independent study Period IV (1 group). Language of instruction: German Work in pairs and groups and written and oral communication exercises in class.	

Evaluation	Evaluation based on a written examination or satisfactorily completed assignments. Continuous assessment based on 75% attendance and active class participation.
Literature	0-5
Prerequisites	Handouts given by the lecturer. The course Työelämän saksaa or equivalent skills CEF-level: B1
Ki7125200	KULTUR UND GESCHICHTE 3 ECTS cr
	German Culture and History
Period	3-4
Lecturer	Sanna Heikkeri
Aims	Students learn about important German cultural personalities and phenomena throughout the times and important historical events in Germany.
Contents	Group assignments and presentations, movies, literature and written assignments related to German culture and history.
Course Work	24 h contact teaching + approx. 54 h independent work. Period III-IV (1 group). Language of instruction: German Active participation in lessons required (min. 50%). Evaluation based on presentations and written assignments.
Evaluation	0-5
Prerequisites	Basic skills in German CEF-level: B1
Ki7125400	INTERKULTURELLER KURS 1 ECTS cr
	Intercultural German Course
Period	1-2
Lecturer	Theodor Steidel
Aims	Improving and maintaining oral communication skills.
Contents	Topics chosen by the group.
Course Work	Conversation with a native German-speaking lecturer and German exchange students. Lessons 24 (6 sessions, dates set in the 1st lesson) Period I-II (1 group). Language of instruction: German Continuous assessment based on 75% attendance and active class participation.
Evaluation	Pass/Fail
Prerequisites	Finnland als Partner or equivalent skills CEF-level: B1
Ki7125600	AKTUELLE THEMEN 1 ECTS cr
	Current Issues in German
Period	3-4
Lecturer	Theodor Steidel
Aims	Improving and maintaining oral communication skills.
Contents	Topics chosen by the group.
Course Work	Conversation with a native German-speaking lecturer, also visiting lecturers. Lessons 24 (6 sessions, dates set in the 1st lesson) Period III-IV (1 group). Language of instruction: German Continuous assessment based on 75% attendance and active class participation.
Evaluation	Pass/Fail
Prerequisites	Finnland als Partner or equivalent skills CEF-level: B2
Ki7125800	FINNISCHE INDUSTRIE 1 ECTS cr
	Finnish Industry in German
Period	1
Lecturer	Jörg Wunderlich
Aims	Students learn to speak and write about Finnish industry and products.
Contents	Students are introduced to material on Finnish industry.

Course Work	The material includes magazine and newspaper articles and brochures of Finnish companies in German. The course is suitable for students from all departments. Individual assignments and work in pairs and groups. Lessons 24 Period I (1 group). Language of instruction: German
Evaluation	Evaluation based on a written examination or satisfactorily completed assignments. Continuous assessment based on 75% attendance and active class participation.
Literature	0-5
Prerequisites	Handouts given by the lecturer. The course Työelämän saksaa or equivalent skills CEF-level: B1

Ki7126000	CHEMIE UND PAPIER	2 ECTS cr
	German for Chemical and Paper Technology	
Period	4	
Lecturer	Jörg Wunderlich	
Aims	Students learn to understand texts about chemical technology and talk about processes.	
Contents	Students revise the structures of specialised technical language. They also practice using technical language in oral and written form.	
Course Work	Lessons 24, appr. 28 hours of independent study Period IV (1 group). Language of instruction: German	
Evaluation	Evaluation based on a written examination or satisfactorily completed assignments. Continuous assessment based on 75% attendance and active class participation.	
Literature	0-5	
Prerequisites	Handouts given by the lecturer. The course Työelämän saksaa or equivalent skills CEF-level: A2	

Ki7126200	MASCHINENBAU	2 ECTS cr
	German for Mechanical Engineering	
Period	2	
Lecturer	Jörg Wunderlich	
Aims	Students learn the basic terminology related to the field.	
Contents	Students revise the structures of specialised technical language. They also practice describing technical processes and products in oral and written form.	
Course Work	Language of instruction: German Lessons: 14, appr. 38 hours of independent study (online course) Period 2: 1 group	
Evaluation	Continuous assessment based on 75% attendance and active class participation. Evaluation based on a written examination or satisfactorily completed assignments.	
Literature	0-5	
Prerequisites	The material includes texts in German and online material. The course Työelämän saksaa or equivalent skills. CEF-level: A2	

Ki7126400	ENERGIETECHNIK	2 ECTS cr
	German for Energy Technology	
Period	3	
Lecturer	Jörg Wunderlich	
Aims	Students learn the basic terminology related to the field.	
Contents	Students revise the structures of specialised technical language. They also practice using technical language in oral and written form.	
Course Work	Language of instruction: German Lessons 24, appr. 28 hours of independent study Period 3: 1 group	
Evaluation	Evaluation based on a written examination or satisfactorily completed assignments. Continuous assessment based on 75% attendance and active class participation.	
	0-5	

Literature	Handouts given by the lecturer.
Prerequisites	The course Työelämän saksaa or equivalent skills. CEF-level: A2
Ki7126600	WALD UND HOLZ 2 ECTS cr
	German for Forest Industry
Period	3
Lecturer	Jörg Wunderlich
Aims	Students learn the basic terminology related to the field.
Contents	Forestry, protecting forests, environmental issues, certification, timber harvesting, wood processing (sawmill, paper and pulp)
Course Work	Lessons 14, appr. 38 hours of independent study Period 3 (1 group). Language of instruction: German For the most part, the coursework is carried out independently through virtual teaching. Evaluation based on a written examination or satisfactorily completed assignments. Continuous assessment based on 75% attendance and active class participation.
Evaluation	0-5
Literature	The material includes texts in German and online material.
Prerequisites	The course Työelämän saksaa or equivalent skills CEF-level: B1
Ki7126800	WIRTSCHAFTSPRACHE DEUTSCH 3 ECTS cr
	Business German
Period	1-2, 3-4
Lecturer	Theodor Steidel
Aims	Students study texts on economics in German and the related structures and vocabulary.
Contents	Students practice reading economic texts and preparing documents in German. The course is suitable for students from all departments.
Course Work	Lessons 48 (24+ 24): Periods I and II (groups A and B) Periods III and IV (groups C and D) Language of instruction: German Evaluation based on a written examination or satisfactorily completed assignments. Continuous assessment based on 75% attendance and active class participation.
Evaluation	0-5
Literature	Handouts given by the lecturer.
Prerequisites	The course Työelämän saksaa or equivalent skills CEF-level: B1
Ki7127000	KOMMUNIKATION IM UNTERNEHMEN 2 ECTS cr
	German Business Communication
Period	3-4
Lecturer	Theodor Steidel
Aims	Students learn about business communication.
Contents	Students learn to recognise difference in communicational cultures; examples from Finnish and German companies.
Course Work	Lessons 24 (12+12): Period III-IV (1 group). Language of instruction: German Evaluation based on a presentation, written assignments and an examination. Continuous assessment based on 75% attendance and active class participation.
Evaluation	0-5
Literature	Handouts given by the lecturer.
Prerequisites	Wirtschaftssprache Deutsch or equivalent skills.
Ki7128200	MAKROÖKONOMIE GANZ EINFACH 3 ECTS cr
	Basics of Macroeconomics
Period	1-2

Lecturer	Theodor Steidel	
Aims	Students learn about the language of economics.	
Contents	Students practice using economics terminology and structures in oral and written form.	
Course Work	Lessons 48 (24+ 24): Period I-II (1 group). Language of instruction: German	
Evaluation	Students prepare and give a presentation or take a written and oral test. Continuous assessment based on 75% attendance and active class participation.	
Literature	0-5	
Prerequisites	Handouts given by the lecturer. Wirtschaftssprache Deutsch or equivalent skills. CEF-level: B2	
Ki7128400	VERHANDLUNGSSPRACHE DEUTSCH	2 ECTS cr
	Negotiating in German	
Period	3-4	
Lecturer	Theodor Steidel	
Aims	Students learn to use the most important expressions commonly used in negotiations.	
Contents	Students prepare for negotiations, simulate and analyse them.	
Course Work	Lessons 48 (12+ 12+ intensive part 24): Period III-IV (1 group). Language of instruction: German	
Evaluation	Active participation or an oral test. Continuous assessment based on 75% attendance and active class participation.	
Literature	0-5	
Prerequisites	Handouts given by the lecturer. CEF-level: B2	
Ki7145200	SUGGESTOPEDIC COURSE IN BUSINESS RUSSIAN	3 ECTS cr
Period	3-4	
Lecturer	Natalia Kurilova	
Aims	Students develop their knowledge and skills in intercultural business communication. The aim is for students to speak more fluently and expand their vocabulary.	
Contents	Typical oral communication situations in business (e.g. receiving guests, presenting the company, business lunches, meetings etc.) Role play, relaxation techniques, exercises that promote creativity.	
Course Work	The course is suitable for students from all departments. Lessons 48 (24+24), Period I and II (1 group). Language of instruction: Russian	
Evaluation	Weekend course, the dates and times are set with the students. Active participation in lessons required.	
Literature	Pass/Fail	
Prerequisites	Handouts given by the lecturer. The course Työelämän venäjää or Russkij jazyk dlja delovyh ljudej or equivalent skills. CEF-level: A2	
Ki7153200	FRANÇAIS DE L'ENTREPRISE	3 ECTS cr
	Business French	
Period	3-4	
Lecturer	David Erent	
Aims	Students learn more about oral and written communication skills required in business, and about French business life.	
Contents	Situations: Presenting the company, roles and responsibilities in an enterprise, professional tasks, business letters, applying for a position (announcements, application, CV), presentation. Structures: Comparison, expressions of condition and supposition, tenses, indirect clauses, adverbs, past perfect, subjunctive, passé simple, past conditional.	
Course Work	Exercises that support communication skills. Lessons 48 (24+ 24), independent work approx. 30 h. Period III-IV (1 group). Written test. Oral test or continuous assessment. Continuous assessment based on 75% attendance and active class participation.	

Evaluation	The course is suitable for students from all departments.
Literature	0-5
Prerequisites	Penformis: Français.com French 3, Työelämän ranskaa or equivalent skills. CEF-level: B1
Ki7155200	SUGGESTOPEDIC FRENCH COURSE 1 ECTS cr
Period	1 or 2
Lecturer	Vuokko Paakkonen
Aims	Activation of oral French skills with a suggestopedic method.
Contents	Everyday communication and business communication.
Course Work	Work in pairs and groups, role play, relaxation techniques, exercises that promote creativity. Lessons 24 (weekend course). Periods I or II (1 group). Continuous assessment based on 80 % attendance and active class participation.
Evaluation	pass/fail
Literature	Handouts given by the lecturer.
Prerequisites	French 3 or equivalent skills CEF-level: B1
Ki7155400	SUGGESTOPEDIC COURSE IN BUSINESS FRENCH 1 ECTS cr
Period	3 or 4
Lecturer	Vuokko Paakkonen
Aims	Activation of oral French skills with a suggestopedic method.
Contents	Typical business communication situations. The course is suitable for students from all departments.
Course Work	Work in pairs and groups, role play, relaxation techniques, exercises that promote creativity. Lessons 24 (weekend course). Period I or II (1 group), Period III or IV (1 group) Continuous assessment based on 80 % attendance and active class participation.
Evaluation	pass/fail
Literature	Handouts given by the lecturer.
Prerequisites	French 3, Työelämän ranskaa or equivalent skills. CEF-level: B1
Ki7156400	FRANCE ET FRANCOPHONIE 3 ECTS cr
	France and Francophony
Period	3-4
Lecturer	David Erent
Aims	Students learn about French-speaking countries, especially France, and learn to communicate related issues mainly orally.
Contents	French-speaking countries and their institutions. French geography, culture and society; the topics will be decided on with the students.
Course Work	Mainly oral, but also some written assignments. Lessons 48 (24+ 24). Continuous assessment based on 75 % attendance and active class participation. The course can be integrated with student exchange or work in a French-speaking country. In such cases the assignments should be discussed in advance with the lecturer.
Evaluation	0-5
Literature	Handouts given by the lecturer.
Prerequisites	CEF-level: B1
Ki7163400	DATOS SOBRE AMÉRICA LATINA 3 ECTS cr
	Facts about Latin America
Period	3-4
Lecturer	Javier Garcia
Aims	Students learn about Latin American countries and cultures and complete reading and writing

Contents	exercises. Topics on history, customs, geography and society.
Course Work	Work in pairs and groups, reading and writing exercises, simple conversations. Each student gives a presentation on a Latin American country. Active participation in 75 % of lessons, satisfactorily completed oral and written assignments, no examination. Lessons 48 (24+ 24): Periods III and IV 1 group Language of instruction: Spanish Part of the course can be carried out in a Latin American country. In such cases assignments are discussed with the lecturer in advance.
Evaluation	Pass/Fail
Literature	Handouts given by the lecturer.
Prerequisites	CEF-level: B1

Ki7189100	FINNISH FOR FOREIGNERS 1	2 ECTS cr
Period	1, 3	
Lecturer	Raija Hietaranta Elina Häkkinen	
Aims	To give the students the ability 1. to cope orally in very simple everyday situations 2. to understand very simple spoken Finnish 3. to read very simple texts with the help of a dictionary. CEF-level A1.1	
Contents	The phonetic, intonation and orthographic systems of the Finnish language, plus basic structures, notions and vocabulary.	
Course Work	The course will begin with an intensive period using the Silent Way teaching/learning method. Pronunciation, listening and speaking will be practised by means of pair and group work plus other similar activities. Lessons 28, homework 26 hours. Period 1: group A (for the departmental international master degree programs), groups B and C (for the exchange students) Period 3: group D (for the exchange students)	
Evaluation	A written examination. Group A: Pass/fail Groups B–D: 0-5	
Course Material	The handouts given in the classes.	
Prerequisites	No previous knowledge of the Finnish language is expected.	

Ki7189200	FINNISH FOR FOREIGNERS 2	2 ECTS cr
Period	2, 4	
Lecturer	Raija Hietaranta Elina Häkkinen	
Aims	To give the students the ability 1. to communicate orally in everyday situations 2. to understand simple spoken Finnish 3. to read simple texts with the help of a dictionary 4. to write simple Finnish CEF-level A1.1	
Contents	The course will broaden the already learnt grammar and increase the vocabulary (for example expressions).	
Course Work	Simple literary texts will be studied both in class and as homework. In the classroom the newly learnt language material will be practised by means of pair and group work plus other similar activities. Lessons 28, homework 26 hours. Period 2: group A (for the departmental international master degree programs), group B (for the exchange students)	
Evaluation	A written examination Group A: Pass/fail Group B: 0-5	
Prerequisites	Finnish for Foreigners 1 or corresponding knowledge	

Ki7189300	FINNISH FOR FOREIGNERS 3	2 ECTS cr
Period	3-4	
Lecturer	Elina Häkkinen	
Aims	To give the students the ability 1. to strengthen the student's oral skills in Finnish 2. to broaden the understanding of Finnish conversations 3. to broaden the grammatical skills of the students	
Contents	CEF-level: A1.2 The course includes new grammatical topics and gives the students more tools to have a conversation in Finnish. The earlier learnt vocabulary will be broadened.	
Course Work	Texts with some new vocabulary and grammatical structures will be studied in classroom and as homework. Different kinds of spoken situations will be practiced. There will be lectures on grammar as well as different written grammar exercises. Lessons 28, homework 26 hours. A written examination	
Evaluation	0-5	
Prerequisites	Finnish for Foreigners 1 and 2 or corresponding knowledge.	
Ki7189800	GERMAN-FINNISH LINGUAL AND CULTURAL TANDEM	1 ECTS cr
Period	1, 3	
Lecturer	Karita Riekkö Elina Häkkinen	
Aims	To strengthen the student's Finnish language skills and expand their cultural awareness. The Tandem course is suitable for completion in connection with Finnish for Foreigners 1 and 2.	
Course Work	Contact teaching 4 lessons Work in pairs 24 lessons The course can be completed during either one or two semesters. A learning diary will be required.	
Evaluation	Pass/Fail.	
Ki7190100	BEGINNING CHINESE 1	3 ECTS cr
Year and Period	Period 1–2, 3–4	
Lecturer	Matina Ma Hwei-Ming Boey	
Aims	To introduce students to the basics of Chinese. CEF level: A1	
Contents	Chinese phonetics and the tone system, followed by an introduction to the skills of reading, writing and speaking Chinese. Language of instruction: English and Chinese	
Course Work	56 contact hours, meeting three times a week. Each lesson lasts one full hour. 1.–2. period, groups A and B 3.–4. period, groups C and D	
Evaluation	Regular class tests and a final exam which tests reading, listening and speaking ability. 0–5	
Course Material	Provided by the teacher.	
Ki7190200	BEGINNING CHINESE 2	3 ECTS cr
Year and Period	Period 1–2, 3–4	
Lecturer	Matina Ma Hwei-Ming Boey	
Aims	To offer those who have completed Ki7190100 Beginning Chinese 1 an opportunity to continue reading, writing and speaking Chinese. CEF level: A1	
Contents	Emphasis is on polishing pronunciation and expanding vocabulary and usage. Language of instruction: English and Chinese	

Course Work	56 contact hours, meeting three times a week. Each lesson lasts one full hour. 1.–2. period (group A), 3.–4. period (group B)
Evaluation	Evaluation: Regular class tests and a final exam.
Course Material	0–5
Prerequisites	Provided by the teacher. Successful completion of Beginning Chinese 1, or possession of equivalent skill level.

Ki7190300	BEGINNING CHINESE 3	3 ECTS cr
Year and Period	Period 1–2, 3–4	
Lecturer	Matina Ma	
Aims	To offer those who have completed Ki7190200 Beginning Chinese 2 an opportunity to continue reading, writing and speaking Chinese.	
Contents	CEF level: A1 Emphasis is on polishing pronunciation and expanding vocabulary and usage. Language of instruction: English and Chinese	
Course Work	56 contact hours, meeting three times a week. Each lesson lasts one full hour. 1.–2. period (group A), 3.–4. period (group B)	
Evaluation	Evaluation: Regular class tests and a final exam	
Course Material	0–5	
Prerequisites	Provided by the teacher. Successful completion of Beginning Chinese 2, or possession of equivalent skill level.	

Ki7190400	BEGINNING CHINESE 4	3 ECTS cr
Year and Period	Period 3–4	
Lecturer	Matina Ma	
Aims	To offer those who have completed Ki7190300 Beginning Chinese 3 an opportunity to continue reading, writing and speaking Chinese.	
Contents	CEF level: A1 Emphasis is on polishing pronunciation and expanding vocabulary and usage. Language of instruction: English and Chinese	
Course Work	56 contact hours, meeting three times a week. Each lesson lasts one full hour. 3.–4. period (1 group)	
Evaluation	Evaluation: Regular class tests and a final exam.	
Course Material	0–5	
Prerequisites	Provided by the teacher. Successful completion of Beginning Chinese 3, or possession of equivalent skill level.	

11 How to Prepare a Master's Thesis

The following instructions on preparing a Master's thesis, issued by the Vice-Rector on 2 June 2006, are observed at Lappeenranta University of Technology.

The Master's thesis is the final project of the Master's degree studies. It demonstrates the student's knowledge of a scientifically or socially 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 measured in credit units). The student must demonstrate the ability to carry out the project independently and following a plan. The student writes the thesis according to instructions and takes a maturity test on its topic.

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.

11.1 Starting the Project

Students who wish to start working on their Master's thesis should read these instructions carefully (http://www.lut.fi/en/lut_students/studying_at_lut/instructions_for_studying.html) 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.

The following points in particular 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 also an 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) and
- matters to be discussed with the community providing the funding and the supervisor representing it.

11.2 Topic, Supervisors and Examiners of the Master's Thesis

The student applies for the approval of the thesis topic and the appointment of the supervising professor and examiners from the department council. An application signed by the examiners and the student is given to the department's study coordinator at least 10 calendar days before the department council meeting. The student's individual study plan is attached to the application. The application form is available on the university web site at http://www.lut.fi/en/lut_students/studying_at_lut/instructions_for_studying.html and instructions for preparing an individual study plan are given on the department's web site or by the study coordinator.

The department council appoints a professor or an adjunct professor as the supervisor of the thesis, and two examiners. The first examiner is the supervising professor appointed by the department council. The second examiner can be appointed from outside LUT. The examiners are usually professors or adjunct professors. If the second examiner is selected from outside the university, he or she must have at least a higher university degree.

In addition, the thesis is usually also supervised by a representative of the company or university that commissioned the thesis. This supervisor is approved by the supervising professor (1st examiner) on signing the topic application. The topic of the Master's thesis is determined by the student and the supervising professor together.

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**
- a compulsory internship of 6 credit units 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 possible courses required by the department (further information provided by study coordinators)

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. The topic application and assessment application are handled in separate department council meetings.

Language of the Master's Thesis

The Master's thesis is written in Finnish, Swedish or English. The student may also apply for the department's approval to write it in another language in connection with the topic application. The author of the thesis is responsible for its language revision. 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 device 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, enters into force 1 January 2007) 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 (the commissioner, university and student).

More information on research and innovation at the university is available at <http://www.lut.fi/en/research/index.html>.

11.3 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 department 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 proficiency in Finnish or Swedish in connection with the Bachelor's degree or another previous university degree, only the content of the maturity test will be evaluated, and the department may decide to substitute the presentation given by the student in the Master's thesis seminar for the maturity test. Departments may also employ alternative 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 by a language consultant assigned by the university.

The maturity test is evaluated on a scale of pass/fail.

Further instructions on the maturity test are available in the Language Centre study guide and on the department web sites. Students can sign up for the maturity test in the department's office.

11.4 Examination and Evaluation of the Master's Thesis

The department council evaluates and approves the Master's thesis upon application. The evaluation is based on a written description and statements by the examiners.

The student turns in the final, printed and bound version of the Master's thesis to the examiners at least two weeks before the department council meeting where the thesis is up for approval. The student provides the examiners each with their own copy.

The student leaves the assessment application, abstracts in Finnish and English and a third bound copy of the Master's thesis with the department's study coordinator at least 10 calendar days before the department council meeting. Foreign students do not need to prepare an abstract in Finnish.

The examiners prepare a written statement including a proposal for the grade and submit the statement to the study coordinator. 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 department 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 department may specify other aspects to be considered in the evaluation.

The Master's thesis is 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 department council within 14 days of the day the grade was made known. The request for correction should be addressed to the department council in question and submitted in writing to the department's study coordinator. 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 department council's decision may bring the matter before the degree board within 14 days of having been informed of the decision. A written request addressed to the degree board is to be submitted to the Study Affairs Office.

The department council may require that the author of the Master's thesis give a brief (approx. 20 min.) public presentation of the thesis.

11.5 Public Access to the Master's thesis

These instructions apply to all Master's theses started after 1 March 2005.

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 confidential information, the university may agree to hold the thesis **confidential for a maximum of two years**. In such cases, the commissioner must provide the university with reasons for confidentiality in writing.

If the commissioner requires a period of confidentiality longer than two years, a 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 department council meeting following normal procedure. The department 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. Department 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.

The department sees to it that students are aware of the maximum period of confidentiality (2 years).

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 department's study coordinator along with the assessment application, at the latest.

The Master's thesis will include the mention "Confidential" and the date the confidentiality expires.

11.6 Writing the 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 44 pt)
- Author's name and year of publication (lower right-hand corner, bottom and right margin 30-35 mm, font size 22 pt)
- An alternative cover format recommended by LUT's publication committee includes the university logo in gold in the upper left-hand corner. Further instructions on this format are available in Finnish at www.lut.fi/fi/opiskelu/nykyiset_opiskelijat/ohjeita_opiskeluun.html.

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 on 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 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 thesis 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 meaning, 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 title page contains the following information:

- university, department
- title of the thesis
- approval date of the topic (e.g. "The topic of this Master's thesis was approved by the department council of the Department of Information Technology on 7 January 2004.")
- examiners and supervisors of the thesis
- date and signature of the author
- author's address and telephone number

The points above are not used as headings on the title page. E.g. "University: Lappeenranta University of Technology" is incorrect, but "Lappeenranta University of Technology, Department of Information 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 objectives of the thesis. It is written in Finnish and English. Foreign students do not need to write a Finnish abstract.

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:

TIIVISTELMÄ (in bold font)

Lappeenrannan teknillinen yliopisto

* department in Finnish *

* author's name *

* Thesis title in Finnish *
(in bold font)

Diplomityö

* year of publication *

* number of pages, figures, tables and
appendices * (xx sivua, xx kuvaa, xx taulukkoa
ja xx liitettä)

Tarkastajat: Professori * name *
Professori * name *

Hakusanat:
Keywords:

English abstract:

ABSTRACT (in bold font)

Lappeenranta University of Technology

* department in English *

* author's name *

* Thesis title in English *
(in bold font)

Master's thesis

* year of publication *

* number of pages, figures, tables and
appendices * (xx pages, xx figures, xx tables
and xx appendices)

Examiners: Professor * name *
Professor * name *

Keywords:

In addition to these general instructions, the departments 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 attached to the assessment application, and they will be forwarded to the LUT library by the study coordinator. The author sends electronic copies of the abstracts to the LUT library; further instructions and information 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.

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 are used in the first-level headings, they should 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 to obtain a neat and legible layout.

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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 of the examiners and supervisors to the research work as well as any help, guidance, advice etc. received from outsiders. The author may also thank sponsors for their financial support and guidance. The foreword is concluded with a date and signature.

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, scope 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 depicting 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 deems fit in reply to the research questions posed, as well as the conclusions based on the material. The discussion must be drawn up so that a professional in the field can repeat the research work to e.g. 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 message must be conveyed 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, and they 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, superscripts and numbers are not italicised, unless they refer to a variable. An example of the correct use of subscripts and variables: 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, and units and variables are marked as they are 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 this relates 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, allowing 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 cited by giving the author's name and publication year (the so-called Harvard system) or by numbering them. 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 cited, they are listed in order of publication. Sources published by an author within the same year 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 numbering system, the references are listed in the order in which 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 from the library administrators. Electronic documents should be cited only if no other original source exists.

Detailed instructions on the Harvard and numbering 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:

Internet Sources

The Finnish Terminology Centre TSK
Research Institute for the Languages of Finland
Finnish Standards Association SFS

www.tsk.fi
www.kotus.fi
www.sfs.fi

Lappeenranta, 2 June 2006

Ilkka Pöyhönen
Vice-Rector