



LAPPEENRANTA  
UNIVERSITY OF TECHNOLOGY

**STUDY GUIDE 2005-2006**  
**INTERNATIONAL STUDY PROGRAMMES**  
**AND COURSES IN ENGLISH**

1	Studying at Lappeenranta University of Technology.....	1
1.1	Study Entitlement and Registration for the Academic Year.....	1
1.2	Study Guidance.....	1
1.3	WebOodi.....	1
1.4	Registration for Courses.....	2
1.5	Registration for Examinations.....	2
1.6	Evaluation of Completed Courses.....	2
1.7	Regulations on Studies.....	3
1.8	Degree Certificates.....	3
2	Support Services for Studies.....	3
2.1	Student Affairs Office.....	3
2.2	International and Career Services.....	4
2.3	Origo and the Learning Centre.....	4
2.4	Library.....	4
3	General Introduction to the Degrees in Technology.....	5
3.1	Bachelor of Science (Technology).....	6
3.2	Master of Science (Technology).....	6
3.3	Postgraduate Degrees.....	7
4	International Master's Degree Programme in Information Technology.....	7
4.1	The Aims of the International Master's Degree Programme.....	7
4.2	Professional Scope of the Master's Degree Programme.....	7
4.3	Fields of Specialisation.....	7
4.4	Degree structure of the International Master's Degree Programme in Information Technology:.....	8
4.4.1	Information Processing.....	8
4.4.2	Communications Engineering.....	9
4.4.3	Technomathematics.....	10
4.5	Minor Subject 20 ECTS cr.....	11
4.5.1	Information Processing.....	11
4.5.2	Communications Engineering.....	11
4.5.3	Technomathematics.....	11
4.5.4	Information Technology.....	11
4.6	The Courses Offered in English.....	12
4.6.1	Course descriptions.....	12
5	International Master's Degree Programme in Mechanical Engineering.....	25
5.1	The Aims of the International Master's Degree Programme.....	26
5.2	Possible Careers for Graduates.....	26
5.3	Course structure.....	26
5.3.1	General Studies (13-15 ECTS credits):.....	26
5.3.2	Major Subject (40-41 ECTS credits):.....	26
5.3.3	Master's Thesis (30 ECTS credits):.....	26
5.3.4	Minor Subject (20 ECTS credits):.....	26
5.3.5	Elective Studies (14-17 ECTS credits):.....	26
5.4	The Courses Offered in English.....	27
5.4.1	Course descriptions.....	28
6	International Master's Degree Programme in Chemical and Process Engineering.....	33
6.1	The Aims of the International Master's Degree Programme.....	33
6.2	Careers for Graduates.....	33
6.3	The Structure of the Programme.....	33
6.3.1	General Studies.....	33
6.3.2	Major and Minor Subjects.....	33
6.4	Additional Information.....	35
6.5	The Courses Offered in English.....	36
6.5.1	Course descriptions.....	37
7	The International Business and Technology Management Programme IBTM.....	48
7.1	Autumn Semester, 24.8. –16.12.2005.....	48
7.1.1	Course descriptons for autumn 2005.....	48
7.2	Spring Semester, 4.1. – 12.5.2006.....	56
7.2.1	Course descriptons for spring 2006.....	56
7.2.2	Courses offered in the autumn and spring semesters.....	61
8	Other Courses Offered in English.....	62
8.1	Course descriptions.....	62
9	Language Centre Courses 2005 - 2006.....	63
9.1	Course descriptions.....	64

# 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. If you wish to take part in lectures, assignments, examinations or other forms of teaching you must register as attending and pay the student union membership fee.

Registration for the academic year 2005-2006 starts 1.6.2005 and ends 22.8.2005. Further details are available on the university web site at [www.lut.fi/en/lut\\_students/index.html](http://www.lut.fi/en/lut_students/index.html)

**The student union membership fee must be paid by all students registered as attending.** You may not enrol for courses or exams before you have registered for the academic year and paid the student union fee.

Students who have not registered by the deadline (22.8.) will be removed from the student register and will no longer be entitled to study at LUT.

## 1.2 Study Guidance

Orientation for new students will be organised at the beginning of the academic year. You will learn more about the university, departments and studies, and you will be helped with practical arrangements related to starting studies at LUT. There will also be assemblies regarding important issues later on during the studies. You 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 [www.lut.fi/en/lut\\_students/index.html](http://www.lut.fi/en/lut_students/index.html) and on the web sites of the departments at [www.lut.fi/en/contacts/departments.html](http://www.lut.fi/en/contacts/departments.html) Individual study guidance is offered by the study coordinators, student advisers, tutors and teachers. Furthermore, the staff of the Student 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 your 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 advisers** are students themselves and offer individual assistance in practical matters related to studies. You can turn to them in questions involving e.g. the course schedule, choosing courses and a major subject, your individual study plan or other practical matters.

**Student tutors** assist new students with practical arrangements at the beginning of their studies. During orientation, you will be divided into small groups led by older students or tutors who will help you start your studies.

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

## 1.3 WebOodi

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

You can access WebOodi and instructions for its use at [www.lut.fi/en/lut\\_students/studying\\_at\\_lut/web\\_oodi.html](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 Student Affairs Office either in person, by telephone or by sending e-mail to [opinto@lut.fi](mailto:opinto@lut.fi).

### How to Modify Your Contact Information

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

## 1.4 Registration for Courses

The times and places of courses are given in the course schedule on the university web site [www.lut.fi/en/lut\\_students/index.html](http://www.lut.fi/en/lut_students/index.html)

You must register for a course before it begins. Furthermore, 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 [www.lut.fi/en/lut\\_students/studying\\_at\\_lut/web\\_oodi.html](http://www.lut.fi/en/lut_students/studying_at_lut/web_oodi.html)

Registration for courses in the academic year 2005-2006 starts 1.8.2005 and ends as follows for each period:

Registration for courses in Period 1 ends	28.8.2005 at 23:59
Registration for courses in Period 2 ends	23.10.2005 at 23:59
Registration for courses in Period 3 ends	8.1.2006 at 23:59
Registration for courses in Period 4 ends	5.3.2006 at 23:59

In the autumn semester, lectures start on Monday, 29.8.2005, and in the spring semester on Monday, 9.1.2006.

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

Remember to register for both 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 [www.lut.fi/en/lut\\_students/studying\\_at\\_lut/exams.html](http://www.lut.fi/en/lut_students/studying_at_lut/exams.html) You can register for exams through WebOodi at [www.lut.fi/en/lut\\_students/studying\\_at\\_lut/web\\_oodi.html](http://www.lut.fi/en/lut_students/studying_at_lut/web_oodi.html) Registration for exams in the autumn semester starts 1.8.2005, and in the spring semester 1.12.2005.

You should register for exams at least a week before the exam date, and you can cancel your registration 3 working days before the exam.

<b>Exam Date</b>	<b>Registration Deadline</b>	<b>Cancellations</b>
Monday	Monday, a week before the exam	Wednesday, the week before the exam
Tuesday	Tuesday, a week before the exam	Thursday, the 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, a 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), very satisfactory (2), satisfactory (1) and failed (0), or pass – fail.

The basis for the course evaluation (exam, assignment etc.) is given in the course descriptions in the curriculum. 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. The appeal can be made orally or in writing within 14 days of the day the grade was made known. Students also have the right to find out why they were given 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 enquiry committee. The correction request must be submitted to the Student Affairs Office within 14 days of receiving the teacher's reply. The decision of the enquiry 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 23.3.2005) will enter into force 1.8.2005. The decree and regulations are available on the university web site at [www.lut.fi/en/lut\\_students/studying\\_at\\_lut/instructions\\_for\\_studying.html](http://www.lut.fi/en/lut_students/studying_at_lut/instructions_for_studying.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.

## 1.8 Degree Certificates

Master's degree certificate will show e.g. the graduate's degree, degree programme, major and minor subjects and the topic of the thesis. 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.

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

Also major and minor subjects are given an overall grade according to the table above. The overall grade is the average of all the LUT courses completed by the student in the subject in question, weighted according to the workload of each course.

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

As an appendix to the degree certificate, students will receive a transcript of records, 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 [www.lut.fi/en/lut\\_students/studying\\_at\\_lut/instructions\\_for\\_studying.html](http://www.lut.fi/en/lut_students/studying_at_lut/instructions_for_studying.html)

## 2 Support Services for Studies

### 2.1 Student Affairs Office

The Student Affairs Office is located in the 1<sup>st</sup> 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 can visit the Student Affairs 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 Student Affairs Office phone numbers are 05-621 6061, 05-621 6062 and 05-621 6063, and you can send e-mail to [opinto@lut.fi](mailto:opinto@lut.fi). The staff and contact information are available on the Internet at [www.lut.fi/fi/opiskelu/nykyiset\\_opiskelijat/henkilokunta.html](http://www.lut.fi/fi/opiskelu/nykyiset_opiskelijat/henkilokunta.html)

### **Transcript of Records and Registration Certificate**

You can get an official transcript of records in Finnish or English from the Student Affairs Office for a fee of € 2.00.

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. Student exchange usually lasts one semester or academic year. Thanks to an extensive cooperation network, LUT students have the opportunity to take part in exchange programmes around the world.

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 3<sup>rd</sup> floor of the university's main building.

## **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 are 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 and the evaluation of teaching and learning. The Virtual University furthers the use of information and communication technology in education and virtual teaching at LUT.

The Learning Centre organises training related to teaching and its development 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, the information service, interlibrary lending, the photocopy service 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) and the higher university degree is Master of Science (Technology). 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:

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

#### 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, the admissions can be based on the applicants' number of ECTS credits, grades and professional experience.

#### Measurement of Studies

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

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

#### Internship

The degree of Bachelor of Science (Technology) can include an internship worth a maximum of 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. The internship included in the Master's degree aims at furthering the student's professional skills and teaching the student to apply theoretical knowledge to practical issues.

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

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. The internship is approved by a person designated by the department. The relevant application form and photocopies of the work certificates are submitted to him or her. Further information on internships is provided by the departments.

#### 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.

#### Credit Transfer

ECTS credits from studies in other Finnish or foreign universities or institutes can be transferred into LUT degrees. In such cases, students must submit an application to the department. More information on credit transfer is given by the study coordinators.

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

### 3.1 Bachelor of Science (Technology)

The workload of the degree of Bachelor of Science (Technology) is 180 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 cr or in Industrial Engineering and Management at least 90 cr
- major subject and supporting studies 40-50 cr
- minor subject, at least 20 cr or in Industrial Engineering and Management at least 30 cr
- elective or optional studies 10-20 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. It is completed as an assignment related to a course or as an independent course in the student's major studies. The thesis is supervised and examined by the instructor of the course in question or someone else assigned by the department.

The workload of the thesis and the related seminar is 10 cr. The thesis is evaluated on the scale excellent (5), very good (4), good (3), satisfactory (2), sufficient (1) and failed (0).

The Bachelor's thesis is prepared according to the instructions given by the vice-rector in charge of teaching. The instructions are available on the university web site at

[www.lut.fi/en/lut\\_students/studying\\_at\\_lut/instructions\\_for\\_studying.html](http://www.lut.fi/en/lut_students/studying_at_lut/instructions_for_studying.html)

#### **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.

The maturity test is supervised and students are not allowed to use reference material. The department sets the date for the maturity test. The maturity test is evaluated by the supervisor of the thesis and a language specialist appointed by the university. See the Language Centre study guide for further details on the maturity test.

### 3.2 Master of Science (Technology)

The workload of the degree of Master of Science (Technology) is 120 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 cr
- major subject and supporting studies 60-70 cr
- minor subject, at least 20 cr
- elective or optional studies 10-20 cr.

Language and communication studies and the internship are included in general studies. The major studies include the Master's thesis, which is worth 30 cr.

#### **Complementary Studies**

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

#### **Master's thesis**

The Master's thesis is the final project of the Master's degree studies. It demonstrates the student's knowledge of a scientifically or socially important topic related to his or her professional field. The Master's thesis is a research project which requires approximately 6 months of work and it is worth 30 ECTS credits. It 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.

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 instructions are available on the university web site at [www.lut.fi/en/lut\\_students/studying\\_at\\_lut/instructions\\_for\\_studying.html](http://www.lut.fi/en/lut_students/studying_at_lut/instructions_for_studying.html)

### **Maturity Test**

Students must take a written maturity test to demonstrate their language skills and how well they know the topic of their thesis. A summary of the Master's thesis presented at the thesis seminar may be considered as a maturity test. Departments may also have other ways of substituting the maturity test.

If a student has demonstrated his or her language skills in connection with the lower university degree, the language of the maturity test will not be evaluated, only the contents.

## **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.

## **4 International Master's Degree Programme in Information Technology**

International Master's Degree Programme in Information Technology is a two-year programme 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 International 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, in addition to information system design and management, the graduate's tasks may include design and product development tasks as well as the specific application of information technology and electronics in production supervision and control. 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**

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

**1. Students of Information Processing** gets a broad idea of the applications and methods of information processing as well as information processing systems and their design. The 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

Based on individual interests, students of Communications Engineering choose their main specialisation area, by selecting either one from two course modules that are offered. Both modules concentrate more deeply on a specific area of Communications Engineering. These areas are Network Architectures, and Parallel and Distributed Computing.

**Module 1: Parallel and Distributed Computing**

Through these courses, 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.

**Module 2: Network Architectures**

The aim of this module is to provide an in-depth view of network architectures including wired, wireless and optical networks. In addition to basic knowledge, students gain knowledge on how to design different networks. Students also learn performance related issues like traffic modeling, routing and quality of service. Other topics include user-network interfaces, security, call processing and switching.

**3. Students of Technomathematics** can specialise in one or more areas of information processing technology and especially in tasks, which require a strong knowledge of mathematics in the research and development sector:

- Advanced measurements and data-analysis
- Modelling, simulation and optimization of systems
- Modelling and control of processes
- Performance and balance analysis
- Modern production management
- Financial models, risk control
- Strategic planning and decision support systems

The student can elect two or more comprehensive study modules in Computational Modelling of Technical Systems, Theory of Applied Analysis, Data Analysis and Stochastics and Discrete and Fuzzy Models and Methods.

**4.4 Degree structure of the International 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.

**4.4.1 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 (\*).

		year	per.	ECTS cr
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**

		year	per.	ECTS cr
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**

Communications Engineering  
or Technomathematics

**Master's Thesis 30 ECTS cr****Elective studies 10 ECTS cr****4.4.2 Communications Engineering****Studies in Science 20 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
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**

One of the two modules should be selected.

<i>Module 1: Parallel and Distributed Computing</i>		year	per.	ECTS cr
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

At least one of the courses marked with (\*) should be selected.

In addition 15 ECTS credits from the following "list of selectable courses" and/or from "module 2" should be selected.

<i>Module 2: Network Architectures</i>		year	per.	ECTS cr
Ti5312700	Network Design and Traffic Engineering	1	3-4	5
Ti5316500	Performance Analysis in Telecommunication Systems	1	1-2	5
Ti5316600	Quality of Service in Communication Systems	2	1-2	5

In addition 15 ECTS credits from the following "list of selectable courses" and/or from "module 1" should be selected.

<i>List of Selectable Courses</i>		year	per.	ECTS cr
Ti5213000	Unix and System Programming	1	2-3	5
Ti5316000	Broadband Communications	1	3-4	8
Ti5317410	Distributed Object Programming	2	1-2	6
Ti5318800	Secured Communications	1-2	3-4	6
Ti5319100	Seminar on Performance Analysis	2	1-2	3
Ti5319600	Research Methods, Laboratory Project	2	2-4	5

**Supporting Studies for Major 10 ECTS cr**

		year	per.	ECTS cr
Ti5315800	Communications Software and Architectures	1	1-2	5
Ti5315900	Communication Software Laboratory Work	1	3-4	5

**Minor Subject 20 ECTS cr**

Information Processing  
or Technomathematics

**Master's Thesis 30 ECTS cr**

**Elective studies 10 ECTS cr**

**4.4.3 Technomathematics**

**Studies in Science 22 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
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:*

<i>Module 1: Computational Modelling of Technical Systems</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
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

<i>Module 2: Theory of Applied Analysis</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
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

<i>Module 3: Data Analysis and Stochastics</i>		<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

<i>Module 4: Discrete and Fuzzy Models and Methods</i>		<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**

	Information Technology
or	Information Processing
or	Communications Engineering

**Master's Thesis 30 ECTS cr**

**Elective studies 12 ECTS cr**

## 4.5 Minor Subject 20 ECTS cr

### 4.5.1 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

### 4.5.2 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
Ti5316000	Broadband Communications	1	3 – 4	8
Ti5316500	Performance Analysis in Telecommunication Systems	1	1 – 2	5
Ti5316600	Quality of Service in Communication Systems	2	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
Ti5317410	Distributed Object Programming	2	1 – 2	6
Ti5318800	Secured Communications	1 – 2	3 – 4	6
Ti5319100	Seminar on Performance Analysis	2	1 – 2	3
Ti5319600	Research Methods, Laboratory Project	2	2 – 4	5

### 4.5.3 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

### 4.5.4 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

## 4.6 The Courses Offered in English

### Information Processing

		ECTS cr
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

		ECTS cr
Ti5312700	Network Design and Traffic Engineering	5
Ti5315000	Network Programming	5
Ti5315800	Communications Software and Architecture	5
Ti5315900	Communication Software Laboratory Work	5
Ti5316000	Broadband Communications	8
Ti5316100	Switching and Routing	4
Ti5316500	Performance Analysis of Telecommunication Systems	5
Ti5316600	Quality of Services in Communication Systems	5
Ti5317000	Parallel Computing	6
Ti5317100	Parallel Programming	5
Ti5317200	Design of Parallel Algorithms	5
Ti5317300	Advanced Parallel Computing	5
Ti5317410	Distributed Object Programming	6
Ti5318300	Wireless Service Engineering	5
Ti5318800	Secured Communications	6
Ti5319100	Seminar on Performance Analysis	3
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

<b>Ti5212500</b>	<b>OBJECT-ORIENTED PROGRAMMING</b>	<b>5 ECTS cr</b>
<b>3rd year</b>	<i>Oliokeskeinen ohjelmointi</i>	
<b>Period 1 - 2</b>		
<b>Lecturer</b>	Senior Assistant, Ph.D. Vladimir Bochko	
<b>Aims</b>	To introduce object-oriented programming in Java.	
<b>Contents</b>	Applets and applications, event handling, images, graphics, controls, multithreaded	

<b>Instruction</b>	programming, networking, RMI, UML-language, patterns. Lectures 42 h, exercises 28 h, 1st period. Project, 2nd period. Exam.
<b>Literature</b>	Jia, X.: Object-Oriented Software Development Using Java, Addison-Wesley, 2003. Hall, M.: Core Servlets and Java Server Pages, Prentice Hall PTR, 2004.
<b>Prerequisites</b>	Ti5212200 Tietorakenteet ja C-kieli, Ti5212400 Olio-ohjelmoinnin perusteet.
<b>Ti5213000</b>	<b>UNIX AND SYSTEM PROGRAMMING</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>3rd year</b>	<i>Unix ja systeemiohjelmointi</i>
<b>Period 2 - 3</b>	
<b>Lecturer</b>	Senior Assistant, Ph.D. Vladimir Bochko
<b>Aims</b>	To familiarize the student with advanced methods of Unix employment, based mainly on C and shell programming.
<b>Contents</b>	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.
<b>Instruction</b>	Lectures 28 h, exercises 28 h, 2nd period. Terminal project, 3rd period. Exam.
<b>Literature</b>	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.
<b>Prerequisites</b>	Ti5212200 Tietorakenteet ja C-kieli, Ti5212600 Käyttöjärjestelmät, Ti5212900 Työaseman käytön perusteet.
<b>Ti5213100</b>	<b>INTRODUCTION TO MACHINE VISION AND MACHINE LEARNING</b> <span style="float: right;"><b>6 ECTS cr</b></span>
<b>2<sup>nd</sup> year</b>	<i>Johdanto konenäköön ja koneoppimiseen</i>
<b>Period 3 - 4</b>	
<b>Lecturer</b>	D.Sc (Tech) Joni Kämäräinen
<b>Aims</b>	Know the basics of machine learning and approaches to decision making using a computer. Know the application areas, restrictions, and structure of machine vision systems.
<b>Contents</b>	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. Parts of a machine vision system. Different systems and their application areas. Basics of digital imaging.
<b>Instruction</b>	Lectures 21 h, exercises 14 h, homework, 3rd period. Lectures 21 h, exercises 14 h, homework, 4 <sup>th</sup> period. Exam.
<b>Literature</b>	Mitchell: Machine Learning; Gonzalez, Woods: Digital Image Processing.
<b>Prerequisites</b>	Mathematics A and B. Ti5210210 Ohjelmoinnin perusteet A or Ti5210220 Ohjelmoinnin perusteet B.
<b>Ti5216000</b>	<b>PATTERN RECOGNITION</b> <span style="float: right;"><b>7 ECTS cr</b></span>
<b>4th year</b>	<i>Hahmontunnistus</i>
<b>Period 3 - 4</b>	
<b>Lecturer</b>	Senior Assistant, D.Sc. (Tech.) Ville Kyrki
<b>Aims</b>	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.
<b>Contents</b>	Introduction. Bayesian inference and statistical pattern recognition. Discriminants and neural pattern recognition. Decision tree, syntactic and structural approaches. Context-dependent classification. Unsupervised learning.
<b>Instruction</b>	Lectures 21 h, exercises 14 h, 3rd period. Lectures 21 h, exercises 14 h, 4th period. Practical assignment. Exam.
<b>Literature</b>	Lecture notes. Theodoridis, S., Koutroubas, K.: Pattern Recognition, Academic Press, 2003. Duda, R.O., Hart, P.E., Stork, D.G.: Pattern Classification, Wiley, 2001.
<b>Prerequisites</b>	Recommended Ti5213100 Introduction to Machine Vision and Machine Learning, Ti5216100 Machine Vision, Ti5413700 Matriisilaskenta.

<b>Ti5216100</b>	<b>MACHINE VISION</b>	<b>7 ECTS cr</b>
<b>4th year</b>	<i>Konenäkö</i>	
<b>Period 1 - 2</b>	<b>Lectured every second year only. Lectured 2006 - 2007.</b>	
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Heikki Kälviäinen	
<b>Aims</b>	To introduce students to the field of machine vision and image analysis and its application areas.	
<b>Contents</b>	Digital image processing: digital image, image transforms, image enhancement, image compression. Image analysis: segmentation, representation and description, recognition and interpretation. Hardware, software and applications.	
<b>Instruction</b>	Lectures 16 h, practical exercises 14 h, seminar presentations 5 h, 1st period. Lectures 14 h, practical exercises 14 h, seminar presentations 7 h and practical assignments, 2nd period. Exam.	
<b>Literature</b>	Gonzales, R.C., Woods, R.E.: Digital image processing, Prentice-Hall, 2002. Jain, A.K.: Fundamentals of digital image processing, Prentice-Hall, 1989.	
<b>Prerequisites</b>	Recommended Ti5212700 Tietokonegrafiikan perusteet, Ti5213100 Introduction to Machine Vision and Machine Learning, Ti5216000 Pattern Recognition, Sa2810600 Sovellettu optiikka.	
<b>Ti5216200</b>	<b>ACTIVE AND ROBOT VISION</b>	<b>7 ECTS cr</b>
<b>4th year</b>	<i>Aktiivi- ja robottinäkö</i>	
<b>Period 1 - 2</b>	<b>Lectured every second year only. Lectured 2005 - 2006.</b>	
<b>Lecturer</b>	Senior Assistant, D.Sc. (Tech.) Ville Kyrki	
<b>Aims</b>	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.	
<b>Contents</b>	Vision in Robotics. Imaging models and calibration. Coordinate frames and geometrical primitives. Single and multi-view geometry. Recognition. Pose estimation. Dynamic vision. Visual servoing.	
<b>Instruction</b>	Lectures 21 h, exercises 14 h, 1st period. Lectures 21 h, exercises 14 h, 2nd period. Practical assignment. Exam.	
<b>Literature</b>	Lecture notes. Trucco, E., Verri, A.: Introductory Techniques for 3-D Computer Vision, Prentice-Hall, 1998. Forsyth, D.A., Ponce, J.: Computer Vision - A modern approach, Prentice-Hall, 2003.	
<b>Prerequisites</b>	Mathematics A and B. Recommended Ti5213100 Introduction to Machine Vision and Machine Learning, Ti5413500 Tilastomatematiikka I, Ti5413600 Numeerinen analyysi I, Ti5413700 Matriisilaskenta.	
<b>Ti5216300</b>	<b>EVOLUTIONARY ALGORITHMS</b>	<b>5 ECTS cr</b>
<b>4th year</b>	<i>Evoluutioalgoritmit</i>	
<b>Period 1 - 3</b>		
<b>Lecturer</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Jouni Lampinen	
<b>Aims</b>	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 problems in the student's own specialization.	
<b>Contents</b>	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.	
<b>Instruction</b>	Lectures 14 h, 1st period. Lectures 14 h, exercises 10 h, 2nd period. Project work seminars 7 h, 3rd period. Project work. Exam.	
<b>Literature</b>	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.	
<b>Prerequisites</b>	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.	

<b>Ti5216400</b>	<b>LANGUAGES, COMPILERS AND INTERPRETERS</b>	<b>5 ECTS cr</b>
<b>4th year</b>	<i>Kielet, kääntäjät ja tulkit</i>	
<b>Period 3 - 4</b>	Senior Assistant, Ph.D. Vladimir Bochko	
<b>Lecturer</b>	To familiarize the student with theory and recognition of selected formal languages and their translation to the executable form.	
<b>Aims</b>	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.	
<b>Contents</b>	Lectures 21 h, exercises 14 h, 3rd period.	
<b>Instruction</b>	Lectures 21 h, exercises 14 h and a terminal project, 4th period. Exam.	
<b>Literature</b>	Aho, A.V., Sethi, R., Ullman, J.D.: Compilers: Principles, Techniques, and Tools, Addison Wesley, 1987. Bennett, J.P.: Introduction to Compiling Techniques, McGraw Hill, 1996.	
<b>Prerequisites</b>	Ti5212000 Tietojenkäsittelyn perusteet I, Ti5212100 Tietojenkäsittelyn perusteet II, Ti5212200 Tietorakenteet ja C-kieli, Ti5212300 Algoritmien suunnittelu.	

<b>Ti5217000</b>	<b>INFORMATION SYSTEMS RESEARCH</b>	<b>7 ECTS cr</b>
<b>4th year</b>	<i>Tietojärjestelmien tutkimus</i>	
<b>Period 1 - 2</b>	Lecturer, M.Sc. (Tech.) Erja Mustonen-Ollila	
<b>Lecturer</b>	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, publishing procedures, understanding the different stages of the research process. Applying qualitative and quantitative research approaches, and discovering the proper research questions/hypotheses, and research problems. Finding out the suitable research organisations, 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.	
<b>Aims</b>	Qualitative and quantitative research. Case research, experiments, survey, archival analysis, and historical research. The classification of research approaches. Approaches studying reality. Researches stressing utility of innovations or what is the reality. Conceptual-analytical approaches. Approaches for empirical studies. Theory testing approaches. Theory creating approaches. Longitudinal studies.	
<b>Contents</b>	Constructing up the conceptual framework, the research models, and concepts. Qualitative, interpretive and new theories creating research. Grounded theory. Contextualism and other qualitative longitudinal research. Ethnographic method. Constructive research. Mathematical research. Data gathering techniques. 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.	
<b>Instruction</b>	Lectures 21 h, exercises 14 h, 1st period. Lectures 21 h, exercises 14 h, 2nd period.	
<b>Literature</b>	Practical assignment (research proposal). Exam. 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.	
<b>Prerequisites</b>	Ti5214000 Ohjelmistotuotanto.	

<b>Ti5312700</b>	<b>NETWORK DESIGN AND TRAFFIC ENGINEERING</b>	<b>5 ECTS cr</b>
<b>4th year</b>	<i>Verkkosuunnittelu</i>	
<b>Period 3 - 4</b>	Professor, Ph.D. Valeriy Naumov	
<b>Lecturer</b>	To make students familiar with fundamental methods in the design of telecommunication networks and traffic engineering.	
<b>Aims</b>	Introduction to the network planning problem; network algorithms; network reliability; capacity planning, network optimization; and traffic engineering.	
<b>Contents</b>		

<b>Instruction</b>	Lectures 14 h, exercises 14 h, 3rd period.
<b>Literature</b>	Lectures 14 h, exercises 14 h and practical work, 4th period. Exam. Robertazzi, T.G.: Planning Telecommunication Networks, IEEE Press, 1999. Kenyon, T.: High Performance Data Network Design, Butterworth-Heinemann, 2000.
<b>Ti5315000</b>	<b>NETWORK PROGRAMMING</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>3rd year</b>	<i>Tietoliikenneohjelmointi</i>
<b>Period 2 - 3</b>	
<b>Lecturer</b>	Senior Assistant, D.Sc. (Tech.) Jouni Ikonen
<b>Aims</b>	Familiarize students to socket programming.
<b>Contents</b>	Use of Internet Protocol in communications programming. Socket interface usage and event-based programming. Synchronous and asynchronous operations. Layers, parallelism and security.
<b>Instruction</b>	Lectures 14 h, exercises 10 h, 2nd period. Exercises 8 h, 3rd period.
<b>Literature</b>	6 practical works. Home examination or seminar work. 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.
<b>Prerequisites</b>	C-language. Basic unix workstation usage skills. Recommended Ti5213000 Unix and System Programming.
<b>Ti5315800</b>	<b>COMMUNICATIONS SOFTWARE AND ARCHITECTURE</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>4th year</b>	<i>Tietoliikenneohjelmistot</i>
<b>Period 1 - 2</b>	
<b>Lecturer</b>	Assistant, M.Sc. (Tech.) Oleg Chistokhvalov
<b>Aims</b>	To give a student the basic knowledge about software, development environments and communications.
<b>Contents</b>	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.
<b>Instruction</b>	Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h, home work, 2nd period. Exam.
<b>Literature</b>	Lecture hand-outs.
<b>Prerequisites</b>	Recommended Ti5212500 Object-Oriented Programming, Ti5214000 Ohjelmistotuotanto, Ti5312000 Tietoliikennetekniikan perusteet 1, Ti5312300 Tietokoneverkot ja datasiirto.
<b>Ti5315900</b>	<b>COMMUNICATION SOFTWARE LABORATORY WORK</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>4th year</b>	<i>Protokollaohjelmointi</i>
<b>Period 3 - 4</b>	
<b>Lecturer</b>	Assistant, M.Sc. (Tech.) Oleg Chistokhvalov
<b>Aims</b>	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.
<b>Contents</b>	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).
<b>Instruction</b>	Laboratory demonstrations 14 h, 3rd period. Laboratory demonstrations 14 h, practical assignments, 4th period.
<b>Literature</b>	Lecture hand-outs.
<b>Prerequisites</b>	Ti5315800 Communications Software and Architecture. Recommended Ti5212200 Tietorakenteet ja C-kieli, Ti5213000 Unix and System Programming, Ti5312000 Tietoliikennetekniikan perusteet 1, Ti5312300 Tietokoneverkot ja datasiirto, and Ti5212400 Olio-ohjelmoinnin perusteet or Ti5212500 Object-Oriented Programming.
<b>Ti5316000</b>	<b>BROADBAND COMMUNICATIONS</b> <span style="float: right;"><b>8 ECTS cr</b></span>
<b>4th year</b>	<i>Laajakaistainen kommunikointi</i>
<b>Period 3 - 4</b>	
<b>Lecturer</b>	Professor, Ph.D. Valeriy Naumov
<b>Aims</b>	To give students the knowledge of operation of broadband networks.
<b>Contents</b>	Optical fiber properties, optical transmitters and receivers, optical amplifiers, modulation, optical link design, wavelength division multiplexing and its nonlinear optical impairments, optical

<b>Instruction</b>	switching, free space optical links, SDH, ATM, optical Internet, wireless broadband network technologies. Lectures 28 h, 3rd period.
<b>Literature</b>	Lectures 28 h, seminars 14 h, 4th period. Exam and practical work.
<b>Prerequisites</b>	Bates, R.J.: Broadband Telecommunications Handbook, McGraw-Hill, 2002. Recommended Ti5312000 Tietoliikennetekniikan perusteet 1, Ti5312100 Tietoliikennetekniikan perusteet 2.
<b>Ti5316100</b>	<b>SWITCHING AND ROUTING</b> <span style="float: right;"><b>4 ECTS cr</b></span>
<b>5th year</b>	<i>Kytkenät ja reititys</i>
<b>Period 1 - 2</b>	<b>Lectured every second year only. Lectured 2006 - 2007.</b>
<b>Lecturer</b>	Professor, Ph.D. Valeriy Naumov
<b>Aims</b>	To study switching and routing technologies in telecommunication networks.
<b>Contents</b>	Circuit switching, packet switching and routing, hierarchical routing. Internet routing protocols, routing in optical networks and ad hoc networks.
<b>Instruction</b>	Lectures and seminars 14 h, exercises 14 h and practical work, 1st period. Lectures and seminars 14 h, exercises 14 h and practical work, 2nd period. Exam.
<b>Literature</b>	Huitema, C.: Routing in the Internet, Prentice Hall, 2000.
<b>Prerequisites</b>	Ti5312300 Tietokoneverkot ja datasiirto.
<b>Ti5316500</b>	<b>PERFORMANCE ANALYSIS OF TELECOMMUNICATION SYSTEMS</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>4th year</b>	<i>Suorituskykyanalyysi</i>
<b>Period 1 - 2</b>	<b>Lectured every second year only. Lectured 2005 - 2006.</b>
<b>Lecturer</b>	Professor, Ph.D. Valeriy Naumov
<b>Aims</b>	To describe the basic methods for modelling of computer and telecommunication systems.
<b>Contents</b>	Markov Chains, Stochastic Petri Nets, Queueing Systems.
<b>Instruction</b>	Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h and practical work, 2nd period. Exam.
<b>Literature</b>	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.
<b>Ti5316600</b>	<b>QUALITY OF SERVICES IN COMMUNICATION SYSTEMS</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>5th year</b>	<i>Uusien tietoliikennejärjestelmien palveluntaso</i>
<b>Period 1 - 2</b>	<b>Lectured every second year only. Lectured 2006 - 2007.</b>
<b>Lecturer</b>	Professor, Ph.D. Valeriy Naumov
<b>Aims</b>	To study different Quality of Service (QoS) requirements and different methods of QoS provisioning in communication networks.
<b>Contents</b>	QoS routing, buffer management, packet scheduling, Integrated Services, Differentiated Services, Multi-Protocol Label Switching.
<b>Instruction</b>	Lectures and seminars 14 h, exercises 14 h and practical work, 1st period. Lectures and seminars 14 h, exercises 14 h and practical work, 2nd period. Exam.
<b>Literature</b>	Jha, S., Hassan, M.: Engineering Internet QoS, Artech House, 2002.
<b>Prerequisites</b>	Recommended Ti5312300 Tietokoneverkot ja datasiirto.
<b>Ti5317000</b>	<b>PARALLEL COMPUTING</b> <span style="float: right;"><b>6 ECTS cr</b></span>
<b>4th year</b>	<i>Rinnakkaislaskennan perusteet</i>
<b>Period 1 - 2</b>	
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Jari Porras
<b>Aims</b>	Introduces parallel and distributed computing to the student, gives an overview of parallel architectures and methods and provides the necessary knowledge for using parallel methods on their own work.
<b>Contents</b>	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

<b>Instruction</b>	environment. Lectures 28 h, exercises 14 h, 1st period.
<b>Literature</b>	Seminars 21 h, practical exercises, 2nd period. Exam. Grama, A. et al.: Introduction to Parallel Computing, Addison-Wesley, 2003.
<b>Prerequisites</b>	Hwang, K., Xu, Z.: Scalable Parallel Computing, McGraw-Hill, 1998. Recommended Ti5212600 Käyttöjärjestelmät, Ti5213000 Unix and System Programming.
<b>Ti5317100</b>	<b>PARALLEL PROGRAMMING</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>4th year</b>	<i>Rinnakkaisohjelmoinnin perusteet</i>
<b>Period 2 - 3</b>	
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Jari Porras
<b>Aims</b>	Introduces the basics of parallel programming. Practical differences between sequential and parallel programming are explained. Teaches how to utilize distributed and shared memory programming models.
<b>Contents</b>	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.
<b>Instruction</b>	Lectures 14 h, exercises 14 h, practical exercises, 2nd period.
<b>Literature</b>	Exercises 14 h, practical exercises, 3 <sup>rd</sup> period. Exam. Hwang, K., Xu, Z.: Scalable Parallel Computing, McGraw-Hill, 1998. Andrews, G.: Foundations of Multithreaded, Parallel and Distributed Programming, Addison-Wesley, 2000. Chandra R. et al.: Parallel Programming in OpenMP, Morgan Kaufman Publishers, 2001. Lecture hand-outs.
<b>Prerequisites</b>	Recommended Ti5212600 Käyttöjärjestelmät, Ti5213000 Unix and System Programming, Ti5317000 Parallel Computing.
<b>Ti5317200</b>	<b>DESIGN OF PARALLEL ALGORITHMS</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>4th - 5th year</b>	<i>Rinnakkaisalgoritmien suunnittelu</i>
<b>Period 3 - 4</b>	<b>Lectured every second year only. Lectured 2006 - 2007.</b>
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Jari Porras
<b>Aims</b>	Introduces students into problems encountered when designing algorithms for the parallel environments. Produces the basic knowledge of parallel algorithm design and implementation.
<b>Contents</b>	Methods for the parallel algorithm design, design and analysis of parallel algorithms, parallel algorithms in different parallel environments. Algorithms are selected each year separately.
<b>Instruction</b>	Lectures, discussions 14 h, exercises 14 h, 3rd period.
<b>Literature</b>	Lectures, discussions 14 h, exercises 14 h, practical work, 4th period. Exam. Jaja, J.: An Introduction to Parallel Algorithms, Addison-Wesley, 1992. Grama, A. et al.: Introduction to Parallel Computing, Addison-Wesley, 2003.
<b>Prerequisites</b>	Recommended Ti5212300 Algoritmien suunnittelu, Ti5317000 Parallel Computing, Ti5317100 Parallel Programming.
<b>Ti5317300</b>	<b>ADVANCED PARALLEL COMPUTING</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>4th - 5th year</b>	<i>Rinnakkaislaskennan jatkokurssi</i>
<b>Period 3 - 4</b>	<b>Lectured every second year only. Lectured 2005 - 2006.</b>
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Jari Porras
<b>Aims</b>	Gives an advanced view to the problems and needs of parallel computing in the modern world.
<b>Contents</b>	Selected each year separately. In 2005 - 2006 the topic will be GRID computing.
<b>Instruction</b>	Lectures 14 h, exercises 14 h, discussions, group works, 3rd period. Lectures 14 h, exercises 14 h, discussions, group works, practical work, 4th period. Exam.
<b>Literature</b>	Will be announced on lectures.
<b>Prerequisites</b>	Recommended Ti5317000 Parallel Computing, Ti5317100 Parallel Programming.
<b>Ti5317410</b>	<b>DISTRIBUTED OBJECT PROGRAMMING</b> <span style="float: right;"><b>6 ECTS cr</b></span>
<b>4th year</b>	<i>Hajautettu objektiiohjelmointi</i>
<b>Period 1 - 2</b>	
<b>Lecturer</b>	Part-time teacher Petri Heinilä
<b>Aims</b>	To introduce the student to the object-oriented design and open distributed processing based digital communication architectures and design methodology.

<b>Contents</b>	Object-oriented systems, UML-language, CORBA-architecture and CORBA-services. Design Patterns, open distributed processing: mobile agents, streams, traders, examples.
<b>Instruction</b>	Foreign students can take this course as a self-access course. Course material is available on web. Introduction lecture 2 h, exercises 14 h, home work, 1st period. Exercises 14 h, home work, project, 2nd period. Exam.
<b>Literature</b>	Lecture notes.
<b>Prerequisites</b>	Recommended Ti5212500 Object-Oriented Programming, Ti5214000 Ohjelmistotuotanto, Ti5315000 Network Programming.
<b>Ti5318300</b>	<b>WIRELESS SERVICE ENGINEERING</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>5th year</b>	<i>Langattomien palveluiden tekniikka</i>
<b>Period 1</b>	Senior Assistant, D.Sc. (Tech.) Pekka Jäppinen
<b>Lecturer</b>	To understand the challenges that wireless communication technologies and mobile devices provide to service development. To learn methods to improve the use of wireless services.
<b>Aims</b>	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.
<b>Contents</b>	Lectures 35 h, exercises 14 h, practical assignment, 1st period. Exam.
<b>Instruction</b>	Will be announced on lectures.
<b>Literature</b>	Ti5312600 Siirtyvä tietoliikenne.
<b>Prerequisites</b>	Recommended Ti5315200 Symbian-ohjelmointi, Ti5315000 Network Programming.
<b>Ti5318800</b>	<b>SECURED COMMUNICATIONS</b> <span style="float: right;"><b>6 ECTS cr</b></span>
<b>4th year</b>	<i>Suojatut tietoyhteydet</i>
<b>Period 3 - 4</b>	Senior Assistant, D.Sc. (Tech.) Pekka Jäppinen
<b>Lecturer</b>	How to secure the communication channel between communicating devices.
<b>Aims</b>	Security risks against communication channel. Creation of secure communication channel.
<b>Contents</b>	Cryptographic methods: Symmetric and asymmetric encryption algorithms, hash functions, key exchange methods. Authentication methods. Digital signatures.
<b>Instruction</b>	Lectures 14 h, exercises 14 h, 3rd period. Seminars 28 h, practical assignment, 4th period. Exam.
<b>Literature</b>	Kerttula, E.: Tietoverkkojen tietoturva, 2. painos, Edita, 2000. Pfleeger, C.: Security in Computing, Prentice Hall, 2000. Schneier, B.: Applied Cryptography, Wiley, 1996. Anonymous: Maximum Security, Sams, 2001. Anonymous: Maximum Linux Security, Sams, 1999. Lecture hand-outs.
<b>Prerequisites</b>	Ti5313500 Tietoturvan perusteet. Recommended Ti5312500 TCP/IP –perusteet, Ti5315000 Network Programming.
<b>Ti5319100</b>	<b>SEMINAR ON PERFORMANCE ANALYSIS</b> <span style="float: right;"><b>3 ECTS cr</b></span>
<b>4th year</b>	<i>Suorituskykyanalyysin seminaari</i>
<b>Period 1 - 2</b>	Professor, Ph.D. Valeriy Naumov
<b>Lecturer</b>	To apply Network Simulator for performance analysis of routing protocols, multicast protocols and IP protocols in wired and wireless networks.
<b>Aims</b>	Topic may change.
<b>Contents</b>	Lectures and seminars 14 h, exercises 14 h, 1st period.
<b>Instruction</b>	Lectures and seminars 14 h, exercises 14 h, 2nd period. Exam and accepted term paper.
<b>Literature</b>	Gelenbe, E., Pujolle, G.: Introduction to Queueing Networks.
<b>Prerequisites</b>	Recommended Ti5312000 Tietoliikennetekniikan perusteet 1, Ti5316500 Performance Analysis of Telecommunication Systems.
<b>Ti5319500</b>	<b>RESEARCH METHODS</b> <span style="float: right;"><b>3 ECTS cr</b></span>
<b>4th year</b>	<i>Tutkimusmenetelmät</i>
<b>Period 1</b>	Professor, D.Sc. (Tech.) Arto Kaarna
<b>Lecturer</b>	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 thesis.
<b>Aims</b>	

<b>Contents</b>	Research work, philosophy of research. Research process. Designing research, research questions and hypothesis. Qualitative and quantitative research methods. Reporting scientific work.
<b>Instruction Literature</b>	Lectures 14 h, practical assignment, 1st period. Exam. 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.
<b>Prerequisites</b>	B.Sc. studies finished.
<b>Ti5319600</b>	<b>RESEARCH METHODS, LABORATORY PROJECT</b> <b>5 ECTS cr</b>
<b>4th year</b>	<i>Tutkimusmenetelmät, laboratorioprojekti</i>
<b>Period 2 - 4 Lecturer</b>	Professor, D.Sc. (Tech.) Heikki Kälviäinen Professor, D.Sc. (Tech.) Arto Kaarna
<b>Aims Contents</b>	To execute a well-defined research task in one of the laboratories at the department. Research work in the topic defined by the laboratory. Reporting and a seminar presentation of the work implemented.
<b>Instruction Literature Prerequisites</b>	Participation in the work of the research group, discussions, 2nd - 4th period. Literature related to the research topic, agreed with the supervisor of the work. Research methods finished, excellent grades in studies, evidence of successful research work.
<b>Ti5413300</b>	<b>COMPLEX ANALYSIS</b> <b>3 ECTS cr</b>
<b>3rd year</b>	<i>Kompleksianalyysi</i>
<b>Period 3 Lecturer Aims</b>	Professor, Ph.D. Heikki Haario Give the students the necessary knowledge of complex analysis needed in technical applications.
<b>Contents</b>	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.
<b>Instruction Literature Prerequisites</b>	Lectures 28 h, exercises 14 h, 3rd period. Exam. Kreyszig, E.: Advanced Engineering Mathematics, 8th Ed., Part D. Recommended Mathematics A and B.
<b>Ti5414100</b>	<b>STATISTICS II</b> <b>3 ECTS cr</b>
<b>4th year</b>	<i>Tilastomatemiikka II</i>
<b>Period 2 Lecturer Aims</b>	Lecturer, Lic.Phil. Sirkku Parviainen To give the students deeper understanding about statistical hypothesis testing, introduction to distributions of several variables, and multiple regression analysis.
<b>Contents</b>	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.
<b>Instruction Literature Prerequisites</b>	Lectures 28 h, exercises 14 h, assignment, 2nd period. Exam. Will be announced on lectures. Recommended Ti5413500 Tilastomatemiikka I.
<b>Ti5414200</b>	<b>SIMULATION</b> <b>4 ECTS cr</b>
<b>3rd - 4th year</b>	<i>Simulointi</i>
<b>Period 1 Lecturer Aims</b>	Professor, Ph.D. Heikki Haario The course gives an introduction to the concepts of discrete simulation models and methods together with numerical examples.
<b>Contents</b>	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.
<b>Instruction Prerequisites</b>	Lectures 28 h, exercises 14 h, home work, 1st period. Exam. Recommended Ti5413500 Tilastomatemiikka I.

<b>Ti5414300</b>	<b>DIFFERENTIAL EQUATIONS</b>	<b>5 ECTS cr</b>
<b>3rd year</b>	<i>Differentiaaliyhtälöt</i>	
<b>Period 3</b>	<b>Lectured every second year only. Lectured 2005 - 2006.</b>	
<b>Lecturer</b>	Professor, Ph.D. Heikki Haario	
<b>Aims</b>	The course introduces the basic concepts of ordinary and partial differential equations together with numerical solution methods.	
<b>Contents</b>	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.	
<b>Instruction</b>	Lectures 28 h, exercises 28 h, home work, 3rd period. Exam.	
<b>Prerequisites</b>	Mathematics A and B. Recommended Ti5413700 Matriisilaskenta.	
<b>Ti5414400</b>	<b>LOGIC AND DISCRETE METHODS</b>	<b>4 ECTS cr</b>
<b>4th year</b>	<i>Logiikka ja diskreetit menetelmät</i>	
<b>Period 4</b>		
<b>Lecturer</b>	Professor, Ph.D. Jorma K. Mattila	
<b>Aims</b>	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.	
<b>Contents</b>	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.	
<b>Instruction</b>	Lectures 21 h, exercises 14 h, 4th period. Exam.	
<b>Literature</b>	Grassmann, W.K., Tremblay J-P.: Logic and Discrete Mathematics, A Computer Science Perspective, Prentice Hall, 1996.	
<b>Prerequisites</b>	Recommended Ti5413400 Diskreetit mallit ja menetelmät.	
<b>Ti5414700</b>	<b>LINEAR ALGEBRA AND NORMED SPACES</b>	<b>3 ECTS cr</b>
<b>4th year</b>	<i>Lineaarialgebra ja normiavaruudet</i>	
<b>Period 1</b>		
<b>Lecturer</b>	Professor, Ph.D. Matti Heiliö	
<b>Aims</b>	Essentials of linear analysis in normed spaces and principles which are needed to understand methods of applied mathematics.	
<b>Contents</b>	Vector spaces and linear operators. Linear subspaces and projection. Norms, metric and convergence. Function spaces. Banach spaces, $L^p$ -spaces. Inner product and orthogonality. Hilbert spaces. Theory of matrices, eigenvalues and spectral decomposition. Applications in systems and signal analysis, numerical methods, optimization.	
<b>Instruction</b>	Lectures 21 h, exercises 14 h, 1st period. Exam.	
<b>Literature</b>	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.	
<b>Prerequisites</b>	Ti5413700 Matriisilaskenta. Recommended Ti5413200 Vektorikentät, Ti5416100 Integral Transforms.	
<b>Ti5416100</b>	<b>INTEGRAL TRANSFORMS</b>	<b>3 ECTS cr</b>
<b>3rd year</b>	<i>Integraalimuunnokset</i>	
<b>Period 4</b>		
<b>Lecturer</b>	Lecturer, Ph.D. Kirsti Oja-Kontio	
<b>Aims</b>	To show how different transform techniques are used in order to solve certain engineering problems.	
<b>Contents</b>	Laplace transform, Fourier transform, z-transform. Examples of applications of transforms in engineering problem solving.	
<b>Instruction</b>	Lectures 28 h, exercises 14 h, 4th period. Exam.	
<b>Literature</b>	Kreyszig, E.: Advanced Engineering Mathematics, Wiley, 1999. James, G.: Advanced Modern Engineering Mathematics, Addison-Wesley, 1993.	
<b>Prerequisites</b>	Recommended Mathematics A and B.	

<b>Ti5416200</b>	<b>NUMERICAL ANALYSIS II</b>	<b>3 ECTS cr</b>
<b>4th year</b>	<i>Numeerinen analyysi II</i>	
<b>Period 4</b>		
<b>Lecturer</b>	Professor, Ph.D. Heikki Haario	
<b>Aims</b>	Presents the basic concepts of numerical linear algebra with applications to regression and data analysis.	
<b>Contents</b>	Continuation to Numerical Analysis I on bachelor level. Numerical sensitivity, condition number of a matrix. Basic matrix decompositions for numerical computations: LU, QR, SVD. Solutions for linear equation systems and overdetermined linear systems. Pseudoinverse, solution and regularization of ill-posed linear systems. Sparse matrixes. Matlab examples from spectral data analysis. Modelling examples from various engineering fields.	
<b>Instruction</b>	Lectures 21 h, exercises 14 h, home work, 4th period. Exam.	
<b>Literature</b>	Will be announced on lectures.	
<b>Prerequisites</b>	Mathematics A and B. Recommended Ti5413600 Numeerinen analyysi I, Ti5413700 Matriisilaskenta.	
<b>Ti5416300</b>	<b>NONLINEAR OPTIMIZATION</b>	<b>4 ECTS cr</b>
<b>3rd - 4th year</b>	<i>Epälineaarinen optimointi</i>	
<b>Period 4</b>	<b>Lectured every second year only. Lectured 2005 - 2006.</b>	
<b>Lecturer</b>	Lecturer, Lic.Phil. Sirkku Parviainen	
<b>Aims</b>	The course introduces the concepts of nonlinear optimization and provides the basic skills for formulating and solving nonlinear optimization tasks.	
<b>Contents</b>	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.	
<b>Instruction</b>	Lectures 28 h, exercises 14 h, home work, 4th period. Exam.	
<b>Literature</b>	Will be announced on lectures.	
<b>Prerequisites</b>	Mathematics A and B, Ti5413600 Numeerinen analyysi I.	
<b>Ti5416400</b>	<b>DISCRETE OPTIMIZATION</b>	<b>4 ECTS cr</b>
<b>3rd - 4th year</b>	<i>Diskreetti optimointi</i>	
<b>Period 4</b>	<b>Lectured every second year only. Lectured 2006 - 2007.</b>	
<b>Lecturer</b>	Lecturer, Lic.Phil. Sirkku Parviainen	
<b>Aims</b>	To introduce the student to discrete or combinatorial optimization methods and problems.	
<b>Contents</b>	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.	
<b>Instruction</b>	Lectures 28 h, exercises 28 h, 4th period. Assignment. Exam.	
<b>Literature</b>	Will be announced on lectures.	
<b>Prerequisites</b>	Experience in programming or using mathematical software required. Recommended Ti5413400 Diskreetit mallit ja menetelmät, Ti5413800 Lineaarinen optimointi.	
<b>Ti5416500</b>	<b>STATISTICAL ANALYSIS IN MODELLING</b>	<b>3 ECTS cr</b>
<b>4th year</b>	<i>Mallien tilastollinen analyysi</i>	
<b>Period 2</b>		
<b>Lecturer</b>	Professor, Ph.D. Heikki Haario	
<b>Aims</b>	Introduction to the methods of estimating reliability of modelling.	
<b>Contents</b>	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.	
<b>Instruction</b>	Lectures 21 h, exercises 14 h, 2nd period. Home work. Exam.	
<b>Prerequisites</b>	Mathematics A and B, Ti5413500 Tilastomatematiikka I. Recommended Ti5414200 Simulation.	

<b>Ti5416600</b>	<b>FUZZY SETS AND FUZZY LOGIC</b>	<b>6 ECTS cr</b>
<b>4th year</b>	<i>Sumeat joukot ja sumea logiikka</i>	
<b>Period 2</b>	<b>Lectured every second year only. Lectured 2006 - 2007.</b>	
<b>Lecturer</b>	Professor, Ph.D. Jorma K. Mattila	
<b>Aims</b>	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.	
<b>Contents</b>	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.	
<b>Instruction</b>	Lectures 28 h, exercises 14 h, 2nd period. Practical work. Exam.	
<b>Literature</b>	Nguyen, H.T., Walker, E.A.: A First Course in Fuzzy Logic, 2nd Ed., Chapman & Hall/CRC, 2000.	
<b>Prerequisites</b>	Recommended Ti5414500 Sumeat menetelmät.	
<b>Ti5416700</b>	<b>FUZZY ENGINEERING</b>	<b>6 ECTS cr</b>
<b>4th year</b>	<i>Sumea teknologia</i>	
<b>Period 4</b>	<b>Lectured every second year only. Lectured 2006 - 2007.</b>	
<b>Lecturer</b>	Senior Assistant, Ph.D. Jari Kortelainen	
<b>Aims</b>	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.	
<b>Contents</b>	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.	
<b>Instruction</b>	Lectures 28 h, exercises 14 h, 4th period. Practical work. Exam.	
<b>Literature</b>	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.	
<b>Prerequisites</b>	Recommended Ti5414500 Sumeat menetelmät, Ti5416600 Fuzzy Sets and Fuzzy Logic.	
<b>Ti5417100</b>	<b>STOCHASTIC THEORY AND MODELS</b>	<b>3 ECTS cr</b>
<b>4th year</b>	<i>Stokastiikan teoriaa ja malleja</i>	
<b>Period 3 - 4</b>		
<b>Lecturer</b>	Professor, Ph.D. Matti Heiliö	
<b>Aims</b>	To present theory of stochastics and advanced statistical methods for understanding systems and phenomena containing randomness and uncertainty.	
<b>Contents</b>	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.	
<b>Instruction</b>	Virtual course. Lectures (web) 14 h, 3rd period. Exercises 12 h, 4th period, self-study material.	
<b>Literature</b>	Will be announced on lectures.	
<b>Prerequisites</b>	Ti5413500 Tilastomatemiikka I, Ti5416500 Statistical Analysis in Modelling. Recommended Ti5414100 Statistics II, Ti5414700 Linear Algebra and Normed Spaces.	
<b>Ti5417200</b>	<b>DESIGN OF EXPERIMENTS</b>	<b>3 ECTS cr</b>
<b>4th year</b>	<i>Koesuunnittelu</i>	
<b>Period 4</b>	<b>Lectured every second year only. Lectured 2005 - 2006.</b>	
<b>Lecturer</b>	Professor, Ph.D. Heikki Haario	
<b>Aims</b>	Introduction to the basic concepts for efficient planning of experiments.	
<b>Contents</b>	Importance of experimental design, minimization of prediction uncertainty. Basic factorial designs: 2N, Central Composite designs for regression analysis. Variance analysis for	

<b>Instruction</b>	qualitative factors. The Taguchi principles. Experimental optimisation of engineering processes.
<b>Prerequisites</b>	Lectures 28 h, exercises and home work 28 h, 4th period. Exam. Mathematics A and B, Ti5413500 Tilastomatematiikka I. Recommended Ti5413700 Matriisilaskenta.
<b>Ti5417300</b>	<b>FUNCTIONAL ANALYSIS</b> <span style="float: right;"><b>3 ECTS cr</b></span>
<b>4th - 5th year</b>	<i>Funktionaalianalyysi</i>
<b>Period 2</b>	<b>Lectured every second year only. Lectured 2006 - 2007.</b>
<b>Lecturer</b>	Professor, Ph.D. Matti Heiliö
<b>Aims</b>	Principles of functional analysis giving a basis for understanding modern theory and methods in applied mathematics.
<b>Contents</b>	Hilbert spaces and Banach spaces. Measures and Lebesgue integral, $L^p$ - 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. Introduction to stochastic differential equations.
<b>Instruction</b>	Lectures 21 h, exercises 14 h, 2nd period. Exam.
<b>Literature</b>	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.
<b>Prerequisites</b>	Ti5414700 Linear Algebra and Normed Spaces. Recommended Ti5413300 Complex Analysis, Ti5413600 Numeerinen analyysi I, Ti5416100 Integral Transforms.
<b>Ti5417400</b>	<b>FUZZY DATA ANALYSIS</b> <span style="float: right;"><b>6 ECTS cr</b></span>
<b>5th year</b>	<i>Data-analyysiä sumeassa ympäristössä</i>
<b>Period 3</b>	<b>Lectured every second year only. Lectured 2005 - 2006.</b>
<b>Lecturer</b>	Senior Assistant, Ph.D. Jari Kortelainen
<b>Aims</b>	To introduce theoretical aspects of data analysis. The student will learn how to model and analyze uncertainty in different problem settings.
<b>Contents</b>	Fuzzy sets and relations. Uncertainty measures. Qualitative and quantitative analysis of fuzzy data. Introduction to possibility theory and generalized measure theory. Evaluation of methods.
<b>Instruction</b>	Lectures 28 h, exercises 14 h, 3rd period. Practical work. Exam.
<b>Literature</b>	Bandemer, H., Näther, W.: Fuzzy Data Analysis, Kluwer Academic Publ., 1992.
<b>Prerequisites</b>	Recommended Ti5414500 Sumeat menetelmät, Ti5416600 Fuzzy Sets and Fuzzy Logic.
<b>Ti5417500</b>	<b>FUZZY DECISION MAKING</b> <span style="float: right;"><b>6 ECTS cr</b></span>
<b>5th year</b>	<i>Päätöksenteko sumeassa ympäristössä</i>
<b>Period 2</b>	<b>Lectured every second year only. Lectured 2005 - 2006.</b>
<b>Lecturer</b>	Professor, Ph.D. Jorma K. Mattila
<b>Aims</b>	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.
<b>Contents</b>	The central methods of fuzzy inference and decision making.
<b>Instruction</b>	Lectures 28 h, exercises 14 h, 2nd period. Practical work. Exam.
<b>Literature</b>	Fullér, R.: Introduction to Neuro-Fuzzy Systems, Physica-Verlag, 2000.
<b>Prerequisites</b>	Recommended Ti5414500 Sumeat menetelmät, Ti5416600 Fuzzy Sets and Fuzzy Logic.
<b>Ti5417600</b>	<b>ADVANCED MATHEMATICAL METHODS</b> <span style="float: right;"><b>3-6 ECTS cr</b></span>
<b>4th year</b>	<i>Matemaattisten menetelmien erikoiskurssi</i>
<b>Period 1 - 4</b>	
<b>Lecturer</b>	Professor, Ph.D. Matti Heiliö
<b>Aims</b>	Student will obtain theoretical and operational skills in some specific area of applied mathematics.

<b>Contents</b>	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.
<b>Prerequisites</b>	Recommended Ti5413200 Vektorikentät, Ti5413600 Numeerinen analyysi I, Ti5413700 Matriisilaskenta.
<b>Ti5417700</b>	<b>MODELLING METHODOLOGY IN PROCESS ENGINEERING 5 ECTS cr</b>
<b>4th year</b>	<i>Mallinnus prosessiteknikassa</i>
<b>Period 1 - 2</b>	
<b>Lecturer</b>	Professor, Ph.D. Heikki Haario
<b>Aims</b>	The course provides an overview to the concepts and techniques of mathematical modelling in process engineering.
<b>Contents</b>	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.
<b>Instruction</b>	Lectures 21 h, exercises 14 h, 1st period. Lectures 21 h, exercises 14 h, 2nd period. Home work. Exam.
<b>Literature</b>	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 Inc., 2003. Svobodny, T.: Mathematical Modeling for Industry and Engineering, Prentice Hall, 1998.
<b>Prerequisites</b>	Mathematics A and B. Recommended Ti5413500 Tilastomatematiikka I, Ti5413600 Numeerinen analyysi I, Ti5413700 Matriisilaskenta, Ti5414300 Differential Equations.
<b>Ti5417800</b>	<b>CASE STUDY SEMINAR 6 ECTS cr</b>
<b>4th year</b>	<i>Sovellatun matematiikan erikoistyöt</i>
<b>Period 1 - 4</b>	
<b>Lecturer</b>	Professor, Ph.D. Heikki Haario
<b>Aims</b>	The course gives an introduction to independent scientific work by presenting seminar works from different fields of applied mathematics.
<b>Contents</b>	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.
<b>Instruction</b>	Exercises 14 h, 1st period. Exercises 14 h, 2nd period. Exercises 14 h, 3rd period. Exercises 14 h, 4th period. Extended project work. Seminar is held in each period. To pass the course student must attend 7 weeks and present his/her project work.
<b>Prerequisites</b>	Mathematics A and B. Recommended Ti5413600 Numeerinen analyysi I, Ti5413700 Matriisilaskenta, Ti5417700 Modelling Methodology in Process Engineering.

## 5 International Master's Degree Programme in Mechanical Engineering

The International Master's Degree Programme in Mechanical Engineering is a two-year degree programme worth of 120 ECTS credits leading to a Master of Science in Technology degree. It is a degree programme, to which there is an annual separate selection. The students have two years of full-time studies in which all lectures and laboratory work are conducted in English. In the first three semesters the students have 90 ECTS credits of classroom and laboratory instruction. The Master's thesis, worth a further 30 ECTS credits, is conducted in the fourth semester, after other courses have been completed.

## 5.1 The Aims of the International 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.

## 5.2 Possible 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.

## 5.3 Course structure

<b>Master’s Thesis 30 ECTS</b>	
<b>Major Subject 40-41 ECTS</b> <b>Structural and Machine Design 40 ECTS or</b> <b>Production Technologies 41 ECTS</b>	<b>Minor Subject 20 ECTS</b>
<b>General Studies 13-15 ECTS</b>	<b>Elective Studies 14-17 ECTS</b>

### 5.3.1 General Studies (13-15 ECTS credits):

General studies are common to all MSc students. They provide a brief introduction to the field of mechanical engineering as well as language skills essential for MSc studies.

### 5.3.2 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 2<sup>nd</sup> period of year 1.

### 5.3.3 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.

### 5.3.4 Minor Subject (20 ECTS credits):

Students can choose any minor subject taught in English at LUT. Students who choose Structural and Machine Design as their minor subject, can freely select 20 ECTS credits of taught courses from the Structural and Machine Design major subject area. Students who choose Production Technologies as their minor subject, can freely select 20 ECTS credits of taught courses from the Production Technologies major subject area.

### 5.3.5 Elective Studies (14-17 ECTS credits):

Students can choose any courses taught in English at LUT if the required prerequisites are completed.

As the MSc degree must include a minimum of 10 and a maximum of 16 ECTS credits of language and communication studies, elective studies should include 4-10 ECTS credits of I & c studies. 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>period</i>	<i>ECTS cr</i>
Ki7119000	Academic Seminar for International Programs	1	1 - 2	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 for attaining proficiency in Swedish (if needed)

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

#### Structural and Machine Design

The person responsible for major in Structural and Machine Design is professor, Dr. Tech. (Eng.) 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. Students should select a minimum of 40 ECTS credits from the following courses:

#### Major in Structural and Machine Design (40 ECTS credits)

<i>Structural and Machine Design</i>		<i>year</i>	<i>period</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

<sup>1)</sup> A required course

<sup>2)</sup> Will be lectured in English in 2006-2007

#### 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.

#### Major in Production Technologies (41 ECTS credits)

<i>Major in Production Technologies</i>		<i>year</i>	<i>period</i>	<i>ECTS cr</i>
Ko4000100	Individual Project Work	2	1 - 4	6
Ko4000200	Research Seminar	2	4	2
Ko4110400	Modern Welding Technology	1	3 - 4	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

#### Further information:

International Officer Minna Loikkanen

Phone (05) 621 2444

Email [minna.loikkanen@lut.fi](mailto:minna.loikkanen@lut.fi)

[www.lut.fi/kote/international\\_studies/](http://www.lut.fi/kote/international_studies/)

## 5.4 The Courses Offered in English

		<i>ECTS cr</i>
Ko4000100	Individual Project Work	6
Ko4000200	Research Seminar	2
Ko4000300	Introduction to M.Sc. Studies	1

<i>Section of Production Technology</i>		<i>ECTS cr</i>
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>		<i>ECTS cr</i>
Ko4210300	Servo Control Engineering	6
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
Ko4250000	Simulation of a Mechatronic Machine	6
Ko4250400	Introduction to Multibody Dynamics	4

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

#### 5.4.1 Course descriptions

<b>Ko4000100</b>	<b>INDIVIDUAL PROJECT WORK</b>	<b>6 ECTS cr</b>
<b>4th year</b>	<i>Kv -maisteriohjelman erikoistyö</i>	
<b>Period 1 - 4</b>	Professors Department of Mechanical Engineering	
<b>Lecturer</b>	Must know: 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.	
<b>Contents</b>		
<b>Instruction</b>	10 h of lectures, 1st-4th period. 150 h of tutorials and independent projects, 1st-4th period. Assessment: Based on written report and oral presentation.	
<b>Prerequisites</b>	Consent of supervising professor.	

<b>Ko4000200</b>	<b>RESEARCH SEMINAR</b>	<b>2 ECTS cr</b>
<b>5th year</b>		
<b>Period 4</b>	Must know: International students will present and defend their own diploma project thesis work as well as serve as opponents and listen to other presentations.	
<b>Contents</b>	Exercises: 10 h, 4th period. Simulation work 40 h. Assessment: Passed/not passed grade based on participation.	
<b>Instruction</b>		

<b>Ko4000300</b>	<b>INTRODUCTION TO M.SC. STUDIES</b>	<b>1 ECTS cr</b>
<b>4th year</b>		
<b>Period 1 - 2</b>	Professor, Dr. Tech (Eng) Gary Marquis	
<b>Lecturer</b>	Must know: This course will help orient international students to the basics of study at LUT.	
<b>Contents</b>	Skills: Orientation week activities, information gathering, and essay.	
<b>Instruction</b>	Lectures 8 h, 1st-2nd period. Exercises 10 h Independent work 8 h, Assessment: Passed/not passed grade based on participation, exercises and essay.	
<b>Literature</b>	LUT Web.	

<b>Ko4110100</b>	<b>MATERIALS SCIENCE</b>	<b>6 ECTS cr</b>
<b>4th year</b>	<i>Materiaalioppi</i>	
<b>Period 1 - 2</b>	Senior assistant, Lic.Sc.(Tech.) Raimo Suoranta	
<b>Lecturer</b>	Assistant, Lic.Sc.(Tech.) Pekka Rajamäki	
<b>Contents</b>	Must know: The structure of steel, plastic deformation, restoration, hardening, heat treatment methods. Selecting materials according to strength, toughness, corrosion resistance, wear resistance. Manufacturability. Should know: Light metals and non-metallic materials. Nice to know: LCC. Systems for selecting materials. Skills: The student is capable to select proper material according to functionality and economically.	
<b>Instruction</b>	28 h of lectures, 1st-2nd period. 42 h of independent work, 1st-2nd period. Assessment: Examination 75 %, tutorials 25 %.	

<b>Ko4110400</b>	<b>MODERN WELDING TECHNOLOGY</b>	<b>7 ECTS cr</b>
<b>5th year</b>	<i>Nykyaikainen hitsaustekniikka</i>	
<b>Period 3 - 4</b>		
<b>Lecturer</b>	Professor, D.Sc. (Tech) Jukka Martikainen Senior assistant, Lic.Sc.(Tech.) Raimo Suoranta	
<b>Contents</b>	Must know: 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. Should know: 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. Nice to know: Adaptive welding. Welding in the global welding workshop.	
<b>Instruction</b>	4 h of lectures, 3rd-4th period. 14 h of laboratory tutorials. 28 h of laboratory- and seminar presentations	
<b>Literature</b>	Assessment: Examination 80 %, laboratory- and seminar presentations 20 %. WebCT material. Lecture notes.	
<b>Ko4111100</b>	<b>VIRTUAL WELDING</b>	<b>3 ECTS cr</b>
<b>4th year</b>	<i>Virtuaalihitsaus</i>	
<b>Period 3 - 4</b>		
<b>Lecturer</b>	Part-time teacher, M.Sc. (Tech) Esa Hiltunen	
<b>Contents</b>	Must know: Welding production planning of workshops. Modelling and simulation of robot welding system. Should know: Virtual technology and its applications in mechanical engineering. Basis of virtual modelling. Basis of industrial robots and their construction. Nice to know: Planning of productive robotized welding. Definition of welding process parameters. Skills: 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.	
<b>Instruction</b>	2 h of lectures, 3rd period. 12 h of controlled tutorials, 3rd-4th period. Assessment: Examination 100 %.	
<b>Literature</b>	WebCT.	
<b>Ko4180700</b>	<b>ADVANCED PRODUCTION ENGINEERING</b>	<b>7 ECTS cr</b>
<b>4th year</b>	<i>Tuotantotekniikka, jatkokurssi</i>	
<b>Period 1 - 2</b>		
<b>Lecturer</b>	Professor, D.Sc (Tech) Juha Varis	
<b>Contents</b>	Must know: 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. Should know: 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. Nice to know: The development of the operations of a workshop and quality technology. Skills: 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.	
<b>Instruction</b>	30 h of lectures, 1st-2nd period. 28 h of exercises, 1st-2nd period. 56 h of laboratory tutorials, 1st -2nd period. Seminar 20 h, 1st-2nd period. Assessment: Examination 60 %, satisfactorily completed tutorials 20 %, project work 20 %.	
<b>Literature</b>	Materials to be announced during lectures.	

<b>Ko4190100</b>	<b>LASER PROCESSES</b>	<b>6 ECTS cr</b>
<b>3rd year</b>	<i>Lasertyöstöprosessit</i>	
<b>Period 1 - 2</b>		
<b>Lecturer</b>	Professori, TkT Veli Kujanpää Part-time teacher, D.Sc. (Tech.) Antti Salminen	
<b>Contents</b>	Must know: 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. Should know: Optics of laser processing, safety and quality assurance. Practical cases. Nice to know: Basics of the interaction between laser beam and materials, absorption, keyhole and its usefulness on laser welding and cutting. Skills: Readiness to understand the special features of laser processing in production and product design.	
<b>Instruction</b>	28 h of lectures, 1st-2nd period. 16 h of tutorials, 1st-2nd period. Assessment: Examination 90 %, seminar 10 %.	
<b>Literature</b>	Steen W., Laser material processing. Material presented during lectures.	
<b>Ko4190200</b>	<b>PRODUCT DESIGN FOR LASER PROCESSING</b>	<b>4 ECTS cr</b>
<b>4th year</b>	<i>Lasertekniikan tuotesuunnittelu</i>	
<b>Period 3 - 4</b>		
<b>Lecturer</b>	Docent, D.Sc (Tech) Antti Salminen	
<b>Contents</b>	Must know: Special features of laser processing methods for product design. The effect of laser processing devices, process features, materials and processing results on product design. Should know: Practical examples on product design and its effects on product properties. Nice to know: Special features of laser processing and its usefulness on product design. Skills: Readiness to use laser processing possibilities on the tasks of product design.	
<b>Instruction</b>	28 h of lectures, 3rd-4th period. 14 h of tutorials, 3rd-4th period. Assessment: Examination 75 %, seminar 25 %.	
<b>Literature</b>	Kujanpää V. et al., Lasertyöstö. Steen W., Laser material processing.	
<b>Prerequisites</b>	Ko4190000 Säädetyöstö or Ko4190100 Laser Processes	
<b>Ko4210300</b>	<b>SERVO CONTROL ENGINEERING</b>	<b>6 ECTS cr</b>
<b>3rd year</b>	<i>Servotekniikka</i>	
<b>Period 3 - 4</b>		
<b>Lecturer</b>	Professor, D.Sc. (Tech) Heikki Handroos	
<b>Contents</b>	Must know: Control of Hydraulic, Pneumatic, and electrical servodrives. Should know: Structures and properties of basic types of servo-drives. Selection of appropriate control methods for different drive types. Nice to know: Fuzzy control of servodrives. Skills: Ability to design and control of different types of servodrives. Ability to evaluate the achievable properties of different servodrives.	
<b>Instruction</b>	42 h of lectures, 3rd-4th period. 42 h of tutorials, 3rd-4th period. 30 h of exercises, 4th period. Assessment: Examination 100 %.	
<b>Literature</b>	Lecture notes.	
<b>Prerequisites</b>	The student must have completed Ko4210000 Mekatroniikan peruskurssi. Recommended Ko4210100 Hydrauliteknikka (not required from International Master's Programme students).	
<b>Ko4240900</b>	<b>STRUCTURAL ANALYSIS</b>	<b>6 ECTS cr</b>
<b>2nd year</b>	<i>Rakenneanalyysi</i>	
<b>Period 1 - 2</b>		
<b>Lecturer</b>	Professor, Dr. Tech (Eng) Gary Marquis	
<b>Contents</b>	Must know: 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. Skills: Drawing shear and moment diagrams, constructing influence lines. Use of STRAN computer program.	

<b>Instruction</b>	42 h of lectures, 1st-2nd period. 18 h of tutorials, 1st-2nd period. 20 h of laboratory works. Assessment: Examination 50 %, exercises 50 %.
<b>Literature</b>	Hibbeler R.C., Structural Analysis - 5th ed., Prentice-Hall, 2002.
<b>Prerequisites</b>	Static equilibrium, understand shear forces, normal forces and bending moments Ko4240000 Statiikka and Ko4240300 Lujusoppi I.
<b>Ko4241000</b>	<b>DESIGN OF STEEL STRUCTURES</b> <span style="float: right;"><b>6 ECTS cr</b></span>
<b>4th year</b>	<i>Teräsrakenteiden suunnittelu</i>
<b>Period 3 - 4</b>	Professor, Dr. Tech (Eng) Gary Marquis
<b>Lecturer</b>	Must know: 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.
<b>Contents</b>	Skills: Use of AGIFAP computer program.
<b>Instruction</b>	42 h of lectures, 3rd-4th period. 10 h of tutorials 3rd-4th period . 5 h of laboratory works, 3rd-4th period. Assessment: Examination 60 %, laboratory projects and reports 40 %.
<b>Literature</b>	Niemi E., Levyrakenteiden suunnittelu, 2003.
<b>Prerequisites</b>	Ko4241100 FE-analyysin peruskurssi or Ko4241200 FE-analysis course
<b>Ko4241200</b>	<b>FE-ANALYSIS COURSE</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>3rd year</b>	<i>FE-analyysi</i>
<b>Period 3 - 4</b>	Lecturer-researcher, D.Sc (Tech) Pasi Tanskanen
<b>Lecturer</b>	Must know: 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.
<b>Contents</b>	Skills: 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.
<b>Instruction</b>	28 h of lectures, 3rd-4th period. 28 h of tutorials, 3rd-4th period. Assessment: Examination 50 %, exercises 50 %.
<b>Literature</b>	The material is to be specified during lectures.
<b>Ko4241400</b>	<b>FATIGUE DESIGN</b> <span style="float: right;"><b>6 ECTS cr</b></span>
<b>4th year</b>	<i>Väsymismitoitus</i>
<b>Period 1 - 2</b>	Professor, Dr. Tech (Eng) Gary Marquis
<b>Lecturer</b>	Must know: 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.
<b>Contents</b>	
<b>Instruction</b>	42 h of lectures, 1st -2nd period. 40 h of tutorials, 1st-2nd period. Assessment: Examination 60 %, exercises 40 %.
<b>Literature</b>	Dowling N.E., Mechanical Behavior of Materials 2nd ed., Prentice Hall.
<b>Prerequisites</b>	Ko4240500 Lujusoppi II or Ko4110100 Materials Science.
<b>Ko4241600</b>	<b>FE-ANALYSIS SEMINAR IN ADVANCED TOPICS</b> <span style="float: right;"><b>3 ECTS cr</b></span>
<b>3rd year</b>	<i>FE-analyysin syventävä seminaarikurssi</i>
<b>Period 1 - 4</b>	Lecturer-researcher, D.Sc (Tech) Pasi Tanskanen
<b>Lecturer</b>	Must know: 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.
<b>Contents</b>	Skills: 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.

<b>Instruction</b>	Lectures 14 h, 1st-4th period. Exercises 14 h, 1st-4th period. Assessment: Exercises 100 %.	
<b>Literature</b>	The material is to be specified during lectures.	
<b>Prerequisites</b>	Ko4241200 FE-analysis course.	
<b>Ko4250000</b>	<b><i>SIMULATION OF A MECHATRONIC MACHINE</i></b>	<b>6 ECTS cr</b>
<b>3rd year</b>	<i>Mekatronisen koneen simulointi</i>	
<b>Period 3 - 4</b>	Professor, D.Sc. (Tech) Aki Mikkola	
<b>Lecturer</b>	Must know: Principles of multibody dynamics, modelling of actuators, coupled simulation. Should know: Description of mechanic flexibility. The use of Lagrangian equation. Constraint equations and Lagrangian multipliers. Inertia of rigid bodies. Modeling of hydraulic components. Nice to know: Numerical integration of the equation of motion. Rotation matrix in spatial cases. Skills: 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.	
<b>Contents</b>	28 h of lectures, 3rd-4th period. 28 h of supervised tutorials, 3rd-4th period. Assessment: Examination 90 %, simulation work 10 %.	
<b>Instruction</b>	Lecture notes.	
<b>Literature</b>	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).	
<b>Prerequisites</b>		
<b>Ko4250400</b>	<b><i>INTRODUCTION TO MULTIBODY DYNAMICS</i></b>	<b>4 ECTS cr</b>
<b>3. vuosi</b>		
<b>Periodi 3</b>	Professor, D.Sc. (Tech) Aki Mikkola	
<b>Opettaja</b>	Must know: Principles of multibody dynamics. Should know: The use of Lagrangian equation. Constraint equations and Lagrangian multipliers. Inertia of rigid bodies. Nice to know: Numerical integration of the equation of motion. Rotation matrix in spatial cases. Skills: The student will obtain the theoretical ability for the mathematical modelling and computer simulation of machine systems that consists of rigid bodies.	
<b>Sisältö</b>	Lectures of 14 h, 3rd period. Exercises of 14 h, 3rd period. Assessment: Examination 90 %, simulation work 10 %.	
<b>Opetus</b>	Lecture notes.	
<b>Kirjallisuus</b>	Students are recommended to have completed Ko4240000 Statiikka, Ko4240100 Dynamiikka I, Ko4240200 Dynamiikka II (not required from International Master's Programme students).	
<b>Esitiedot</b>		
<b>Ko4530000</b>	<b><i>WOOD PROCESSING MACHINERY</i></b>	<b>6 ECTS cr</b>
<b>3rd year</b>	<i>Sahakoneet</i>	
<b>Period 3</b>	Professor, Dr. Tech (Eng) Jaakko Vuorilehto	
<b>Lecturer</b>	Researcher, M.Sc. (Tech) Kimmo Piispa	
<b>Contents</b>	Must know: Primary wood processing technologies and machinery. Should know: Production planning, wood as raw material, maintenance, environment and labour safety. Nice to know: Background for measurement and control. Skills: Comprehensive insight on machinery used in the primary wood processing industry. Basic knowledge of cutting processes, saws, debarking, chipping, sorting, drying and grading machines. Practical knowledge of sawmills.	
<b>Instruction</b>	28 h of lectures, 3rd period. 32 h of exercises, 3rd period. 24 h of independent projects, 3rd period. Assessment: Examination 80 %, seminars 20 %.	
<b>Literature</b>	Vuorilehto J., Sawmill Machines. Course Book 2006.	

<b>Ko4530100</b>	<b>MEASURING TECHNOLOGY AT MECHANICAL WOOD PROCESSES</b>	<b>4 ECTS cr</b>
<b>4th year</b>	<i>Sahateollisuuden mittaustekniikka</i>	
<b>Period 4 Lecturer</b>	Professor, Dr. Tech (Eng) Jaakko Vuorilehto Researcher, M.Sc. (Tech) Kimmo Piispa	
<b>Contents</b>	Must know: Measuring and control techniques in mechanical wood industry. Should know: Structure and physics of measuring devices and techniques. Nice to know: Economic aspects of control activities. Skills: 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.	
<b>Instruction</b>	32 h of lecturers, 4. period. 32 h of exercises, 4. period. 20 h of independent project. Assessment: Examination 80 %, seminars 20 %.	
<b>Literature Prerequisites</b>	Vuorilehto J., Measuring Technology at Mechanical Wood Processes. Course Book 2006. Ko4530000 Wood Processing Machinery.	

## 6 International Master's Degree Programme in Chemical and Process Engineering

This international Master's degree programme, titled as "Innovative Process and Product Engineering", takes two years, corresponds to 120 ECTS 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.

### 6.1 The Aims of the International Master's Degree Programme

The general goal of the programme is to give students sufficient scientific and technological knowledge for the career of chemical and process engineer 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 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 The Structure of the Programme

#### 6.3.1 General Studies

General studies are common to all the students in the programme. The studies consist of the following three thematic blocks:

- Communication Skills
- Industrial Applications
- Methodology for Industrial Innovations

The courses provide the core knowledge of chemical and process engineering, simultaneously emphasizing the specific themes of the programme, namely: the development of new technology, strong industrial connections, internationality and communication.

#### 6.3.2 Major and Minor Subjects

The major subject can be selected from three alternatives: Pulp and Paper Technology, Separation Technology and Computer Aided Process Engineering. The minor subject can be selected from four alternatives: Pulp and Paper Technology, Separation Technology, Computer Aided Process Engineering and Environmental Technology. The students choose their major and minor subjects by the end of the first period in autumn 2005.

## Computer Aided Process Engineering

Teacher responsible: Professor Ilkka Turunen

This topic includes a wide selection of modern computer aided methods and tools for chemical and process engineering. The methods cover both equipment and process design, as well as product and process development, process control, molecular modeling and production planning. In addition, well-known European specialists will introduce some of the latest developments in the field.

## Environmental Technology (only as a minor subject)

Teacher responsible: Professor Juha Kallas

The minor subject in environmental technology gives the theoretical background and calculation methods for the treatment processes in polluted water and air purification and in solid wastes treatment. The equipment for environmental engineering unit operations is introduced, the flow diagrams at present and in the future are presented and discussed. Principles of green chemistry in industrial production and in pollution treatment technology are presented.

## Pulp and Paper Technology

Teacher responsible: Professor Kaj Henricson

The student will get familiar with the major fiber production methods and the manufacture of paper and board. The courses will cover the production of mechanical fibers, recycled fiber technology and the production of chemical fibers as well as recovery of cooking chemicals. Wet end technology and fiber preparation are included in the courses of manufacture of paper and board. The main emphasis is on engineering aspects. The aim of the studies is to give the student the ability to work as a process or development engineer within the pulp and paper industry or the associated supplier industry.

## Separation Technology

Teacher responsible: Professor Juha Kallas

The subject consists of separate courses which give a wide overview of the many separation methods used in industry. Examples of unit operations included in the courses are filtration, precipitation, crystallization, extraction, adsorption and ion-exchange. The methods are theoretically described on molecular level as well as on equipment level so that the student is able to choose for a specific application the correct method and to calculate the size of the equipment based on mathematical models.

## General Studies (obligatory)

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

<sup>\*)</sup> The course Ki7131200 Teknisk svenska is obligatory for Finnish students who have not attained proficiency in Swedish in their previous degree.

<sup>\*)</sup> The course Ki7113400 English for Academic Seminars is strongly recommended.

<i>Industrial Applications (14 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ke3130400	Project on Process and Plant Design	5	1 - 2	11
Ke3600300	Industrial Technologies	4	1 - 2	3

<i>Methodology for Industrial Innovations (24 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ke3111300	Product Design	4	4	5
Ke3130200	Creative Design	4	1 - 2	3
Ke3131100	Process Intensification	4	2	2
Ke3600400	R&D Methodology	5	2	3
Ti5417700	Modelling Methodology in Process Engineering	4	1 - 2	5
Tu6306000	Technology Management	4	1	3
Tu6306050	Cost and Profitability Estimation	4	2	3

## Major Subjects

### Computer Aided Process Engineering

<i>Obligatory Studies (60 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ke3130600	Computational Fluid Dynamics in Chemical Engineering	5	1 - 2	6
Ke3600000	Latest Developments in CAPE	5	1 - 2	6
Ke3600100	Production Planning	5	1 - 2	4
Ke3600200	Dynamics and Control of Chemical Processes	5	1 - 2	4
Ke3600500	Process Simulation	4	3 - 4	6
Ke3600700	Molecular Modelling	4	4	4
Thesis	Master's Thesis			30

## Pulp and Paper Technology

<i>Obligatory Studies (62 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ke3250100 <sup>(†)</sup>	Chemical Pulping Technology	4	1 - 4	10
Ke3600600	Process Control Systems in Pulp and Paper Industry	5	1 - 2	3
Ke3600800	Recycled Fiber Technology	5	1 - 2	5
Puu-21.211	Introduction to Pulp and Paper Industry	4	3 - 4	3
Puu-21.218	Paper Technology	4	3 - 4	5
Puu-23.126	Applied Chemical Engineering and Unit Operations in Pulp and Paper Processes	5	1 - 2	6
Thesis	Master's Thesis			30

<sup>†</sup> Module B is studied in spring 2006, Module A is studied in autumn 2006.

## Separation Technology

<i>Obligatory Studies (59 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ke3110500 <sup>(†)</sup>	Chemical Engineering Unit Operations II	4	1	4
Ke3110600 <sup>(†)</sup>	Chemical Engineering Unit Operations III	4	2	4
Ke3111200	Filtration and Mixing	4	3 - 4	6
Ke3220700 <sup>(†)</sup>	Membrane Separation	4	1 - 2	4
Ke3320300	Transport Phenomena	4	2	3
Ke3330800	Chemical Separation Methods	4	3 - 4	8
Thesis	Master's Thesis			30

<sup>†</sup> The course will be studied in the 5th year.

## Minor Subjects

### Computer Aided Process Engineering

<i>Obligatory Studies (10 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ke3600500	Process Simulation	4	3 - 4	6
Ke3600700	Molecular Modelling	4	4	4

### Environmental Technology

<i>Obligatory Studies (11 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ke3110900 <sup>(†)</sup>	Treatment Processes of Industrial Discharges	3	3 - 4	5
Ke3111100	Advanced Course in Environmental Technology	4	3 - 4	6

<sup>†</sup> The course will be studied in the 4th year.

## Pulp and Paper Technology

<i>Obligatory Studies (8-9 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ke3250120 <sup>(†)</sup>	Module B: Fiberline Operations	4	3 - 4	6
Puu-21.211	Introduction to Pulp and Paper Industry	4	3 - 4	3
Puu-21.218 <sup>(†)</sup>	Paper Technology	4	3 - 4	5

<sup>†</sup> Students must choose either one of these courses.

## Separation Technology

<i>Obligatory Studies (11 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
Ke3111200	Filtration and Mixing	4	3 - 4	6
Ke3330800	Chemical Separation Methods	4	3 - 4	5

## 6.4 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.

### Elective Studies

To attain the full 120 ECTS cr, the students might need to take some additional courses. Elective studies can include any courses offered by Lappeenranta University of Technology.

## 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](mailto:harri.niemi@lut.fi))

### Contact Information

Programme Coordinator:

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

Programme Secretary:

Piia Vahvanen (room 2318, [piia.vahvanen@lut.fi](mailto:piia.vahvanen@lut.fi)), practical issues

Programme web pages:

[www.lut.fi/ippe](http://www.lut.fi/ippe)

## 6.5 The Courses Offered in English

<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
Ke3111100	Advanced Course in Environmental Technology	6
Ke3111200	Filtration and Mixing	6
Ke3111300	Product Design	5

<i>Laboratory of Product and Process Development</i>		<i>ECTS cr</i>
Ke3130200	Creative Design	3
Ke3130400	Project on Process and Plant Design	11
Ke3130600	Computational Fluid Dynamics in Chemical Engineering	6
Ke3131100	Process Intensification	2

<i>Laboratory of Membrane Technology and Technical Polymer Chemistry</i>		<i>ECTS cr</i>
Ke3220400	Membraanitekniiikan 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
Ke3220600	Proteiinien kemia ja mikrobiologia / Protein Chemistry and Microbiology*	4
Ke3220700	Membrane Separation	4
Ke3220800	Advanced Course in Membrane Technology	5

\* The course will be given in English if required.

<i>Laboratory of Fiber Technology</i>		<i>ECTS cr</i>
Ke3250100	Chemical Pulping Technology	10
(Ke3250110	Module A: Chemical Recovery)	
(Ke3250120	Module B: Fiberline Operations)	

<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
Ke3330800	Chemical Separation Methods	5-8
Ke3330900	Separation Methods in Food Industry	3

\* The course will be given in English if required.

<i>International Master's 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
Ke3600300	Industrial Technologies	3
Ke3600400	R&D Methodology	3
Ke3600500	Process Simulation	6

Ke3600600	Process Control Systems in Pulp and Paper Industry	3
Ke3600700	Molecular Modelling	4
Ke3600800	Recycled Fiber Technology	5
Ke3600900	Cross-Cultural Communication for Working Life**	2
Puu-21.211	Introduction to Pulp and Paper Industry**	3
Puu-21.218	Paper Technology**	5
Puu-23.126	Applied Chemical Engineering and Unit Operations in Pulp and Paper Processes**	6

\*\* Only for the students of International Master's Programme in Chemical Technology (IPPE).

### 6.5.1 Course descriptions

<b>Ke3110500</b>	<b>CHEMICAL ENGINEERING UNIT OPERATIONS II</b>	<b>4 ECTS cr</b>
<b>4th year</b>	<i>Kemiantekniikan yksikköoperaatiot II</i>	
<b>Period 1</b>		
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Juha Kallas Senior assistant, D.Sc. (Tech.) Harri Niemi	
<b>Aims</b>	To familiarize students with separation techniques and the theory of mass transfer more extensively than in the course Ke3110400 Kemiantekniikan yksikköoperaatiot I.	
<b>Contents</b>	The topics are as follows: 1. Membrane Separation: Mass transfer, modelling, process design, simulation of industrial membrane processes. 2. Adsorption: theory, equipment, design of adsorption columns, and applications in industry and purification of fluids.	
<b>Instruction</b>	Lectures 12 h, exercises 28 h, 1st period. Written examination.	
<b>Literature</b>	Will be informed at lectures.	
<b>Prerequisites</b>	Ke3110400 Kemiantekniikan yksikköoperaatiot I and Ke3320100 Johdanto kemialliseen termodynamiikkaan passed.	

<b>Ke3110600</b>	<b>CHEMICAL ENGINEERING UNIT OPERATIONS III</b>	<b>4 ECTS cr</b>
<b>4th year</b>	<i>Kemiantekniikan yksikköoperaatiot III</i>	
<b>Period 2</b>		
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Juha Kallas Docent, D.Sc. (Tech.) Marjatta Louhi-Kultanen	
<b>Aims</b>	To familiarize students with separation techniques and the theory of mass transfer more extensively than in the course Ke3110400 Kemiantekniikan yksikköoperaatiot I.	
<b>Contents</b>	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.	
<b>Instruction</b>	Lectures 12 h, exercises 28 h, 2nd period. Laboratory work, reports passed. Written examination.	
<b>Literature</b>	Will be informed at lectures.	
<b>Prerequisites</b>	Ke3110400 Kemiantekniikan yksikköoperaatiot I and Ke3320100 Johdanto kemialliseen termodynamiikkaan passed.	

<b>Ke3110900</b>	<b>TREATMENT PROCESSES OF INDUSTRIAL DISCHARGES</b>	<b>5 ECTS cr</b>
<b>3rd year</b>	<i>Teollisuuden päästöjen käsittelyprosessit</i>	
<b>Period 3 - 4</b>		
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Juha Kallas Docent, Ph.D. Sergei Preis	
<b>Aims</b>	To familiarize students with engineering solutions of environmental problems concerning water and wastewater treatment, air emissions control and solid waste processing and disposal.	
<b>Contents</b>	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.	
<b>Instruction</b>	Lectures and exercises 20 h, 3rd period. Lectures and exercises 24 h, 4th period. Written examination.	

<b>Literature</b>	Peavy, H.S., Rowe, D.R., Tchobanoglous, G., Environmental Engineering, McGraw-Hill, 1st Ed., 1985.
<b>Prerequisites</b>	Recommended Ke3110000 Nesteiden, kaasujen ja kiintoaineiden käsittely, Ke3110100 Mekaaniset erotusmenetelmät and Ke3110400 Kemiantekniikan yksikköoperaatiot I osa 2 attended.
<b>Ke3111100</b>	<b>ADVANCED COURSE IN ENVIRONMENTAL TECHNOLOGY 6 ECTS cr</b>
<b>4th year</b>	<i>Ympäristötekniikan jatkokurssi</i>
<b>Period 3 - 4</b>	
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Juha Kallas Professor (Tallinn University of Technology), D.Sc. (Tech.) Rein Munter
<b>Contents</b>	Recent results of "green chemistry" in technology and in treatment of industrial and municipal wastes. Closing of water cycles.
<b>Instruction</b>	Lectures 7 h, exercises 8 h, 3rd period. Lectures 7 h, exercises 8 h, 4th period. Written examination.
<b>Literature</b>	To be announced later.
<b>Ke3111200</b>	<b>FILTRATION AND MIXING 6 ECTS cr</b>
<b>4th year</b>	<i>Suodatus ja sekoitus</i>
<b>Period 3 - 4</b>	
<b>Lecturer</b>	Lecturer, D.Sc. (Tech.) Ritva Tuunila Docent, D.Sc. (Tech.) Tuomas Koironen Docent, D.Sc. (Tech.) Marjatta Louhi-Kultanen
<b>Aims</b>	To familiarize students with solid-liquid separation techniques and mixing processes.
<b>Contents</b>	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.
<b>Instruction</b>	Lectures 14 h, exercises 14 h, 3rd period. Lectures 14 h, exercises 14 h, 4th period. Laboratory work, reports passed. Written examination.
<b>Literature</b>	Additional material will be informed at lectures.
<b>Prerequisites</b>	Ke3110100 Mekaaniset erotusmenetelmät passed.
<b>Ke3111300</b>	<b>PRODUCT DESIGN 5 ECTS cr</b>
<b>4th year</b>	<i>Tuotesuunnittelu</i>
<b>Period 4</b>	
<b>Lecturer</b>	Professor, Ph.D. Andrzej Kraslawski
<b>Contents</b>	Types of chemical products. Identification of consumer needs. Product functions, engineering and physico-chemical properties. High-throughput experiments. Computer-aided product design. Knowledge-based systems.
<b>Instruction</b>	Lectures 21 h, exercises 14 h, 4th period. Individual assignments and exercises. Written examination.
<b>Literature</b>	Lecture notes.
<b>Ke3130200</b>	<b>CREATIVE DESIGN 3 ECTS cr</b>
<b>4th year</b>	<i>Luova suunnittelu</i>
<b>Period 1 - 2</b>	
<b>Lecturer</b>	Professor, Ph.D. Andrzej Kraslawski Lecturer N. N.
<b>Contents</b>	Types of innovation. Product, process, service innovation. Innovations in process engineering. Patents. Models of creativity. Enhancement of creativity. Brainstorming. Synectics. Quality function deployment. Morphological analysis. MindMaps case-based reasoning. TRIZ. SCAMPER. Arrowsmith.
<b>Instruction</b>	Lectures 12 h, exercises 16 h, 1st period. Lectures 10 h, exercises 18 h, 2nd period. Individual assignments and written examination.
<b>Literature</b>	Lecture notes.

<b>Ke3130400</b>	<b>PROJECT ON PROCESS AND PLANT DESIGN</b>	<b>11 ECTS cr</b>
<b>5th year</b>	<i>Suunnitteluprojekti</i>	
<b>Period 1 - 2</b>	<b>HUOM! Suomenkielisille työryhmille opintojakso opetetaan suomeksi.</b>	
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Ilkka Turunen	
<b>Aims</b>	The purpose is to make students familiar with process and plant design with the help of an extensive project work.	
<b>Contents</b>	The projects are carried out in groups of five students. The topics are from industry. A typical topic is a feasibility study of a process covering a brief market survey, comparison of process alternatives, preliminary process design (process flowsheet, mass and energy balances, sizing of main equipment), lay-out, cost and profitability estimation. Different aspects are emphasized in different projects, depending on the topic.	
<b>Instruction</b>	Lectures 5 h, project meetings, 1st period. Lectures 5 h, project meetings, 2nd period. Design and project work about 280 h, 1st - 2nd period.	
<b>Prerequisites</b>	No examination. Ke3110000 Nesteiden, kaasujen ja kiintoaineiden käsittely Ke3130100 Ideasta tuotantoon	
<b>Ke3130600</b>	<b>COMPUTATIONAL FLUID DYNAMICS IN CHEMICAL ENGINEERING</b>	<b>6 ECTS cr</b>
<b>5th year</b>	<i>Numeerinen virtauslaskenta kemianteeniikassa</i>	
<b>Period 1 - 2</b>	<b>The course will be lectured next time during the academic year 2006 - 2007.</b>	
<b>Lecturer</b>	Docent, D.Sc. (Tech.) Zuoliang Sha	
<b>Aims</b>	To teach students to use CFD to solve chemical engineering problems, e.g. in equipment design and trouble shooting.	
<b>Contents</b>	Theoretical basis of CFD. Introduction of CFX software. Applications of CFD in process industry. Solving chemical engineering problems with CFD.	
<b>Instruction</b>	Lectures 14 h, 1st period. Lectures 14 h, 2nd period.	
<b>Literature</b>	Exercises with CFD software 120 h, 1st and 2nd period. Seminar presentation. No examination. To be announced later.	
<b>Ke3131100</b>	<b>PROCESS INTENSIFICATION</b>	<b>2 ECTS cr</b>
<b>4th year</b>	<i>Prosessien intensifiointi</i>	
<b>Period 2</b>		
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Ilkka Turunen	
<b>Aims</b>	To make students familiar with the methods and latest achievements of process intensification.	
<b>Contents</b>	Definitions of process intensification. Examples of intensified equipment and processes. Methodology of process intensifications. Static mixing in process intensification. The role of structured catalytic reactors in process intensification.	
<b>Instruction</b>	Lectures 21 h, exercises arranged as brainstorming sessions 9 h, 2nd period. Written examination.	
<b>Ke3220400</b>	<b>MEMBRAANITEKNIIKAN JA TEKNILLISEN POLYMEERIKEMIAN SYVENTÄVÄ OPINTOJAKSO</b>	<b>10 ECTS cr</b>
<b>5. vuosi</b>	<i>Advanced Course in Membrane Technology and Technical Polymer Chemistry</i>	
<b>Periodi 1 - 2</b>	<b>The course will be given in English if required.</b>	
<b>Opettaja</b>	Professori, FT Marianne Nyström	
<b>Tavoitteet</b>	Opiskelijan perehdyttäminen membraanitekniiikan, teknillisen polymeerikemian ja puukemian erityisaloihin.	
<b>Sisältö</b>	Polymeeriluonteisten raaka-aineiden jalostaminen, polymerointi ja tutkiminen eri määritysmenetelmiä käyttäen. Membraaniprosessit.	
<b>Opetus</b>	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 loppuentti. Seminaaritulaisuuksiin osallistuminen pakollista.	

<b>Esitiedot</b>	Ke3220100 Teknillinen polymeerikemia tai Ke3220200 Luonnon polymeerit kuunneltuna.	
<b>Ke3220500</b>	<b>SYNTEETTISET POLYMEERIT: LIIMAT JA HARTSIT</b>	<b>5 ECTS cr</b>
<b>4. - 5. vuosi</b>	<i>Synthetic Polymers: Glues and Resins</i>	
<b>Periodi 1 - 2</b>	<b>Luennoidaan joka toinen vuosi, seuraavan kerran lukuvuonna 2005 - 2006. The course will be given in English if required.</b>	
<b>Opettaja</b>	Professori, FT Marianne Nyström Professori, TkT Ilkka Pöyhönen Tuntiopettaja, TKL Jouni Rainio Tuntiopettaja N. N.	
<b>Tavoitteet</b>	Syventää opiskelijan tietämystä synteettisten polymeerien kemiasta, määritysmenetelmistä ja käytöstä teollisuudessa.	
<b>Sisältö</b>	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.	
<b>Opetus</b>	Intensiivikurssi. Luentoja 35 h ja seminaarityö, 1. ja/tai 2. periodi. Seminaarityö, harjoitukset, tehdaskäynti ja loppuentti.	
<b>Ke3220600</b>	<b>PROTEIINIEN KEMIA JA MIKROBIOLOGIA</b>	<b>4 ECTS cr</b>
<b>4. vuosi</b>	<i>Protein Chemistry and Microbiology</i>	
<b>Periodi 3 - 4</b>	<b>The course will be given in English if required.</b>	
<b>Opettaja</b>	Professori, FT Marianne Nyström Dosentti, FT Sinikka Parkkinen Tuntiopettaja N.N.	
<b>Tavoitteet</b>	Syventää opiskelijan tietämystä proteiinien kemiasta ja polyelektrolyyttien kemiasta. Opintojakso antaa myös tietoa proteiinien hyödyntämisestä sekä mikrobiologian perustietoa, varsinkin elintarviketekniikassa esiintyvistä mikrobeista.	
<b>Sisältö</b>	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.	
<b>Opetus</b>	Luentoja 35 h, laboratoriotöitä 45 h, 3. ja/tai 4. periodi. Luennot, laboratoriotyöt ja loppuentti.	
<b>Ke3220700</b>	<b>MEMBRANE SEPARATION</b>	<b>4 ECTS cr</b>
<b>4th year</b>	<i>Kalvoerotus</i>	
<b>Period 1 - 2</b>	<b>The course will be lectured 1st time during the academic year 2006 - 2007.</b>	
<b>Lecturer</b>	Professor, Ph.D. Marianne Nyström Senior assistant, D.Sc. (Tech.) Harri Niemi	
<b>Aims</b>	To give the student understanding on the membrane technology and its use in various applications.	
<b>Contents</b>	Membrane processes (MF, UF, NF, RO, etc.). Novel membranes and their manufacturing, materials, modification and characterization. Calculations, modeling, simulation and applications.	
<b>Instruction</b>	Lectures and seminars 21 h, 1st period. Lectures and seminars 21 h, 2nd period. Individual assignments, final exam.	
<b>Literature</b>	Will be announced at the beginning of the course. Lecture notes.	
<b>Ke3220800</b>	<b>ADVANCED COURSE IN MEMBRANE TECHNOLOGY</b>	<b>5 ECTS cr</b>
<b>4th - 5th year</b>	<i>Kalvotekniikan jatkokurssi</i>	
<b>Period 3 - 4</b>	<b>Lectured every second year, the next time spring 2006.</b>	
<b>Lecturer</b>	Professor, Ph.D. Marianne Nyström	
<b>Aims</b>	To give the student a deeper understanding on membrane technology and its use in various	

<b>Contents</b>	applications. Membrane processes (microfiltration, ultrafiltration, nanofiltration, reverse osmosis, pervaporation, membrane distillation, membrane reactors, membrane bioreactors, membrane contactors, electrodialysis etc.). Novel membranes and their manufacturing, materials, modification and characterisation. Calculations, modeling and applications.
<b>Instruction</b>	Intensive course. Lectures and seminars 28 h, individual assignments, 3rd and/or 4th period. Final exam.
<b>Literature</b>	Will be announced at the beginning of the course. Lecture notes.
<b>Prerequisites</b>	Ke3220000 Kalvotekniikka or Ke3220700 Membrane Separation (lectures attended).
<b>Ke3250100</b>	<b>CHEMICAL PULPING TECHNOLOGY</b> <b>10 ECTS cr</b>
<b>4th year</b>	<i>Selluloosatekniikka</i>
<b>Period 1 - 4</b>	
<b>Lecturer</b>	Professor, M.Sc. (Tech.) Kaj Henricson Lecturer N. N.
<b>Aims</b>	To familiarize the students with the process and equipment technology, as well as the environmental aspects, in the manufacture of chemical pulp.
<b>Modules</b>	Ke3250110 Module A: Chemical Recovery; 4 ECTS Ke3250120 Module B: Fiberline Operations; 6 ECTS
<b>Instruction</b>	Modules A and B are independent courses and can also be studied in the opposite order.
<b>Prerequisites</b>	Ke3250000 Selluloosatekniikan perusteet attended or corresponding knowledge of forest industry.
<b>Ke3250110</b>	<b>MODULE A: CHEMICAL RECOVERY</b> <b>4 ECTS cr</b>
<b>4th year</b>	<i>Selluloosatekniikka, Talteenotto</i>
<b>Period 1 - 2</b>	
<b>Lecturer</b>	Professor, M.Sc. (Tech.) Kaj Henricson Lecturer N. N.
<b>Aims</b>	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.
<b>Contents</b>	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. Environmental aspects in the manufacture of chemical pulp.
<b>Instruction</b>	Lectures, exercises and seminars 14 h, 1st period. Lectures, exercises and seminars 14 h, 2nd period. WebCT - support.
<b>Literature</b>	Lectures, personal assignment and seminars. Written examination. 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. WebCT course material, handouts and other specified reading.
<b>Ke3250120</b>	<b>MODULE B: FIBERLINE OPERATIONS</b> <b>6 ECTS cr</b>
<b>4th year</b>	<i>Selluloosatekniikka, Kuitulinja</i>
<b>Period 3 - 4</b>	
<b>Lecturer</b>	Professor, M.Sc. (Tech.) Kaj Henricson Lecturer N. N.
<b>Aims</b>	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 environmental aspects related to fiberline operations.
<b>Contents</b>	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. Environmental aspects in the manufacture of chemical pulp.
<b>Instruction</b>	Lectures, exercises and seminars 21 h, 3rd period. Lectures, exercises and seminars 21 h, 4th period. WebCT - support.
<b>Literature</b>	Lectures, personal assignment and seminars. Written examination. 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.

<b>Ke3320300</b>	<b>TRANSPORT PHENOMENA</b>	<b>3 ECTS cr</b>
<b>4th year</b>	<i>Kuljetusominaisuudet</i>	
<b>Period 2</b>	Professor, D.Sc. (Tech.) Matti Lindström	
<b>Lecturer</b>	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.	
<b>Aims</b>	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.	
<b>Contents</b>	Lectures and seminars 21 h, exercises 14 h, 2nd period.	
<b>Instruction</b>	Active participation in lectures and exercises. Final exam.	
<b>Literature</b>	Lindström, M., Transport Phenomena, Lecture Notes, LUT, 2001, Castellán, G.W., Physical Chemistry (3rd Ed.), Chapters 30 - 31.	
<b>Prerequisites</b>	Sa2810310 Fysiikka L(B), osa 1, Sa2810320 Fysiikka L(B), osa 2, Sa2810430 Fysiikan laboratoriotyöt (Ke, Ko) and Ke3310000 Epäorgaaninen kemia I (lectures attended).	
<b>Ke3320900</b>	<b>PROPERTIES OF GASES AND LIQUIDS</b>	<b>5 ECTS cr</b>
<b>4th year</b>	<i>Kaasujen ja nesteiden fysikaalis-kemiallisten ominaisuuksien arviointi</i>	
<b>Period 3 - 4</b>	<b>The course will be lectured 1st time during the academic year 2008 - 2009.</b>	
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Matti Lindström	
<b>Aims</b>	To be able to estimate physico-chemical properties of pure gases and liquids and their mixtures.	
<b>Contents</b>	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.	
<b>Instruction</b>	Lectures 21 h, exercises and seminars 14 h, 3rd and 4th period.	
<b>Literature</b>	Active participation in lectures and exercises. Final exam.	
<b>Prerequisites</b>	Poling, B. E., Prausnitz, J. M. And O'Connell, J. P., The Properties of Gases and Liquids, 5ht Ed., McGraw-Hill, Boston, 2001, Chapters 1-6. Ke3320100 Johdanto kemialliseen termodynamiikkaan and Ke3320200 Kemiallisten tasapainotilojen termodynamiikka passed.	
<b>Ke3330200</b>	<b>TEKNILLINEN KEMIA</b>	<b>10 ECTS cr</b>
<b>4. vuosi</b>	<i>Industrial Chemistry, Teknisk kemi</i>	
<b>Periodi 3 - 4</b>	<b>The lectures will be given in English and they are the same as in the course Ke3330800 Chemical Separation Methods.</b>	
<b>Opettaja</b>	Professori, TkT Erkki Paatero	
<b>Tavoitteet</b>	Yliassistentti, TkT Kimmo Klemola	
<b>Sisältö</b>	Syventää tietoja kemialla soveltavilta teollisuuden eri aloilta sekä kehittää opiskelijan teknistieteellistä suullista ja kirjallista esityskykyä.	
<b>Opetus</b>	Henkilökohtainen harjoitustyö, joka liittyy laboratorion tutkimukseen reaktiotekniikan tai erotustekniikan alalta. Osa harjoitustöistä on elintarviketekniikan piiristä. Luennot tukevat tutkimusaiheita.	
<b>Esitiedot</b>	Luentoja ja seminaareja 21 h, 3. periodi. Luentoja ja seminaareja 21 h, 4. periodi. Kirjallisuustyö ja seminaarit, opintoretkiä sekä laboratorioharjoitustöitä n. 165 h. Luennot ja seminaarit sekä hyväksytyt harjoitustyöt ja suullinen loppotentti. Ke3330000 Kemianteollisuuden prosessit Ke3330100 Kemiallinen reaktiotekniikka Ke3330300 Teknillisen kemian laboratoriotyöt	
<b>Ke3330400</b>	<b>CATALYSIS</b>	<b>4 ECTS cr</b>
<b>4th year</b>	<i>Katalyysi</i>	
<b>Period 1</b>	<b>The course will be lectured next time during the academic year 2006 - 2007.</b>	
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Erkki Paatero	
<b>Aims</b>	The course gives the theoretical basis for homogeneous and heterogeneous catalysts and how they work in chemical reactors.	
<b>Contents</b>	The focus during the course is on the structures, properties and applications of heterogeneous	

<b>Instruction</b>	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. Lectures and exercises 28 h, 1st period.
<b>Literature</b>	Homework and a written examination. Thomas, J.M. & Thomas, W.J., Principles and Practice of Heterogeneous Catalysis, John Wiley & Sons, 1997.
<b>Prerequisites</b>	Ke3330000 Kemianteollisuuden prosessit
<b>Ke3330700</b>	<b>INDUSTRIAL BIOTECHNOLOGY</b> <span style="float: right;"><b>2 ECTS cr</b></span>
<b>4th - 5th year</b>	<i>Teollinen biotekniikka, Industriell bioteknik</i>
<b>Period int.</b>	<b>Lectured every 1,5 year, next time autumn 2006.</b>
<b>Lecturer</b>	D.Sc. (Tech.) Heikki Ojamo
<b>Contents</b>	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.
<b>Instruction</b>	Lectures 14 h, in three intensive days. A written literature survey on a specific subject. Homework on calculations. Written examination.
<b>Literature</b>	Aittomäki, E., Eerikäinen, T., Leisola, M., Ojamo, H., Suominen, I., von Weymarn, N., BIOprosessiteknikka, WSOY 2002 (where applicable) Literature surveys.
<b>Prerequisites</b>	Ke3310300 Teknillisen biokemian perusteet
<b>Ke3330800</b>	<b>CHEMICAL SEPARATION METHODS</b> <span style="float: right;"><b>5-8 ECTS cr</b></span>
<b>4th year</b>	<i>Kemialliset erotusmenetelmät</i>
<b>Period 3 - 4</b>	<b>The lectures are included as a part in Ke3330200 Teknillinen kemia.</b>
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Erkki Paatero
<b>Aims</b>	The course gives the theoretical basis for chemically assisted separation methods.
<b>Contents</b>	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.
<b>Instruction</b>	Lectures and seminars 21 h, 3rd period. Lectures and seminars 14 h, 4th period. Oral examination. The students of International Master's Programme IPPE majoring in Separation Technology: the course also includes laboratory work approximately 100 h, the extent of the course will then be 8 ECTS.
<b>Prerequisites</b>	Ke3330000 Kemianteollisuuden prosessit
<b>Ke3330900</b>	<b>SEPARATION METHODS IN FOOD INDUSTRY</b> <span style="float: right;"><b>3 ECTS cr</b></span>
<b>4th year</b>	<i>Elintarviketeollisuuden erotusmenetelmät</i>
<b>Period 3 - 4</b>	<b>The course will be lectured 1st time during the academic year 2006 - 2007. The lectures are partly the same as in Ke3330800 Chemical Separation Methods and Ke3110600 Chemical Engineering Unit Operations III.</b>
<b>Lecturer</b>	Professor, D.Sc. (Tech.) Erkki Paatero
<b>Aims</b>	The course is tailored for students who want to specialize in food technology.
<b>Contents</b>	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.
<b>Instruction</b>	Lectures and seminars 21 h, 3rd period. Lectures and seminars 14 h, 4th period. Written examination.

<b>Ke3600000</b>	<b>LATEST DEVELOPMENTS IN CAPE</b>	<b>6 ECTS cr</b>
<b>5th year</b>	<i>Tietokoneavusteisen prosessitekniiikan nykysuuntaukset</i>	
<b>Period 1 - 2</b>	<b>The course will be lectured 1st time during the academic year 2006 - 2007.</b>	
<b>Lecturer</b>	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)	
<b>Contents</b>	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. 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.	
<b>Instruction</b>	Intensive course. Lectures 30 h, exercises 30 h, 1st and/or 2nd period. Individual assignments and project work. Written examination.	
<b>Literature</b>	Lecture notes, ICAS documentation.	
<b>Ke3600100</b>	<b>PRODUCTION PLANNING</b>	<b>4 ECTS cr</b>
<b>5th year</b>	<i>Tuotannonsuunnittelu</i>	
<b>Period 1 - 2</b>	<b>The course will be lectured 1st time during the academic year 2006 - 2007.</b>	
<b>Lecturer</b>	Professor (College of Industrial Engineering of Barcelona), Dr. Moisés Graells Professor, Ph.D. Andrzej Kraslawski (contact person)	
<b>Contents</b>	Types of production processes. Modelling and optimisation of batch processes. Batch process scheduling. Cycle time reduction and de-bottlenecking. Cost analysis and project economic evaluation.	
<b>Instruction</b>	Lectures 20 h, exercises 30 h, 1st and/or 2nd period. Individual assignments and exercises. Written examination.	
<b>Literature</b>	Lecture notes.	
<b>Ke3600200</b>	<b>DYNAMICS AND CONTROL OF CHEMICAL PROCESSES</b>	<b>4 ECTS cr</b>
<b>5th year</b>	<i>Kemiallisten prosessien dynamiikka ja säätö</i>	
<b>Period 1 - 2</b>	<b>The course will be lectured 1st time during the academic year 2006 - 2007.</b>	
<b>Lecturer</b>	Docent, D.Sc. (Tech.) Leif Hammarström Professor, Ph.D. Andrzej Kraslawski (contact person)	
<b>Contents</b>	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.	
<b>Instruction</b>	Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h, 2nd period. Project work. Written examination.	
<b>Literature</b>	To be specified later. Matlab-Simulink simulation environment, Process Control, System Identification and Fuzzy Control toolboxes, Mathworks 1984 - 2004.	

<b>Ke3600300</b>	<b>INDUSTRIAL TECHNOLOGIES</b>	<b>3 ECTS cr</b>
<b>4th year</b>	<i>Prosessiteknikkaa eri teollisuussektoreilla</i>	
<b>Period 1 - 2</b>		
<b>Lecturer</b>	Docent, D.Sc. (Tech.) Pekka Oinas D.Sc. (Tech.) Olli Hyvärinen Lic.Sc.(Tech.) Pekka Leppänen Professor, Ph.D. Andrzej Kraslawski (contact person)	
<b>Aims</b>	To make students familiar with specific methods and problems in different fields of process industry.	
<b>Contents</b>	Typical methods and approaches in the design of processes for fine chemical, metallurgical and pulp and paper industries.	
<b>Instruction</b>	Intensive course. Lectures 28 h, 1st and/or 2nd period. Excursions. Written examination.	
<b>Ke3600400</b>	<b>R&amp;D METHODOLOGY</b>	<b>3 ECTS cr</b>
<b>5th year</b>	<i>Prosessitutkimuksen ja -kehityksen menetelmät</i>	
<b>Period 2</b>		
<b>Lecturer</b>	Docent, D.Sc. (Tech.) Pekka Oinas Professor, Ph.D. Andrzej Kraslawski (contact person)	
<b>Aims</b>	To make students familiar with modern industrial methodology in process R&D.	
<b>Contents</b>	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.	
<b>Instruction</b>	Intensive course. Lectures 14 h, exercises 14 h, individual assignments, 2nd period. Written examination.	
<b>Ke3600500</b>	<b>PROCESS SIMULATION</b>	<b>6 ECTS cr</b>
<b>4th year</b>	<i>Prosessisimulointi</i>	
<b>Period 3 - 4</b>		
<b>Lecturer</b>	D.Sc. (Tech.) Kari Keskinen Ph.D. Sakari Kajaluoto Professor, Ph.D. Andrzej Kraslawski (contact person)	
<b>Aims</b>	To make students familiar with process simulation as a tool in development, design and operation in chemical and pulp and paper industry.	
<b>Contents</b>	Basics of process simulation. Steady-state and dynamic simulation. Introduction to ASPEN and BALAS-software. Examples of industrial simulation cases for process design.	
<b>Instruction</b>	Intensive course. Lectures 28 h, 3rd and/or 4th period. Simulation exercises as guided individual assignments. Written examination.	
<b>Prerequisites</b>	Ke3110300 Prosessisimuloinnin perusteet	
<b>Ke3600600</b>	<b>PROCESS CONTROL SYSTEMS IN PULP AND PAPER INDUSTRY</b>	<b>3 ECTS cr</b>
<b>5th year</b>	<i>Prosessiautomaatiojärjestelmät massa- ja paperiteollisuudessa</i>	
<b>Period 1 - 2</b>		
<b>Lecturer</b>	Lic.Sc.(Tech.) Merja Mäkelä Professor, Ph.D. Andrzej Kraslawski (contact person)	
<b>Contents</b>	Processes and instrumentation. Need of measurements, open loop and closed loop controls. 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 operations. System configuration, engineering and documentation. Single-input, single-output and multiple-input, multiple-output controls. 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. Automation maintenance and innovative development.	
<b>Instruction</b>	Lectures 16 h, 1st period. Lectures 12 h, 2nd period.	

<b>Literature</b>	Individual or team project work with supervision 12 h, 2nd period. Written examination. 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.
<b>Ke3600700</b>	<b>MOLECULAR MODELLING</b> <span style="float: right;"><b>4 ECTS cr</b></span>
<b>4th year</b>	<i>Molekyyli mallinnus</i>
<b>Period 4</b>	
<b>Lecturer</b>	Professor (University of Joensuu), Ph.D. Tapani Pakkanen Ph.D. Pipsa Hirva Professor, Ph.D. Andrzej Kraslawski (contact person)
<b>Contents</b>	The course gives an introduction to modern methods in molecular modelling. The theoretical foundation and the basis of modelling techniques will be reviewed. The main emphasis is in quantum chemical methods, but molecular dynamics and Monte-Carlo techniques will be discussed as well. The main goal of the course is to demonstrate the applicability of the modelling methods to practical chemical problems. Modelling demonstrations and modelling exercises are also included.
<b>Instruction</b>	Lectures 28 h, exercises 14 h, 4th period. Written examination.
<b>Ke3600800</b>	<b>RECYCLED FIBER TECHNOLOGY</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>5th year</b>	<i>Kierrätyskuituteknologia</i>
<b>Period 1 - 2</b>	<b>The course will be lectured 1st time during the academic year 2006 - 2007.</b>
<b>Lecturer</b>	Lic.Sc.(Tech.) Jukka Heimonen Ph.D. Jaana Sjöström Professor, Ph.D. Andrzej Kraslawski (contact person)
<b>Aims</b>	The aim of this course is to introduce the student with basic principles of recycled fiber (RCF) processing, both deinked pulp (DIP) for graphic papers and brown grades (OCC/MW) for packaging papers and boards.
<b>Contents</b>	The sources and properties of recycled fiber raw material will be studied. Basic principles of RCF equipment and process technologies including system performance evaluation will be reviewed. Also special features of RCF raw material compared to mechanical and chemical pulps will be discussed.
<b>Instruction</b>	Intensive course. Lectures and exercises 28 h, 1st and/or 2nd period. The course includes personal literature work and wrap-up session. Written examination.
<b>Ke3600900</b>	<b>CROSS-CULTURAL COMMUNICATION FOR WORKING LIFE</b> <span style="float: right;"><b>2 ECTS cr</b></span>
<b>4th year</b>	<i>Viestintä kansainvälisessä työyhteisössä</i>
<b>Period 3 - 4</b>	<b>Only for the students of International Master's Programme in Chemical Technology (IPPE).</b>
<b>Lecturer</b>	B.Sc. James Nimmo Professor, Ph.D. Andrzej Kraslawski (contact person)
<b>Aims</b>	To provide students knowledge about problems arising in industrial working environments due to ineffective communication.
<b>Contents</b>	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.
<b>Instruction</b>	Lectures 16 h, exercises 16 h, 3rd and/or 4th period. Active participation in lectures and exercises. Grading: Pass/Fail.

<b>Puu-21.211</b>	<b>INTRODUCTION TO PULP AND PAPER INDUSTRY</b>	<b>3 ECTS cr</b>
<b>4th year</b>	<i>Johdatus selluloosa- ja paperiteollisuuteen</i>	
<b>Period 3 - 4</b>	<b>The course is arranged by the Helsinki University of Technology.</b>	
<b>Lecturer</b>	Professor (HUT), D.Sc. (Tech.) Hannu Paulapuro Professor, Ph.D. Andrzej Kraslawski (contact person)	
<b>Contents</b>	The purpose is to give the students an overall view of the pulp and paper industry and its technological base. The course discusses raw materials used, the principles and main features of the unit processes of pulping and papermaking as well as the main end products.	
<b>Instruction</b>	Intensive course. Lectures 22 h, 3rd and/or 4th period. Written examination.	
<b>Literature</b>	Will be announced at the beginning of the course.	
<b>Puu-21.218</b>	<b>PAPER TECHNOLOGY</b>	<b>5 ECTS cr</b>
<b>4th year</b>	<i>Paperitekniikka</i>	
<b>Period 3 - 4</b>	<b>The course is arranged by the Helsinki University of Technology.</b>	
<b>Lecturer</b>	Professor (HUT), D.Sc. (Tech.) Hannu Paulapuro Professor, Ph.D. Andrzej Kraslawski (contact person)	
<b>Contents</b>	Mechanical pulping including screening, cleaning and reject refining. Beating of chemical pulp. Paper machine operations including approach flow system and short circulation. Stability of papermaking processes.	
<b>Instruction</b>	Intensive course. Lectures 45 h, 3rd and/or 4th period. Individual assignment. Written examination.	
<b>Literature</b>	Will be announced at the beginning of the course.	
<b>Puu-23.126</b>	<b>APPLIED CHEMICAL ENGINEERING AND UNIT OPERATIONS 6 ECTS cr IN PULP AND PAPER PROCESSES</b>	
<b>5th year</b>	<i>Sovellettu kemian laitetekniikka ja yksikköoperaatiot selluloosan ja paperin valmistuksessa</i>	
<b>Period 1 - 2</b>	<b>The course is arranged by the Helsinki University of Technology. The course will be lectured 1st time in autumn 2006.</b>	
<b>Lecturer</b>	D.Sc. (Tech.) Kari Kovasin Lecturer N. N. Professor, Ph.D. Andrzej Kraslawski (contact person)	
<b>Aims</b>	Give the understanding of the possibilities of the modelling and calculation methods of chemical engineering for the applications of pulp and paper processes. All the main fields of chemical engineering: fluid mechanics, heat transfer and mass transfer will be covered in order to familiarize the typical modelling and calculation tasks for pulp and paper processes. The focus will be put on the specific characteristics of chip, fiber and black liquor systems. From the process point of view, the focus will be in cooking, pulp mill fiberline, evaporation, paper machine wet end and web drying.	
<b>Contents</b>	Part I: Chemical engineering fundamentals Part II: Unit operations of cooking Part III: Unit operations of fiber processing Part IV: Unit operations of black liquor systems Part V: Specific unit operations of paper technology (Drying of the web)	
<b>Instruction</b>	Intensive course. Lectures 30 h, exercises 8 h, 1st and/or 2nd period. Homework assignments. Written examination.	
<b>Literature</b>	Written lecture material prepared for the course Gulichsen, J., Paulapuro, H. (eds), Papermaking Science and Technology, Fapet Oy, (2000) specified sections. Dence, C., Reeve, D. (eds), Pulp Bleaching - Principles and Practice, Tappi Press (1996) specified sections.	

## 7 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](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](mailto:ibtm@lut.fi)

### 7.1 Autumn Semester, 24.8. –16.12.2005

1<sup>st</sup> period/24.8. - 21.10.2005  
 2<sup>nd</sup> period/24.10. - 16.12.2005

#### Orientation Day, 24.8.2005

Course number	Course	ECTS cr
Ka6520350	Emerging Market Finance	4
Ka6610500	Management Consulting	6
Ka6610900	Cross-Cultural Management	6
Ka6619000	Organizational Culture and Gender Aspects in Management	5
Ka6620000	Basics of Dynamic Intellectual Capital	3
Ka6620050	Basics in 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
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
Ki7189900	Finnish Society and Culture	2

Subject to alterations

#### 7.1.1 Course descriptions for autumn 2005

<b>Ka6520350</b>	<b>EMERGING MARKET FINANCE</b>	<b>4 ECTS cr</b>
<b>Lecturer</b>	Dr. Mika Vaihekoski, Professor LUT/Department of Business Administration	
<b>Aims</b>	The aim of the course is to introduce different emerging markets and their special characteristics as well as to deepen student's knowledge of the special corporate finance and asset pricing issues related to emerging markets.	
<b>Contents</b>	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.	

<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level
<b>Instruction</b>	14 hours of lectures in English. Visiting speakers.
<b>Prerequisites</b>	Basic studies in Finance required.
<b>Assessment</b>	A written essay. A written examination.
<b>Literature</b>	1. Reading package 2. Handouts in the class and all additional material required by the lecturer.
<b>Study period</b>	2 <sup>nd</sup> period, 2005

<b>Ka6610500</b>	<b>MANAGEMENT CONSULTING</b>	<b>6 ECTS cr</b>
<b>Lecturer</b>	Dr. Janne Tienari, Professor Dr. Olli Kuivalainen, Senior Lecturer Dr. Sami Saarenketo, Professor LUT/Department of Business Administration	
<b>Aims</b>	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, 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.	
<b>Contents</b>	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.	
<b>Status</b>	Course for 3 <sup>rd</sup> year students at the Bachelor level	
<b>Instruction</b>	The course requires active participation in all sessions. Thematic course sessions 7 x 3 hours (including exam). Group work (written report and oral presentation).	
<b>Prerequisites</b>	Basic knowledge of management and organization studies	
<b>Assessment</b>	A written examination 70 % and group work 30 %	
<b>Literature</b>	A selected set of articles is compiled for course reading, which will be available for purchase at Digipaino (details are announced later).	
<b>Study period</b>	2 <sup>nd</sup> period, 2005	

<b>Ka6610900</b>	<b>CROSS-CULTURAL MANAGEMENT</b>	<b>6 ECTS cr</b>
<b>Lecturer</b>	Dr. Janne Tienari, Professor LUT/Department of Business Administration	
<b>Aims</b>	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.	
<b>Contents</b>	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.	
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level	
<b>Instruction</b>	Intensive course (sessions 1-6 held October 17-21, 2005; exam October 26, which requires active participation in all sessions. Thematic course sessions 6 x 4 hours (including exam). Group work (written report and oral presentation). Registration: Information about registering for the course will be made available in early September 2005. The course group is restricted to 30 students.	
<b>Prerequisites</b>	Basic knowledge of management and organization studies is required.	
<b>Assessment</b>	A written examination 70 % and group work 30 %	
<b>Literature</b>	Søderberg, Anne-Marie and Vaara, Eero (Editors): Merging Across Borders: People, Cultures and Politics. Copenhagen: Copenhagen Business School Press, 2003.	
<b>Study period</b>	1 <sup>st</sup> period, 2005	

<b>Ka6619000</b>	<b>ORGANIZATIONAL CULTURE AND GENDER ASPECTS IN MANAGEMENT</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	D.Sc. (Econ.) Albert J. Mills, Professor, Saint Mary's University, Halifax D.Sc. (Econ.) Iiris Aaltio, Professor LUT/Department of Business Administration	
<b>Aims</b>	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.	
<b>Contents</b>	<ol style="list-style-type: none"> <li>1. Understanding organizational culture. Its definition, discussion and methods of analysis.</li> <li>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.</li> <li>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.</li> <li>4. Equality practices in Finland.</li> <li>5. Managing gender at work - issues and debates.</li> </ol>	
<b>Status</b>	Course at the Master level	
<b>Instruction</b>	24 hours of lectures, case exercises and group work in English. An important element of the course will involve small groups of 3-4 students analyzing and discussing assigned cases.	
<b>Prerequisites</b>	Basic courses in Human Resource Management advisable	
<b>Assessment</b>	Active class participation and group reports	
<b>Literature</b>	Articles, book chapters and cases to be specified by the lecturers and read before the course	
<b>Study period</b>	2 <sup>nd</sup> period, 2005	

<b>Ka6620000</b>	<b>BASICS OF DYNAMIC INTELLECTUAL CAPITAL</b>	<b>3 ECTS cr</b>
<b>Lecturer</b>	Dr. Mauri Grönroos, Docent Research Assistant Elina Hyrkäs LUT/Department of Business Administration	
<b>Aims</b>	To gain a basic understanding and the key elements of Knowledge Management and the related functional principles and supporting tools.	
<b>Contents</b>	The course has two major theoretical bases: first, The New Theory of Growth that shows how the role of new ideas and innovations has become an even more crucial factor of competition than the traditional means, capital and labour. Another theoretical base for the course is the systemic view on organizations. The course will show how organizations' systemic efficiency can vary according to its strategy and business environment. The challenges for Knowledge Management from these perspectives will be identified and discussed during the course.	
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level	
<b>Instruction</b>	The reading, active participation, assignments and tests are conducted virtually.	
<b>Assessment</b>	Within each part the assessment is conducted as follows: Course evaluation: 50% of the final grade, based primarily on the Exam, active participation to the course discussions is also required.	
<b>Literature</b>	Web materials in WebCT course: Virtual Introduction to Knowledge Management Stähle, P. - Grönroos, M. Dynamic Intellectual Capital, Knowledge Management in Theory and Practice. WSOY, Porvoo, Helsinki, Juva 2000, 2001	
<b>Study period</b>	1 <sup>st</sup> period, 2005	

<b>Ka6620050</b>	<b>BASICS IN KNOWLEDGE MANAGEMENT</b>	<b>4 ECTS cr</b>
<b>Lecturer</b>	Dr. Jianzhong Hong, Senior Lecturer Research Assistant Elina Hyrkäs LUT/Department of Business Administration	
<b>Aims</b>	To gain an overall view of knowledge management, to understand key elements of knowledge management and the related functional principles and tools.	
<b>Contents</b>	The focus will be on systemic view of organizational knowledge and its creation, process and development. The course consists of two parts: 1) knowledge management overview, including basic KM concepts, perspectives, and enabling tools; and 2) specific KM approaches and	

<b>Status</b>	models and their applications in organizations (e.g., Stähle's self-renewal systems approach; Nonaka and Takeuchi's knowledge creating company; and Engeström's expansive learning model).
<b>Instruction</b>	Course for 4 <sup>th</sup> year students at the Master level
<b>Assessment</b>	Form: intensive lecture + virtual study and exercises.
<b>Literature</b>	Active participation (20%), short essay and peer evaluation (40%), and tutor-marked term paper (40%).
<b>Literature</b>	1. Stähle, P. - Grönroos, M.: Chapters from Dynamic Intellectual Capital, Knowledge Management in Theory and Practice. WSOY, Porvoo, Helsinki, Juva 2000. 2. Nonaka, I. - Takeuchi, H.: Chapters from Knowledge-Creating Company: How Japanese Companies Create the Dynamics on Innovation, Oxford University Press, 1995. 3. Ahonen, H., Engeström, Y. & Virkkunen J.: Knowledge Management - The second generation: Creating competencies within and between work communities in competence laboratory, 282 - 305, In y. Malhotra (Ed.), Knowledge Management and Virtual Organizations. Idea Group Publishing, 2000.
<b>Study period</b>	2 <sup>nd</sup> period, 2005

<b>Ka6620450</b>	<b>FOUNDATIONS OF KNOWLEDGE MANAGEMENT AND ORGANIZATION</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	Dr. Jianzhong Hong, Senior Lecturer LUT/Department of Business Administration	
<b>Aims</b>	To explore the fundamental theories and concepts surrounding knowledge management and organization, and to facilitate an overview of knowledge management in modern organizations.	
<b>Contents</b>	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.	
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level	
<b>Instruction</b>	Orientation lecture at the beginning of the study + Independent study of assigned literature. There will be a question and answer session before the exam.	
<b>Assessment</b>	A written examination	
<b>Literature</b>	1. Morgan, Gareth (1997). Image of Organization. Sage Publications. 2. More reading materials to be announced on the course web page	
<b>Study period</b>	2 <sup>nd</sup> period, 2005	

<b>Ka6620500</b>	<b>ACTIVITY THEORETICAL APPROACH TO KNOWLEDGE CREATION AND INNOVATION</b>	<b>4 ECTS cr</b>
<b>Lecturer</b>	Dr. Jianzhong Hong, Senior Lecturer LUT/Department of Business Administration Guest lectures	
<b>Aims</b>	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.	
<b>Contents</b>	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.	
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level	
<b>Instruction</b>	Intensive lectures + student individual project.	
<b>Assessment</b>	An individual project	
<b>Literature</b>	Selected articles and book chapters (to be announced on the course web page)	
<b>Study period</b>	2 <sup>nd</sup> period, 2005	

<b>Ka6720050</b>	<b>CROSS-CULTURAL MARKETING STRATEGIES</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	Dr. Liisa-Maija Sainio, Lecturer LUT/Department of Business Administration	
<b>Aims</b>	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.	

<b>Contents</b>	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.
<b>Status</b>	Course for 2 <sup>nd</sup> year students at the Bachelor level
<b>Instruction</b>	10 hours of lectures
<b>Prerequisites</b>	Basic knowledge of international marketing
<b>Assessment</b>	Group assignments, oral group exam. Individual term paper.
<b>Literature</b>	Usunier, Jean-Claude: Marketing Across Cultures, 3rd Edition, Prentice-Hall, 2000. Other material distributed during the course
<b>Study period</b>	2 <sup>nd</sup> period, 2005

<b>Ka6720400</b>	<b>RESEARCH IN MARKETING SEMINAR COURSE</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	Dr. Sanna-Katriina Asikainen, Professor LUT/Department of Business Administration	
<b>Aims</b>	To familiarize the students with the scientific writing (writing process, finding and analyzing the quality of references, scientific critique). To provide the students with knowledge and skills to formulate, analyze and critically evaluate scientific research. To familiarize students with marketing classics (theories and research).	
<b>Contents</b>	Both the latest developments and thinking and the classics in international marketing management strategies, e.g. buyer behavior, competitive advantages, innovation management, e-business strategies, business models, internationalization.	
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level	
<b>Instruction</b>	08 hours of lectures in the 1 <sup>st</sup> period. 16 hours of seminar working in the 2 <sup>nd</sup> period. Assigned reading. All instruction will be in English. The number of students attending the course may have to be limited based on pre-exam if the number of students exceeds 30.	
<b>Prerequisites</b>	Basic knowledge of international marketing	
<b>Assessment</b>	Pre-exam. Active participation, analyzing and preparing for assignments, written report.	
<b>Literature</b>	Material distributed in the class.	
<b>Study period</b>	1 <sup>st</sup> -2 <sup>nd</sup> periods, 2005	

<b>Ka6720600</b>	<b>INTERNATIONAL DISTRIBUTION STRATEGIES</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	Dr. Mika Gabrielsson, Docent Dr. Olli Kuivalainen, Senior Lecturer LUT/Department of Business Administration	
<b>Aims</b>	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.	
<b>Contents</b>	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.	
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level	
<b>Instruction</b>	12 hours of lectures as intensive teaching and 4 hours of exercises (see the course web page for further information).	
<b>Prerequisites</b>	Basic understanding of international marketing.	
<b>Assessment</b>	A written examination. Oral and written project work.	
<b>Literature</b>	To be announced on the course web page.	
<b>Study period</b>	2 <sup>nd</sup> period, 2005	

<b>Ka6729000</b>	<b>INTRODUCTION TO INTERNATIONAL BUSINESS AND PLANNING</b>	<b>3 ECTS cr</b>
<b>Lecturer</b>	Dr. Toivo S. Äijö Top Trainers Group	

<b>Aims</b>	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.
<b>Contents</b>	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.
<b>Status</b>	Course for 2 <sup>nd</sup> - 3 <sup>rd</sup> year students at the Bachelor level
<b>Instruction</b>	25 hours of lectures and case exercises in English
<b>Prerequisites</b>	Basic course in marketing
<b>Assessment</b>	Case studies and a written examination
<b>Literature</b>	1. James Taggart – Michael McDermott: The Essence of International Business, Prentice-Hall 1993 2. Other material will be announced during lectures
<b>Study period</b>	1 <sup>st</sup> period, 2005

<b>Tu6100300</b>	<b>BUSINESS FORECASTING</b>	<b>4 ECTS cr</b>
<b>Lecturer</b>	Professor Seppo Pitkänen LUT/Department of Industrial Engineering and Management	
<b>Contents</b>	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. Skills: Ability to predict by conventional quantitative methods, and knowing the possibilities of the other approaches.	
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level	
<b>Instruction</b>	28 hours of lectures and 14 hours of exercises in English. Independent work 70 hours.	
<b>Prerequisites</b>	Basic skills in statistics (hypothesis testing, etc.), matrix algebra and elementary differential calculus. Recommended: A course dealing with economic/business decision making, or marketing research.	
<b>Assessment</b>	A written examination 80-100 %, exercise report 0-20 %.	
<b>Literature</b>	Will be distributed to the participants.	
<b>Study period</b>	1 <sup>st</sup> period, 2005	

<b>Tu6100550</b>	<b>INTERNATIONAL BUSINESS METHODS</b>	<b>7 ECTS cr</b>
<b>Lecturer</b>	Dr. Tauno Tiusanen, Professor Assistant Jatta Kinnunen LUT/Department of Industrial Engineering and Management	
<b>Contents</b>	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. Skills: Students know the advantages and disadvantages of different entry modes, and are able to evaluate risks and opportunities in the global markets.	
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level	
<b>Instruction</b>	42 hours of lectures and 28 hours of practical exercises in English. Independent work 74 hours.	
<b>Prerequisites</b>	Introduction to International Business	
<b>Assessment</b>	A written examination 50 %, exercises 25 %, research report 25 %.	
<b>Literature</b>	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.	
<b>Study period</b>	1 <sup>st</sup> -2 <sup>nd</sup> periods, 2005	

<b>Tu6100800</b>	<b>THE BASICS OF DOING BUSINESS IN RUSSIA</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	Professor Juha Väättänen LUT/Department of Industrial Engineering and Management	
<b>Contents</b>	Must know: transition of Russian society and business environment. Should know: competitive advantages, industrial sectors and foreign direct investments. Russian business culture. Nice to know: Russia's economic and political integration with the world economy. Skills: to understand the special characteristics of Russian economy and society.	
<b>Status</b>	Course for 3 <sup>rd</sup> year students at the Bachelor level	
<b>Instruction</b>	38 hours of lectures, presentations 10 hours, seminar work 40 hours, independent work 45 hours.	
<b>Prerequisites</b>	No prerequisites	
<b>Assessment</b>	A written examination 60 %, seminar work 30 %, presentations 10 %.	
<b>Literature</b>	Will be announced on lectures	
<b>Study period</b>	2 <sup>nd</sup> period, 2005	

<b>Tu6107000</b>	<b>THE ECONOMIES OF THE BALTIC STATES</b>	<b>3 ECTS cr</b>
<b>Lecturer</b>	Dr. Alari Purju, Professor Tallinn University of Technology	
<b>Aims</b>	To familiarize the students with the Baltic economies including historical background, present characteristics and future trends.	
<b>Contents</b>	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?	
<b>Status</b>	Course at the Master level	
<b>Instruction</b>	20 hours of lectures and case studies in English	
<b>Prerequisites</b>	Basic courses in international economy and marketing	
<b>Assessment</b>	Active class participation, group case studies and an essay	
<b>Literature</b>	1. Sutela, P.: "Managing Capital Flows in Estonia and Latvia", BOFIT Working Paper No. 17, 2001, 65 p. 2. Purju, A.: "Trade Reform and Trade Policy in Estonia and the other Baltic States", in (editors Barry Lesser and Ivan Razputenko) <i>Economic Issues. Theory and Application with Reference to Ukraine</i> . Canada-Ukraine-Baltic Economic Management Training Program, Halifax: Dalhousie University, 2002, pp. 95-126. 3. Articles from the Baltic Review, Vol. 23, 24, 2003, 2004. 4. Case studies of enterprises.	
<b>Study period</b>	2 <sup>nd</sup> period, 2005	

<b>Tu6307000</b>	<b>TECHNOLOGY MANAGEMENT IN JAPAN</b>	<b>3 ECTS cr</b>
<b>Lecturer</b>	Dr. Takaya Ichimura, Professor Nihon University, Tokyo	
<b>Aims</b>	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.	
<b>Contents</b>	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	

	<ul style="list-style-type: none"> <li>- causes of development of Japanese industry</li> <li>- an overview of technology management in Japan</li> <li>- the role of technology and its management in Japanese industry</li> <li>- new dilemma of Japanese industry</li> </ul> <p>5. Aspects of technology management</p> <ul style="list-style-type: none"> <li>- R &amp; D management</li> <li>- new product development and product improvement</li> <li>- management technology and its application</li> <li>- computer technology and industrial technology</li> <li>- production management and technology management</li> </ul> <p>6. Future problem on technology management</p>
<b>Status</b>	Course at the Master level
<b>Instruction</b>	16 hours of lectures and class discussions in English
<b>Prerequisites</b>	Basic knowledge of management
<b>Assessment</b>	Active participation in classes and a written assignment
<b>Literature</b>	Written material will be distributed during lectures
<b>Study period</b>	1 <sup>st</sup> period, 2005

<b>Tu6307050</b>	<b>TECHNOLOGY, VALUES AND SOCIETY</b>	<b>3 ECTS cr</b>
<b>Lecturer</b>	Dr. Jorma Heinonen, Professor Concordia International University Estonia	
<b>Aims</b>	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.	
<b>Contents</b>	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	
<b>Status</b>	Course at the Master level	
<b>Instruction</b>	20 hours of lectures, case exercises and reporting in English	
<b>Prerequisites</b>	Basic knowledge in international business or marketing	
<b>Assessment</b>	Active class participation, individual assignments and a written examination	
<b>Literature</b>	Written material will be distributed during lectures	
<b>Study period</b>	1 <sup>st</sup> period, 2005	

<b>Tu6307100</b>	<b>MANAGEMENT OF TECHNOLOGY</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	Dr. Tuomo Kässi, Professor LUT/Department of Industrial Engineering and Management	
<b>Aims</b>	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.	
<b>Contents</b>	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	
<b>Status</b>	Course at the Master level	
<b>Instruction</b>	28 hours of lectures in English	
<b>Prerequisites</b>	Basic knowledge of strategic planning	
<b>Assessment</b>	Classes, assignments and a written examination	
<b>Literature</b>	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	
<b>Study period</b>	1 <sup>st</sup> -2 <sup>nd</sup> period, 2005	

## 7.2 Spring Semester, 4.1. – 12.5.2006

3<sup>rd</sup> period/4.1. – 3.3.2006

4<sup>th</sup> period/6.6. – 12.5.2006

### Orientation Day, 4.1.2006

Course number	Course	ECTS cr
Ka6620300	Organizational Learning and Competence Management	6
Ka6639000	Small and Medium Size Enterprise Management and Business Development	3
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	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
Ki7189900	Finnish Society and Culture	2

Subject to alterations

### 7.2.1 Course descriptions for spring 2006

<b>Ka6620300</b>	<b>ORGANIZATIONAL LEARNING AND COMPETENCE MANAGEMENT</b>	<b>6 ECTS cr</b>
<b>Lecturer</b>	Dr. Jianzhong Hong, Senior Lecturer Researcher Juha Levy Research Assistant Elina Hyrkäs LUT/Department of Business Administration	
<b>Aims</b>	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.	
<b>Contents</b>	The course consists of three parts of virtual participation and interaction: 1) intensive reading of the course materials presented on the web and required journal articles and book chapters; 2) case analysis and written report by group; and 3) case presentation and discussion in the virtual discussion forum. The case analysis is supposed to be accomplished with the guide of the problem-based learning method.	
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level	
<b>Instruction</b>	Reading summaries, online exam, group assignment and discussion through WebCT. There will be an info-meeting at the beginning of the course, and a guiding session before the start of the group work.	
<b>Assessment</b>	Virtual exercises and online examination.	
<b>Literature</b>	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	
<b>Study period</b>	4 <sup>th</sup> period, 2006	
<b>Ka6639000</b>	<b>SMALL AND MEDIUM SIZE ENTERPRISE MANAGEMENT AND BUSINESS DEVELOPMENT</b>	<b>3 ECTS cr</b>
<b>Lecturer</b>	Dr. Timo Pihkala, Professor LUT/Department of Business Administration	

<b>Aims</b>	To provide students with a multi-perspective of concepts, frameworks, and models for understanding and analysing growth situations in SMEs.
<b>Contents</b>	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.
<b>Status</b>	Course at the Master level
<b>Instruction</b>	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.
<b>Prerequisites</b>	Basic knowledge of management
<b>Assessment</b>	Classes, case studies and an essay
<b>Literature</b>	Compendium of articles and cases
<b>Study period</b>	4 <sup>th</sup> period, 2006

<b>Ka6720100</b>	<b>INTEGRATED MARKETING COMMUNICATION</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	Dr. Liisa-Maija Sainio, Lecturer LUT/Department of Business Administration	
<b>Aims</b>	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.	
<b>Contents</b>	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. International marketing communication. (The course is focused especially in mass-communication, because there is a separate course available in personal selling and sales management.)	
<b>Status</b>	Course for 3 <sup>rd</sup> year students at the Bachelor level	
<b>Instruction</b>	28 hours of lectures and 14 hours of practical exercises	
<b>Prerequisites</b>	Basic knowledge of marketing and international marketing	
<b>Assessment</b>	Active class participation, oral and written reports and a written examination	
<b>Literature</b>	1. Percy, Rossiter & Elliott (2001): Strategic Advertising Management, Oxford University Press 2. Assigned reading	
<b>Study period</b>	4 <sup>th</sup> period, 2006	

<b>Ka6720150</b>	<b>INTERNATIONALIZATION OF THE FIRM</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	Dr. Sami Saarenketo, Professor LUT/Department of Business Administration	
<b>Aims</b>	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.	
<b>Contents</b>	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.	
<b>Status</b>	Course for 3 <sup>rd</sup> year students at the Bachelor level	
<b>Instruction</b>	21 hours of lectures and 14 hours of practical exercises	
<b>Prerequisites</b>	Basic knowledge of international marketing	
<b>Assessment</b>	Active class participation, oral and written project reports. A written final examination.	
<b>Literature</b>	1. Hollensen, S.: Global Marketing – A Market Responsive Approach, 2001. 2. Assigned reading.	
<b>Study period</b>	3 <sup>rd</sup> period, 2006	

<b>Ka6720200</b>	<b>SALES MANAGEMENT AND PERSONAL SELLING</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	Research Assistant Anssi Tarkiainen LUT/Department of Business Administration	
<b>Aims</b>	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.	
<b>Contents</b>	Special characteristics of business-to-business, industrial and organizational selling. Fundamentals of personal selling, negotiations and sales management.	
<b>Status</b>	Course for 3 <sup>rd</sup> year students at the Bachelor level	
<b>Instruction</b>	24 hours of lectures in 3 <sup>rd</sup> period. 14 hours of exercises in 4 <sup>th</sup> period.	
<b>Prerequisites</b>	Basic knowledge of marketing	
<b>Assessment</b>	Active participation on the course. Term paper. A written final exam.	
<b>Literature</b>	1. Donaldson, Bill (1998): Sales Management: Theory and Practice. 2nd edition. MacMillan Press Ltd, London. 2. Allen, Peter & Wootten, Geoffrey: Selling, 5th ed., Prentice Hall, 1998. 3. An article package	
<b>Study period</b>	3 <sup>rd</sup> -4 <sup>th</sup> periods, 2006	
<b>Ka6720350</b>	<b>CORPORATE SOCIAL RESPONSIBILITY</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	M.Sc. (Econ.) Riikka Lammi	
<b>Aims</b>	To familiarise 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.	
<b>Contents</b>	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.	
<b>Status</b>	Course for 2 <sup>nd</sup> year students at the Bachelor level	
<b>Instruction</b>	15 hours of lectures, intensive teaching (3 <sup>rd</sup> period) Group assignments (4 <sup>th</sup> period) WebCT assignments (4 <sup>th</sup> period)	
<b>Prerequisites</b>	Basic knowledge of international marketing	
<b>Assessment</b>	Assignments and a written examination	
<b>Literature</b>	Grayson & Hodges (2002), Everybody's business - Managing risks and opportunities in today's global society Klein (2000), No Logo - Taking Aim at the Brand Bullies Other material distributed during the course	
<b>Study period</b>	3 <sup>rd</sup> -4 <sup>th</sup> periods, 2006	
<b>Ka6720450</b>	<b>HIGH TECHNOLOGY MARKETING</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	Dr. Sanna-Katriina Asikainen, Professor LUT/Department of Business Administration	
<b>Aims</b>	To provide a deep understanding of the functions of marketing regarding challenges and opportunities in high tech products and markets. To assist the participants to understand the virtue and limitations of traditional marketing thinking and tools in emergent, high-tech markets.	
<b>Contents</b>	Updated insights regarding challenges and opportunities in high-tech markets. The concepts of technology and "high-tech". Innovation and new products in high-tech markets. New information technologies and marketing. Coping with uncertainty. Diffusion of innovations.	
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level	
<b>Instruction</b>	28 h of interactive lectures. All instruction will be in English. The number of students attending the course may have to be limited based on pre-exam if the number of students exceeds 30. Obligatory course in International Marketing advanced studies.	
<b>Prerequisites</b>	090286000 Intermediate International Marketing or Ka6720150 Internationalization of the Firm.	
<b>Assessment</b>	Active participation. In-class assignments. A written examination.	
<b>Literature</b>	Will be announced later.	
<b>Study period</b>	4 <sup>th</sup> period, 2006	

<b>Ka6720500</b>	<b>INTERNATIONAL ENTREPRENEURSHIP</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	Dr. Sami Saarenketo, Professor Dr. Olli Kuivalainen, Senior Lecturer LUT/Department of Business Administration	
<b>Aims</b>	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.	
<b>Contents</b>	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.	
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level	
<b>Instruction</b>	9 hours of lectures including guest entrepreneurs as lecturers. 12 hours of field project presentations. Group tutorials	
<b>Prerequisites</b>	Basic understanding of international business. Entrepreneurship studies are recommended. Preliminary exam if there are more than 30 students applying for the course (see the course web page for further information).	
<b>Assessment</b>	Active class and tutorial participation (part of the grade). Field project. A written examination.	
<b>Literature</b>	To be announced on the course web page	
<b>Study period</b>	3 <sup>rd</sup> -4 <sup>th</sup> periods, 2006	

<b>Ka6729100</b>	<b>CROSS-CULTURAL ENCOUNTERS</b>	<b>3 ECTS cr</b>
<b>Lecturer</b>	M.A. Sini Konivuori, Programme Coordinator University of Jyväskylä/Department of Communication	
<b>Aims</b>	The purpose of the course is to develop students' abilities to understand and appreciate cultural differences both in business and private life.	
<b>Contents</b>	Cultures and communication, verbal and nonverbal communication, national stereotypes, intercultural sensitivity, cross-cultural interaction, culture shock, adaptation, intercultural effectiveness, cultures and organisations, expatriate assignments.	
<b>Status</b>	Course for 2 <sup>nd</sup> year students at the Bachelor level	
<b>Instruction</b>	24 hours of lectures and case exercises in English	
<b>Prerequisites</b>	Active participation and 80 % attendance	
<b>Assessment</b>	Assessment based on activity, exercises, a completed lecture diary and an essay	
<b>Literature</b>	Reading material for the course provided by the lecturer	
<b>Study period</b>	3 <sup>rd</sup> period, 2006	

<b>Tu6100050</b>	<b>INTRODUCTION TO INTERNATIONAL BUSINESS</b>	<b>4 ECTS cr</b>
<b>Lecturer</b>	Dr. Tauno Tiusanen, Professor LUT/Department of Industrial Engineering and Management	
<b>Contents</b>	Must know: basic definitions and features of international business will be introduced. Attention will be paid to foreign trade theories and alternatives in export business. Balance of payments on current account will be overviewed. Should know: different trade policy alternatives are overviewed. Currency issues, especially exchange rates will be discussed. Evaluation of export markets and communicating across cultures. Skills: Students have the basic knowledge of international business.	
<b>Status</b>	Course for 2 <sup>nd</sup> year students at the Bachelor level	
<b>Instruction</b>	21 hours of lectures. Independent work 84 hours.	
<b>Assessment</b>	A written examination	
<b>Literature</b>	Lecture handouts. Root, Franklin: Entry Strategies: for International Markets. 1994. Three first chapters.	
<b>Study period</b>	4 <sup>th</sup> period, 2006	

<b>Tu6100500</b>	<b>CONSUMER BEHAVIOR</b>	<b>4 ECTS cr</b>
<b>Lecturer</b>	Professor Seppo Pitkänen LUT/Department of Industrial Engineering and Management	
<b>Contents</b>	Must know: Consumption and buying behavior explained by economical, psychological and sociological factors at the individual, as well as organizational level.	

<b>Status</b>	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. Skills: Basic skills to understand consumption and buying decisions.
<b>Instruction</b>	Course for 3 <sup>rd</sup> year students at the Bachelor level
<b>Prerequisites</b>	28 hours of lectures. Independent work 84 hours.
<b>Assessment</b>	Basic knowledge of international business
<b>Literature</b>	A written examination
<b>Study period</b>	Solomon, Michael R. & Bamossy, Gary & Askegaard, Søren: Consumer Behaviour - A European Perspective. Prentice Hall Europe, 1999.
	3 <sup>rd</sup> period, 2006

<b>Tu6100600</b>	<b>DOING BUSINESS IN TRANSITIONAL ECONOMIES</b>	<b>7 ECTS cr</b>
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<b>Lecturer</b>	Dr Tauno Tiusanen, Professor Assistant Jatta Kinnunen LUT/Department of Industrial Engineering and Management
<b>Contents</b>	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. Skills: Students are able to evaluate the emerging markets and choose the right modes of operations in TEs.
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level
<b>Instruction</b>	42 hours of lectures and 14 hours of exercises in 3 <sup>rd</sup> period. 14 hours exercises in 4 <sup>th</sup> period. Independent work 76 hours.
<b>Prerequisites</b>	International Business Methods
<b>Assessment</b>	A written examination 50 %, exercises 25 %, research report 25 %
<b>Literature</b>	Lecture handouts. 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.
<b>Study period</b>	3 <sup>rd</sup> - 4 <sup>th</sup> periods, 2006

<b>Tu6100750</b>	<b>ENTERPRISES AND COMPETITION IN RUSSIA</b>	<b>5 ECTS cr</b>
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<b>Lecturer</b>	Professor Juha Väättänen LUT/Department of Industrial Engineering and Management
<b>Contents</b>	Must know: Russian enterprise structures, emergence of new enterprises, natural resources and consumer markets. Should know: deregulation of the economy, foreign direct investments. Nice to know: government regulations and licensing. Skills: to understand Russian business environment, enterprise structures and competition on Russian markets.
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level
<b>Instruction</b>	38 hours of lectures, presentations 20 hours, seminar work 40 hours, independent work 35 hours.
<b>Prerequisites</b>	The Basics of Doing Business in Russia, not required from foreign exchange students.
<b>Assessment</b>	A written examination 60 %, seminar work 30 %, presentations 10 %.
<b>Literature</b>	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. Lappeenranta University of Technology 2005.
<b>Study period</b>	3 <sup>rd</sup> period, 2006

<b>Tu6100850</b>	<b>TRANSITIONAL COUNTRIES INTEGRATION WITH THE EUROPEAN UNION - TRADE, MANUFACTURING AND LABOUR PERSPECTIVE</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	Professor Juha Väättänen LUT/Department of Industrial Engineering and Management	
<b>Contents</b>	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. Skills: to understand the process of European Union enlargement and its influence on the competitiveness of EU.	
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level	
<b>Instruction</b>	38 hours of lectures, presentations 20 h, seminar work 40 hours, independent work 35 hours.	
<b>Prerequisites</b>	No prerequisites	
<b>Assessment</b>	A written examination 60 %, seminar work 30 %, presentations 10 %.	
<b>Literature</b>	Literature will be announced on lectures.	
<b>Study period</b>	4 <sup>th</sup> period, 2006	

<b>Tu6107050</b>	<b>BUSINESS ENVIRONMENT IN TRANSITIONAL ECONOMIES</b>	<b>4 ECTS cr</b>
<b>Lecturer</b>	Dr. Tauno Tiusanen, Professor LUT/Department of Industrial Engineering and Management	
<b>Aims</b>	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.	
<b>Contents</b>	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.	
<b>Status</b>	Course at the Master level	
<b>Instruction</b>	28 hours of lectures in English	
<b>Prerequisites</b>	Good command in English and in business methods	
<b>Assessment</b>	Active class participation and successful participation on case exercise	
<b>Literature</b>	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	
<b>Study period</b>	4 <sup>th</sup> period, 2006	

### 7.2.2 Courses offered in the autumn and spring semesters

<b>Ki7189900</b>	<b>FINNISH SOCIETY AND CULTURE</b>	<b>2 ECTS cr</b>
<b>Lecturer</b>	Dr. Kalle Michelsen, Professor (Finnish History, Political Culture, Social and Economic System) M.A. Kristiina Korjonen-Kuusipuro, Reseacher (Finnish Culture)	
<b>Aims</b>	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).	
<b>Instruction</b>	24 h lectures in English. The course is divided in three parts: A) Finnish history (8 lectures) B) Finnish political culture, social and economic systems (8 lectures) C) Finnish culture (8 lectures)	
<b>Assessment</b>	Participation 60%, final report or presentation 40%.	
<b>Study period</b>	1 <sup>st</sup> -2 <sup>nd</sup> period, 2005 and 3 <sup>rd</sup> -4 <sup>th</sup> period, 2006	

## LITERATURE EXAMS - Independent study of assigned literature

<b>Tu6100650</b>	<b>THE TRANSFORMATION OF THE BUSINESS MANAGEMENT IN RUSSIA</b>	<b>5 ECTS cr</b>
<b>Lecturer</b>	Professor Juha Väättänen LUT/Department of Industrial Engineering and Management	
<b>Contents</b>	Must know: organisational and managerial transformation in Russia. Should know: decision making in Russia, cultural characteristics. Transition 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. Skills: to know the key phases of the transformation of the business management in Russia.	
<b>Status</b>	Course for 4 <sup>th</sup> year students at the Master level	
<b>Instruction</b>	Independent work 132 hours.	
<b>Prerequisites</b>	Basics of Doing Business in Russia	
<b>Assessment</b>	A written examination	
<b>Literature</b>	<ol style="list-style-type: none"> <li>Holden, Nigel - Cooper, Gary - Carr, Jennifer: Dealing with the New Russia, Management Cultures in Collision. John Wiley &amp; Sons, Chichester, 1998.</li> <li>Liuhto, Kari: Ex-Soviet Enterprises and Their Managers Facing the Challenges of the 21<sup>st</sup> Century, Lappeenranta University of Technology, Lappeenranta, 2001.</li> <li>Puffer, Sheila (ed.): Business and Management in Russia. Edward Elgar Publishing Company, Cheltenham, UK, 1996.</li> </ol>	

## 8 Other Courses Offered in English

Course number	Course	ECTS cr
Tu6306000	Technology Management	3
Tu6639000	Cost and Profitability Estimation	3
Ka6720550	Services Marketing and Management	5

### 8.1 Course descriptions

<b>Tu6306000</b>	<b>TECHNOLOGY MANAGEMENT</b>	<b>3 ECTS cr</b>
<b>4th year</b>	<i>Teknologiajohtamisen perusteet</i>	
<b>Period 1</b>	<b>For LUT International Master's Degree programme.</b>	
<b>Lecturer</b>	D.Sc. (Tech.) Ville Ojanen	
<b>Contents</b>	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.	
<b>Instruction</b>	Lectures 18 h, exercises 10 h 1. period. Assessment: examination 70 %, written and oral case/research article reports 30 %.	
<b>Literature</b>	Lecture notes. M. Baker & S. Hart (1999): Product Strategy and Management. Articles and Case Studies Other literature announced later.	
<b>Tu6306050</b>	<b>COST AND PROFITABILITY ESTIMATION</b>	<b>3 ECTS cr</b>
<b>4th year</b>	<i>Kustannusten ja kannattavuuden arviointi</i>	
<b>Period 2</b>	<b>For LUT International Master's Degree programme.</b>	
<b>Lecturer</b>	Professor, Lic.Sc.(Tech.) Timo Kärri N. N.	
<b>Contents</b>	Must know: Cost terms. Cost-volume-profit analysis. Time value of money. Cash flow and its	

<b>Instruction</b>	components. Estimation methods for operating and capital costs. Profitability appraisal methods. Cost of capital. Risk estimation. Cost/Schedule control of project. Lectures 14 h, exercises 14 h 2. period. Assessment: examination.
<b>Literature</b>	Lecture notes. Mott, G.: Investment Appraisal, 3rd ed. Horngren, C. T. & Datar, S.M. & Foster, G.: Cost Accounting - A Managerial Emphasis, 11th ed. 2003.

<b>Ka6720550</b>	<b>SERVICES MARKETING AND MANAGEMENT</b>	<b>5 ECTS cr</b>
<b>4th year</b>	<i>Palveluiden markkinointi ja johtaminen</i>	
<b>Period 1 Lecturer</b>	Professor, D.Sc. (Econ. & Bus.Adm.) Jukka Ojasalo Assistant, M.Sc. (Econ.) Hanna Salojärvi	
<b>Aims</b>	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.	
<b>Contents</b>	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.	
<b>Instruction</b>	14 h of lectures in the 1st period. All instruction will be in English. A written term-paper and written examination.	
<b>Literature</b>	Elective course in International Marketing advanced studies	
<b>Prerequisites</b>	Will be announced later. Bachelor level marketing studies	

## 9 Language Centre Courses 2005 - 2006

### English

		<i>ECTS cr</i>
Ki7110100	Technical English Reading Course 1	2
Ki7110200	Technical English Reading Course 2	2
Ki7110300	Business English Reading Course	2
Ki7110400	Activation of English Skills	3
Ki7112000	Information Technology	2
Ki7112200	Energy Issues	3
Ki7112400	Technology and the Environment	3
Ki7112600	Machines and Processes	3
Ki7112800	Financial English	2
Ki7113000	English for Marketing	3
Ki7113200	Writing for Business	2
Ki7113400	English for Academic Seminars	3
Ki7113600	American Civilization and Culture	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
Ki7117000	Scientific and Technical English Writing Course	3
Ki7119000	Academic Seminar for International Programs	6

### German

		<i>ECTS cr</i>
Ki7124200	Suggestopedic German Course	1
Ki7124400	Finnland als Partner	3
Ki7125000	Die Alpenländer	1
Ki7125200	Kultur und Geschichte	3
Ki7125400	Interkultureller Kurs	1
Ki7125600	Aktuelle Themen	1
Ki7125800	Finnische Industrie	1

Ki7126000	Chemie und Papier	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 cr</i>
Ki7141300	Russian 1 Intensive Course	3
Ki7145100	Suggestopedic Russian Course	1
Ki7145200	Suggestopedic Course in Business Russian	3

### French

		<i>ECTS cr</i>
Ki7153200	Français de l'entreprise	3
Ki7154200	Machines et processus de fabrication	3
Ki7155200	Suggestopedic French Course	1
Ki7155400	Suggestopedic Course in Business French	1
Ki7156200	La Finlande en français	3
Ki7156400	France et francophonie	3
Ki7157200	Actualités en français	3

### Spanish

		<i>ECTS cr</i>
Ki7163000	Curso intercultural entre Finlandia y España	3
Ki7163400	Datos sobre América Latina	3

### Finnish

		<i>ECTS cr</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 cr</i>
Ki7190100	Beginning Chinese 1	3
Ki7190200	Beginning Chinese 2	3

## 9.1 Course descriptions

<b><i>Ki7110100</i></b>	<b><i>TECHNICAL ENGLISH READING COURSE 1</i></b>	<b><i>2 ECTS cr</i></b>
<b><i>1st - 4th year</i></b>		
<b><i>Period 1, 3, 4</i></b>		
<b>Lecturer</b>	Jukka Taipale	
<b>Aims</b>	To learn general technical vocabulary through reading general technical texts and to learn how to read quickly and effectively.	
<b>Contents</b>	Vocabulary exercises, skimming, scanning and affixes, reading comprehension exercises, individual, pair or group work.	
<b>Instruction</b>	This one-period course (28 hours) is taught three times in the academic year: I period - 1 group, III period - 1 group, IV period - 1 group. 1st to 4th year students from all departments are welcome. 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. The languages of instruction are both Finnish and English.	
<b>Literature</b>	Evaluation: A reading comprehension test (duration 90 minutes). Students must do all the course assignments to be eligible for the examination. Provided by the teacher	

<b>Ki7110200</b>	<b>TECHNICAL ENGLISH READING COURSE 2</b>	<b>2 ECTS cr</b>
<b>1st - 4th year</b>		
<b>Period 2, 3, 4</b>	Jukka Taipale	
<b>Lecturer</b>		
<b>Aims</b>	To learn how to handle 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.	
<b>Contents</b>	General technical reading texts. Activities which require both oral and written work in addition to reading. Vocabulary exercises, skimming, scanning and affixes, reading comprehension exercises, individual, pair or group work.	
<b>Instruction</b>	This one-period course (28 hours) is taught three times in the academic year: II period (1 group), III period - 1 group, IV period - 1 group. 1st to 4th year students from all departments are welcome. 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. The languages of instruction are both Finnish and English.	
<b>Literature</b>	Evaluation: A reading comprehension test (duration 90 minutes). Students must do all the course assignments to be eligible for the examination. Provided by the teacher.	
<b>Ki7110300</b>	<b>BUSINESS ENGLISH READING COURSE</b>	<b>2 ECTS cr</b>
<b>1st year</b>		
<b>Period 1, 2, 3</b>	Jukka Taipale	
<b>Lecturer</b>		
<b>Aims</b>	To learn general business vocabulary through reading general business texts, and to learn how to read quickly and effectively.	
<b>Contents</b>	Vocabulary exercises, skimming, scanning and affixes, reading comprehension exercises, individual, pair or group work.	
<b>Instruction</b>	This one-period course (28 hours) is taught three times in the academic year: I period - 1 group, II period - 1 group, III period - 1 group. 1st year KATI or TUTA students. Students who have taken course Technical English Reading Course 1 or Technical English Reading Course 2 are not eligible for this course. The languages of instruction are both Finnish and English.	
<b>Literature</b>	Evaluation: A reading comprehension test (duration 90 minutes). Students must do all the assignments to be eligible for the examination. Provided by the teacher.	
<b>Ki7110400</b>	<b>ACTIVATION OF ENGLISH SKILLS</b>	<b>3 ECTS cr</b>
<b>1st year</b>		
<b>Period 1 - 2, 3 - 4</b>	N. N.	
<b>Lecturer</b>		
<b>Aims</b>	During the course, students will: <ul style="list-style-type: none"> <li>• work on and improve their active listening skills - both listening for general understanding and for specific information,</li> <li>• work on their oral communication skills and coping mechanisms,</li> <li>• work on grammar that causes difficulties,</li> <li>• expand their active vocabulary both in general English as well as in more specific areas, such as business and engineering,</li> <li>• work on pronunciation, both on common problems as well as those specific to the individual,</li> <li>• work on improving basic writing skills.</li> </ul>	
<b>Contents</b>	Using topics that they mainly decide on themselves, students go through a variety of exercises, both spoken and written to help them gain confidence in their English skills and to prepare them for other, more difficult English language courses in the future. In the first period of study, the concentration is mainly on topics of general interest and more technically and business-oriented subjects will be covered in the second period of study. Students will also be taught a variety of methods to continue their studies outside of the classroom.	
<b>Instruction</b>	48 hours of contact + 8 hours of feedback, with at least the same amount of time (48 h) required for homework and self-study. This class is open to students from all disciplines.	

	The language of instruction is English.
<b>Literature</b>	Evaluation: Student marks will be determined through continuous assessment as well as self-assessment. If a student's attendance has been poor and therefore cannot he/she cannot be evaluated using continuous assessment, listening and speaking test will be administered after all assignments have been handed in.
<b>Prerequisites</b>	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. The course will be taught at a B1 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 <a href="http://www.dialang.org">www.dialang.org</a> Students can choose to do the test on their own or during a scheduled testing session before the beginning of the course. Students who have a B1 or higher should seriously consider taking one of the higher level English courses that the Language Centre has to offer instead of Activation of English Skills.

<b>Ki7112000</b>	<b>INFORMATION TECHNOLOGY</b>	<b>2 ECTS cr</b>
<b>2nd - 5th year</b>		
<b>Period 1, 2, 4</b>		
<b>Lecturer</b>	Jukka Taipale	
<b>Aims</b>	To learn the language needed to read and talk about issues connected with information technology and to develop the study skills needed to follow lectures given in English.	
<b>Contents</b>	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.	
<b>Instruction</b>	This one-period course (28 hours) is taught three times in the academic year: I period - 1 group, II period - 1 group, IV period - 1 group. 2nd to Nth year students from all departments are welcome. The language of instruction is English.	
	Evaluation: 1. Continuous assessment of the student's participation in class, resulting in an oral mark. 2. Written exercises approved by the teacher.	
<b>Literature</b>	Provided by the teacher.	

<b>Ki7112200</b>	<b>ENERGY ISSUES</b>	<b>3 ECTS cr</b>
<b>2nd - 5th year</b>		
<b>Period 3 - 4</b>		
<b>Lecturer</b>	Peter Jones	
<b>Aims</b>	To develop the student's speaking, listening and reading skills.	
<b>Contents</b>	Various energy issues - ranging from technological challenges to economic and environmental considerations - arising from the different forms of energy being harnessed in the world today.	
<b>Instruction</b>	48 contact hours (2 groups). The language of instruction is English.	
	Evaluation: Written test and continuous assessment / oral test.	
<b>Literature</b>	Handouts	

<b>Ki7112400</b>	<b>TECHNOLOGY AND THE ENVIRONMENT</b>	<b>3 ECTS cr</b>
<b>2nd - 5th year</b>		
<b>Period 1 - 2</b>		
<b>Lecturer</b>	Hwei-Ming Boey	
<b>Aims</b>	To develop the student's speaking, listening and reading skills.	
<b>Contents</b>	A wide range of environmental issues, from domestic and global concerns to problem-solving innovations in the field.	
<b>Instruction</b>	48 contact hours. The language of instruction is English.	
	Evaluation: A listening comprehension and an oral expression test.	
<b>Literature</b>	Provided by the teacher.	

<b>Ki7112600</b>	<b>MACHINES AND PROCESSES</b>	<b>3 ECTS cr</b>
<b>1st - 3rd year</b>		
<b>Period 1 - 2, 3 - 4</b>		
<b>Lecturer</b>	Paula Haapanen	
<b>Aims</b>	During the course, students will: <ul style="list-style-type: none"> <li>• review and reactivate basic technical vocabulary necessary in the engineering field,</li> <li>• expand their technical vocabulary,</li> <li>• work on and improve their active listening skills,</li> <li>• review the difference between active and passive forms,</li> <li>• give 3 presentations in various situations - a lab tour, a trade fair and a specific technical topic,</li> <li>• work on pronunciation, both on common problems as well as those specific to the individual.</li> </ul>	
<b>Contents</b>	Using technically-oriented materials, both related and unrelated to students' fields of study, students will work on their oral communication skills, mainly in small groups, with some concentration on active listening skills and report writing. Students will be required to give presentations and though there will be no in depth teaching of presentation skills, a basic overview will be given.	
<b>Instruction</b>	40 hours of contact + 8 hours of feedback, with at least the same amount (48 h) required for homework and self-study. This class is oriented towards students in engineering and they will be given priority. If there is space available students from other disciplines will be welcome. The language of instruction is English.	
<b>Literature</b>	Evaluation: Student marks will be determined through continuous assessment as well as self-assessment. If a student's attendance has been poor and therefore he/she cannot be evaluated using continuous assessment, listening and speaking tests will be administered after all assignments have been handed in.	
<b>Prerequisites</b>	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. The course will be taught at a B2/B2+ level according to the Common European Framework. It is recommended that students assess their level of English before the course using an online diagnostic tool called Dialang. It can be found at <a href="http://www.dialang.org">www.dialang.org</a> . Students at levels of B1 and lower should consider doing the course Ki7110400 Activation of English Skills before applying for Machines and Processes.	
<b>Ki7112800</b>	<b>FINANCIAL ENGLISH</b>	<b>2 ECTS cr</b>
<b>2nd - 5th year</b>		
<b>Lecturer</b>	Peter G. Jones	
<b>Aims</b>	To improve fluency and extend vocabulary in the field of financial management.	
<b>Contents</b>	The language of finance, including business finance, taxation, investment etc.	
<b>Instruction</b>	24 Contact Hours. I period - 1 group, IV period - 1 group The language of instruction is English.	
<b>Literature</b>	Evaluation: Written examination Handouts	
<b>Ki7113000</b>	<b>ENGLISH FOR MARKETING</b>	<b>3 ECTS cr</b>
<b>1st - 3rd year</b>		
<b>Period 1 - 2, 3 - 4</b>		
<b>Lecturer</b>	Paula Haapanen	
<b>Aims</b>	During the course, students will: <ul style="list-style-type: none"> <li>• work on and improve their general oral communication skills as well as learn phrases to use in more specific scenarios such as negotiations, presentations and customer service,</li> <li>• expand their marketing vocabulary,</li> <li>• work on and improve their active listening skills,</li> <li>• produce a variety of written samples, which include a product description, a marketing report, a print ad and a direct sales letter,</li> <li>• give a group presentation about the marketing report,</li> <li>• work on pronunciation, both on common problems as well as those specific to the</li> </ul>	

<b>Contents</b>	individual 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.
<b>Instruction</b>	40 hours of contact + 8 hours of feedback, with at least the same amount of time (48 h) required for homework and self-study. 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. The language of instruction is English.
<b>Literature</b>	Evaluation: Student marks will be determined through continuous assessment as well as self-assessment. If a student's attendance has been poor and therefore he/she cannot be evaluated using continuous assessment, a writing, listening and speaking test will be administered after all assignments have been handed in.  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.
<b>Prerequisites</b>	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. The course will be taught at a B2/B2+ level according to the Common European Framework. It is recommended that students assess their level of English before the course using an online diagnostic tool called Dialang. It can be found at <a href="http://www.dialang.org">www.dialang.org</a> Students at levels of B1 and lower should consider taking the course Ki7110400 Activation of English Skills before applying to English for Marketing.

<b>Ki7113200</b>	<b>WRITING FOR BUSINESS</b>	<b>2 ECTS cr</b>
<b>1st - 3rd year</b>		
<b>Period 1, 2, 3, 4</b>		
<b>Lecturer</b>	Paula Haapanen	
<b>Aims</b>	During the course, students will: <ul style="list-style-type: none"> <li>• learn set phrases to help them correspond in a number of professional situations,</li> <li>• learn to differentiate between formal, less-formal and informal business correspondence,</li> <li>• learn how to find sources of reference in connection with writing,</li> <li>• learn to critically read and constructively comment on other students' work through peer review.</li> </ul>	
<b>Contents</b>	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. Students will be required to cover a core set of correspondence types but will also have the opportunity to present other types of business correspondence for study, should the need arise.	
<b>Instruction</b>	14 hours of contact + 40 to 45 hours of individual study, virtual group work and peer evaluation. The language of instruction is English.  The course will mainly use the WebCT platform so that students can share ideas and critique each other's work. The contact hours will be used to address specific problems that students have encountered as well as to introduce new aspects of correspondence for consideration. Students will be required to keep a log of the time spent on self-study. Students of all disciplines are welcome.	
<b>Literature</b>	Evaluation: The marks are based on a final writing exam. 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	
<b>Prerequisites</b>	The course will be taught at a B2/B2+ level 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 <a href="http://www.dialang.org">www.dialang.org</a> Students at levels of B1+ and up will be accepted.	

<b>Ki7113400</b>	<b>ENGLISH FOR ACADEMIC SEMINARS</b>	<b>3 ECTS cr</b>
<b>3rd - 5th year</b>		
<b>Period 1</b>		
<b>Lecturer</b>	Peter G. Jones	
<b>Aims</b>	To learn and practise the skills needed to research and give an academic seminar in English.	
<b>Contents</b>	Students will study features of English for science and technology. They will then research and hold a seminar in English.	
<b>Instruction</b>	24 Contact hours in Period 1. Seminar presentation in Period 2. The language of instruction is English.	
	Evaluation: Seminar paper and presentation.	
	This course is primarily meant for students of chemical technology. The course is compulsory for students majoring in Applied Chemistry and is recommended for students on the International Master's Degree Programme in chemical and process engineering, "Innovative Process and Product Engineering". Students of other departments should contact the teacher before applying.	
	Topics for the seminar will be given by the Department of Chemical Technology for students of chemistry	
<b>Literature</b>	Handouts	

<b>Ki7113600</b>	<b>AMERICAN CIVILIZATION AND CULTURE</b>	<b>3 ECTS cr</b>
<b>Period 3 - 4</b>		
<b>Lecturer</b>	Barbara Miraftabi	
<b>Aims</b>	For students to experience an American-style course in order to develop skills in note-taking, small group debating and presenting, descriptive writing, and critical response writing in the form of a "letter to the editor".	
<b>Contents</b>	Lectures will be given by the instructor on the topic of American life as it is influenced by history and climate for note-taking skill development. In addition to lectures, emphasis is on small group and pair work to develop active student participation. Students will use sources such as the Internet, movies, etc, to research topics for class presentations. Students will be expected to develop their own vocabulary from the contents so that they can talk about similar course aspects in relation to their own countries, e.g. describing the geography and climate of Finland and how they affect Finnish life. Much of this type of work will be done by class presentations.	
<b>Instruction</b>	48 h, III-IV period, taught once in the academic year, one group	
	This is a communicative style English course so the instructor will not prepare traditional "language learning materials". Students will be expected to develop their own language learning tactics. Some activities will use the WebCT platform for group writing and reading other students' work. The language of instruction is English.	
	Evaluation: Continuous assessment based on class participation and a self-evaluation statement or a writing test and an oral test given after all required class assignments are completed. All students will be expected to hand in all written assignments for the evaluation process.	
	This course is meant for students from all departments, in particular students planning to apply for exchange programs in North America or those who have lived there. Please mention your situation, if applicable, when applying.	
	The course will be taught at a B2+/C1 level according to the Common European Framework.	
	Note: Active class participation in both small groups and the total class is important in order to receive a final grade through continuous assessment. Otherwise the exams will be required.	
<b>Literature</b>	No required book; handouts will be given and Internet sources used.	

<b>Ki7116000</b>	<b>ASPECTS OF WORK</b>	<b>3 ECTS cr</b>
<b>2nd - 5th year</b>		
<b>Period 1 - 2, 3 - 4</b>		
<b>Lecturer</b>	Hwei-Ming Boey	
<b>Aims</b>	To develop the student's speaking, listening and reading skills, and to practise writing curricula vitae and letters of application.	
<b>Contents</b>	Issues concerning working life including the process of getting a job - job applications, interviews etc.	
<b>Instruction</b>	48 contact hours. The language of instruction is English.	

<b>Literature</b>	Evaluation: A reading comprehension and an oral expression test. Provided by the teacher.
<b>Ki7116200</b>	<b>TECHNICAL AND CURRENT ISSUES</b> <span style="float: right;"><b>2 ECTS cr</b></span>
<b>2nd - 5th year</b>	
<b>Period 1 - 2, 3 - 4</b>	
<b>Lecturer</b>	Jukka Taipale Peter G. Jones
<b>Aims</b>	To increase and/or maintain the fluency of students with good oral skills, to improve sophistication in spoken English and to improve understanding of spoken discourse, both technical and general
<b>Contents</b>	Audio and video material selected from a variety of sources. Task-oriented listening activities and exercises.
<b>Instruction</b>	This is a two-period course (28 hours) and the course is taught twice in the academic year: I - II period - 2 groups, III - IV period 2 groups. The language of instruction is English.
	Students who have taken the course Current Issues are not eligible for this course.
	Evaluation: Listening comprehension test and continuous assessment / speaking test.
<b>Literature</b>	Provided by the teachers.
<b>Ki7116400</b>	<b>ENGLISH FOR NEGOTIATING</b> <span style="float: right;"><b>3 ECTS cr</b></span>
<b>3rd - 5th year</b>	
<b>Period 3 - 4</b>	
<b>Lecturer</b>	Hwei-Ming Boey
<b>Aim</b>	To practise the language needed for participating in negotiations.
<b>Contents</b>	Discussion and practice of the language for effective negotiating, participation in a number of simulations of negotiations, and video analysis.
<b>Instruction</b>	48 contact hours. The language of instruction is English.
	Evaluation: Continuous assessment.
<b>Literature</b>	Provided by the teacher.
<b>Ki7116600</b>	<b>ENGLISH FOR PRESENTATIONS</b> <span style="float: right;"><b>2 ECTS cr</b></span>
<b>2nd - 5th year</b>	
<b>Period 1, 2</b>	
<b>Lecturer</b>	Peter G. Jones
<b>Aim</b>	To improve the ability to construct and deliver oral presentations in English.
<b>Contents</b>	The language of presentations - starting a presentation, controlling the flow, the language of diagrams, summing up etc.
<b>Instruction</b>	24 Contact hours. The language of instruction is English.
	Evaluation: Evaluated presentation
<b>Literature</b>	Handouts
<b>Ki7116800</b>	<b>GOING INTERNATIONAL AND INTERCULTURAL COMMUNICATION</b> <span style="float: right;"><b>3 ECTS cr</b></span>
<b>1st - 3rd year</b>	
<b>Period 3 - 4</b>	
<b>Lecturer</b>	Barbara Miraftabi
<b>Aims</b>	To develop knowledge, skills and awareness of: oneself as a cultural being, aspects of communication related to culture, and techniques of working with people from other countries.
<b>Contents</b>	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

<b>Instruction</b>	<p>spent on the do's and don'ts of individual cultures. Periods III and IV, 2 groups, taught once in the academic year. The language of instruction is English.</p> <p>Note: This is a content course offered by the Language Centre and should not be thought as a "language course". 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.</p> <p>Students from all departments are welcome. Preference will be given to students applying to be exchange students or planning to work abroad.</p> <p>The course will be taught at a C1/C2 level according to the Common European Framework.</p> <p>Evaluation: Continuous assessment based on class participation, the papers, and group and individual presentations or a writing test and an oral test given after all required class assignments are completed. All students are expected to hand in all written assignments for the evaluation process. Without active class participation in both small groups and the total class, students will be expected to take the exams to receive the final grade.</p> <p>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 and may delay granting of the grade because of the extra work required to grade additional work.</p>
<b>Literature</b>	No required book; handouts will be given and Internet sources used.

<b>Ki7117000</b>	<b>SCIENTIFIC AND TECHNICAL ENGLISH WRITING COURSE</b>	<b>3 ECTS cr</b>
<b>4th - 5th year</b>		
<b>Period 3 - 4</b>		
<b>Lecturer</b>	Barbara Miraftabi	
<b>Aims</b>	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 so that it is clear that the students understand the difference between writing and speaking.	
<b>Contents</b>	The draft of the paper must contain an acceptable introduction (written according to the John Swales' CARS model or some other equally acceptable model which the student will have to provide for approval). The paper must also contain acceptable sections, including an abstract. After peer review (in order to monitor, critique and support each other's work) and consultation with the 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. Thorough presentation techniques will not be taught, but some basic skills will be presented.	
<b>Instruction</b>	48 hours, III - IV period The course is offered once every year (one group) and a limited number are accepted. The language of instruction is English.	
	Teaching includes theory and practical writing exercises both in class and done as homework. Some activities will use the WebCT platform so students can read each other's work.	
	Evaluation: Pass or Fail	
	The course will be taught at a C1/C2 level according to the Common European Framework.	
	The course is meant for 4-5 DI/KTM level and post graduate students, i.e. Those who need to use written English in course of their higher studies in economics, science, engineering and / or research.	
	It would be beneficial for participants to have some piece of factual material related to their field of study to develop.	
<b>Literature</b>	No book required; there will be handouts from various books, including materials developed by the teacher. Information on the Internet will also be referenced.	

<b>Ki7119000</b>	<b>ACADEMIC SEMINAR FOR INTERNATIONAL PROGRAMS</b>	<b>6 ECTS cr</b>
<b>Period 1 - 2</b>		
<b>Lecturer</b>	Barbara Miraftabi	
<b>Aims</b>	To practice listening skills related to lecturers 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 answerers, questioners and listeners; to write a seminar paper; to present an oral report on the seminar paper.	
<b>Contents</b>	During the first period of the autumn semester, concentration will be on listening and oral skills.	

<b>Instruction</b>	<p>Students will work in small groups to critique each other's language skills and help each other to develop. This will be a period with a great deal of independent study. During the test week (held between periods 1 &amp; 2), there will be a two day intensive course on basic writing skills for research papers. This two day intensive course is required attendance! Plan in advance!!</p> <p>During the second period, writing theory will continue and will include much writing practice subject to peer group review during various stages of writing. The final result is a paper written on 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 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. Thorough presentation techniques will not be taught, but some basic skills will be presented.</p> <p>48 hours, I - II periods The language of instruction is English.</p> <p>Evaluation: Pass or Fail</p> <p>The course will be taught at a C1/C2 level according to the Common European Framework. The course is offered once during the academic year for the departmental programs. It is wise to remember that attendance is important. Since this is a 6 ECTS course, student responsibility will be noted and a student may fail if not attending the classes regularly.</p>
<b>Literature</b>	No required book; there will be handouts from various books, including material developed by the teacher. Information on the Internet will also be referenced.
<b>Prerequisites</b>	Acceptance by a department of LUT into an International Master Degree program.
<b>Ki7124400</b>	<b>FINNLAND ALS PARTNER</b> <b>3 ECTS cr</b>
<b>Period 1 - 2, 3 - 4</b>	
<b>Lecturer</b>	Lecturer Jörg Wunderlich Lecturer Theodor Steidel
<b>Aims</b>	Knowledge of the differences and similarities between Finland and Germany. Basic oral communication skills needed in business and at work.
<b>Contents</b>	Students learn to use expressions and vocabulary needed in oral communication situations. Small talk about Finland.
<b>Instruction</b>	Lessons 48 (24+ 24): Periods I and II (2 groups), Periods III and IV (2 groups) 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.
<b>Literature</b>	Handouts given by the lecturer.
<b>Prerequisites</b>	The course Työelämän saksaa or equivalent skills
<b>Ki7125000</b>	<b>DIE ALPENLÄNDER</b> <b>1 ECTS cr</b>
<b>Period 4</b>	
<b>Lecturer</b>	Lecturer Jörg Wunderlich
<b>Aims</b>	Students learn about the people, culture and geographic characteristics of Austria and Switzerland.
<b>Contents</b>	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.
<b>Instruction</b>	Lessons 24 Period IV (1 group). Language of instruction: German Work in pairs and groups and written and oral communication exercises in class. Evaluation based on a written examination or satisfactorily completed assignments.
<b>Literature</b>	Handouts given by the lecturer.
<b>Prerequisites</b>	The course Työelämän saksaa or equivalent skills
<b>Ki7125200</b>	<b>KULTUR UND GESCHICHTE</b> <b>3 ECTS cr</b>
<b>Period 3 -4</b>	
<b>Lecturer</b>	Lecturer Pirjo Rantonen
<b>Aims</b>	Students learn about important German cultural personalities and phenomena throughout the times and important historical events in Germany.
<b>Contents</b>	Group assignments and presentations, movies, literature and written assignments related to German culture and history.
<b>Instruction</b>	24 h contact teaching + approx. 54 h independent work. Period III-IV (1 group).

<b>Prerequisites</b>	Language of instruction: German Active participation in lessons required. Evaluation based on presentations and written assignments. Basic skills in German
<b>Ki7125400</b>	<b>INTERKULTURELLER KURS</b> <span style="float: right;"><b>1 ECTS cr</b></span>
<b>Period 1 -2</b> <b>Lecturer</b> <b>Aims</b> <b>Contents</b> <b>Instruction</b>  <b>Prerequisites</b>	Lecturer Theodor Steidel Improving and maintaining oral communication skills. Topics chosen by the group. 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 Active participation in lessons required. Continuous assessment Finland als Partner or equivalent skills
<b>Ki7125600</b>	<b>AKTUELLE THEMEN</b> <span style="float: right;"><b>1 ECTS cr</b></span>
<b>Period 3 -4</b> <b>Lecturer</b> <b>Aims</b> <b>Contents</b> <b>Instruction</b>  <b>Prerequisites</b>	Lecturer Theodor Steidel Improving and maintaining oral communication skills. Topics chosen by the group. 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 Active participation in lessons required. Continuous assessment Finland als Partner or equivalent skills
<b>Ki7125800</b>	<b>FINNISCHE INDUSTRIE</b> <span style="float: right;"><b>1 ECTS cr</b></span>
<b>Period 1</b> <b>Lecturer</b> <b>Aims</b> <b>Contents</b>  <b>Instruction</b>  <b>Literature</b> <b>Prerequisites</b>	Lecturer Jörg Wunderlich Students learn to speak and write about Finnish industry and products. Students are introduced to material on Finnish industry. 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 based on a written examination or satisfactorily completed assignments. Handouts given by the lecturer. The course Työelämän saksaa or equivalent skills
<b>Ki7126000</b>	<b>CHEMIE UND PAPIER</b> <span style="float: right;"><b>2 ECTS cr</b></span>
<b>3rd – 5th year</b>  <b>Period 4</b> <b>Lecturer</b> <b>Aims</b> <b>Contents</b>  <b>Instruction</b>  <b>Literature</b> <b>Prerequisites</b>	Lecturer Jörg Wunderlich Students learn to understand texts about chemical technology and talk about processes. Students revise the structures of specialised technical language. They also practice using technical language in oral and written form. Lessons 24, Period IV (1 group). Language of instruction: German Evaluation based on a written examination or satisfactorily completed assignments. Handouts given by the lecturer. The course Työelämän saksaa or equivalent skills
<b>Ki7126600</b>	<b>WALD UND HOLZ</b> <span style="float: right;"><b>2 ECTS cr</b></span>
<b>3<sup>rd</sup> – 5<sup>th</sup> year</b>  <b>Period 3</b> <b>Lecturer</b> <b>Aims</b> <b>Contents</b>	Lecturer Jörg Wunderlich Students learn the basic terminology related to the field. Forestry, protecting forests, environmental issues, certification, timber harvesting, wood processing (sawmill, paper and pulp)

<b>Instruction</b>	Lessons 14, Period III (1 group). Language of instruction: German For the most part, the coursework is carried out independently through virtual teaching.
<b>Literature</b>	Evaluation based on a written examination or satisfactorily completed assignments.
<b>Prerequisites</b>	The material includes texts in German and online material. The course Työelämän saksaa or equivalent skills
<b>Ki7126800</b>	<b>WIRTSCHAFTSPRACHE DEUTSCH</b> <b>3 ECTS cr</b>
<b>Period 1 - 2, 3 - 4</b>	
<b>Lecturer</b>	Lecturer Theodor Steidel
<b>Aims</b>	Students study texts on economics in German and the related structures and vocabulary.
<b>Contents</b>	Students practice reading economic texts and preparing documents in German. The course is suitable for students from all departments.
<b>Instruction</b>	Lessons 48 (24+ 24): Periods I and II (2 groups), Periods III and IV (2 groups) Language of instruction: German Active participation in lessons required. Evaluation based on a written examination or satisfactorily completed assignments.
<b>Literature</b>	Handouts given by the lecturer.
<b>Prerequisites</b>	The course Työelämän saksaa or equivalent skills
<b>Ki7127000</b>	<b>KOMMUNIKATION IM UNTERNEHMEN</b> <b>2 ECTS cr</b>
<b>Period 3 -4</b>	
<b>Lecturer</b>	Lecturer Theodor Steidel
<b>Aims</b>	Students learn about business communication.
<b>Contents</b>	Students learn to recognise difference in communicational cultures; examples from Finnish and German companies.
<b>Instruction</b>	Lessons 24 (12+12): Period III-IV (1 group). Language of instruction: German Active participation in lessons required. Evaluation based on a presentation, written assignments and an examination.
<b>Literature</b>	Handouts given by the lecturer.
<b>Prerequisites</b>	Wirtschaftssprache Deutsch or equivalent skills.
<b>Ki7128200</b>	<b>MAKROÖKONOMIE GANZ EINFACH</b> <b>3 ECTS cr</b>
<b>Period 1 -2</b>	
<b>Lecturer</b>	Lecturer Theodor Steidel
<b>Aims</b>	Students learn about the language of economics.
<b>Contents</b>	Students practice using economics terminology and structures in oral and written form.
<b>Instruction</b>	Lessons 48 (24+ 24): Period I-II (1 group). Language of instruction: German Active participation in lessons required. Students prepare and give a presentation or take a written and oral test.
<b>Literature</b>	Handouts given by the lecturer.
<b>Prerequisites</b>	Wirtschaftssprache Deutsch or equivalent skills.
<b>Ki7128400</b>	<b>VERHANDLUNGSSPRACHE DEUTSCH</b> <b>2 ECTS cr</b>
<b>Period 3 -4</b>	
<b>Lecturer</b>	Lecturer Theodor Steidel
<b>Aims</b>	Students learn to use the most important expressions commonly used in negotiations.
<b>Contents</b>	Students prepare for negotiations, simulate and analyse them.
<b>Instruction</b>	Lessons 48 (12+ 12+ intensive part 24): Period III-IV (1 group). Language of instruction: German Active participation and oral test.
<b>Literature</b>	Handouts given by the lecturer.
<b>Prerequisites</b>	Good German skills.
<b>Ki7141300</b>	<b>RUSSIAN 1 INTENSIVE COURSE</b> <b>3 ECTS cr</b>
<b>Period 1 -2</b>	
<b>Lecturer</b>	Lecturer Natalia Kurilova
<b>Aims</b>	Students learn to use basic structures, vocabulary and polite Russian forms and expressions in

<b>Contents</b>	work and everyday communication. Gender and plural forms of nouns and adjectives, possessive pronouns, conjugating verbs in the present tense, telling time, cases, presenting yourself and others, simple phone conversations, shopping.
<b>Instruction</b>	Texts that support communication skills. Lessons 48 (6 sessions on weekdays), Period I-II (1 group). Languages of instruction: Russian and English Continuous assessment based on written homework assignments or a written test. Evaluation: Pass/Fail
<b>Literature</b>	M. Jegorenkov, S. Piispanen, T. Väisänen: Možno! 1

<b>Ki7145100</b>	<b>SUGGESTOPEDIC RUSSIAN COURSE</b>	<b>1 ECTS cr</b>
<b>Period 3</b>	<b>This course is organised every other year.</b>	
<b>Lecturer</b>	Lecturer Natalia Kurilova	
<b>Aims</b>	Activation of basic language skills, especially oral communication and listening comprehension. Expanding the students' vocabulary. Practicing oral communication.	
<b>Contents</b>	Students revise skills learnt in Russian 1 and Russian 2 based on suggestopedic methods. The students' language skills are activated by simulating everyday situations: shopping, finding your way etc. Activating grammar skills.	
<b>Instruction</b>	Lessons 24 (weekend course), Period III (1 group). Language of instruction: Russian 100% attendance in classes require Evaluation: Pass/Fail	
<b>Literature</b>	Handouts given by the lecturer.	
<b>Prerequisites</b>	Russian 1-2 or equivalent skills	

<b>Ki7145200</b>	<b>SUGGESTOPEDIC COURSE IN BUSINESS RUSSIAN</b>	<b>3 ECTS cr</b>
<b>Period 1 -2</b>		
<b>Lecturer</b>	Lecturer Natalia Kurilova	
<b>Aims</b>	Students develop their knowledge and skills in intercultural business communication. The aim is for students to speak more fluently and expand their vocabulary.	
<b>Contents</b>	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.	
<b>Instruction</b>	The course is suitable for students from all departments. Lessons 48 (24+24), Period I and II (1 group). Language of instruction: Russian Weekend course, the dates and times are set with the students. Active participation in lessons required. Evaluation: Pass/Fail	
<b>Literature</b>	Handouts given by the lecturer.	
<b>Prerequisites</b>	The course Työelämän venäjää or Russkij jazyk dlja delovyh ljudej or equivalent skills.	

<b>Ki7153200</b>	<b>FRANÇAIS DE L'ENTREPRISE</b>	<b>3 ECTS cr</b>
<b>Period 3 -4</b>		
<b>Lecturer</b>	Lecturer David Erent	
<b>Aims</b>	Students learn more about oral and written communication skills required in business, and about French business life.	
<b>Contents</b>	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.	
<b>Instruction</b>	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. The course will be graded. The course is suitable for students from all departments.	
<b>Literature</b>	Penfornis: Français.com	
<b>Prerequisites</b>	French 3, Työelämän ranskaa or equivalent skills.	

<b>Ki7155200</b>	<b>SUGGESTOPEDIC FRENCH COURSE</b>	<b>1 ECTS cr</b>
<b>Period 1/2</b> <b>Lecturer</b> <b>Aims</b> <b>Contents</b> <b>Instruction</b>	Lecturer Vuokko Paakkonen Activation of oral French skills with a suggestopedic method. Everyday communication and business communication. Work in pairs and groups, role play, relaxation techniques, exercises that promote creativity. Lessons 24 (weekend course). Periods I and II (1 group). Active participation in lessons required. Evaluation: pass/fail based on continuous assessment	
<b>Literature</b> <b>Prerequisites</b>	Handouts given by the lecturer. French 3 or equivalent skills	
<b>Ki7155400</b>	<b>SUGGESTOPEDIC COURSE IN BUSINESS FRENCH</b>	<b>1 ECTS cr</b>
<b>Period 1/2, 3/4</b> <b>Lecturer</b> <b>Aims</b> <b>Contents</b> <b>Instruction</b>	Lecturer Vuokko Paakkonen Activation of oral French skills with a suggestopedic method. Typical business communication situations. The course is suitable for students from all departments. 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) Active participation in lessons required. Evaluation: pass/fail based on continuous assessment	
<b>Literature</b> <b>Prerequisites</b>	Handouts given by the lecturer. French 3, Työelämän ranskaa or equivalent skills.	
<b>Ki7156200</b>	<b>LA FINLANDE EN FRANÇAIS</b>	<b>3 ECTS cr</b>
<b>Period 1 -2</b> <b>Lecturer</b> <b>Aims</b> <b>Contents</b> <b>Instruction</b>	Lecturer David Erent How to communicate issues related to the Finnish culture, geography and business life in French. Topic related to describing Finland will be decided on with the students. Written and oral communication exercises. Lessons 48 (24+ 24). Period I-II (1 group). Evaluation based on active participation and satisfactorily completed written assignments. Evaluation based on continuous assessment	
<b>Literature</b> <b>Prerequisites</b>	Handouts given by the lecturer. 2-3 years of French studies	
<b>Ki7156400</b>	<b>FRANCE ET FRANCOPHONIE</b>	<b>3 ECTS cr</b>
<b>Period 3 -4</b> <b>Lecturer</b> <b>Aims</b> <b>Contents</b> <b>Instruction</b>	Lecturer David Erent Students learn about French-speaking countries, especially France, and learn to communicate related issues mainly orally. French-speaking countries and their institutions. French geography, culture and society; the topics will be decided on with the students. Mainly oral, but also some written assignments. Lessons 48 (24+ 24). Active participation in lessons required. Evaluation based on continuous assessment 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.	
<b>Literature</b> <b>Prerequisites</b>	Handouts given by the lecturer. 2-3 years of French studies	
<b>Ki7163000</b>	<b>CURSO INTERCULTURAL ENTRE FINLANDIA Y ESPAÑA</b>	<b>3 ECTS cr</b>
<b>Period 1 -2</b>	<b>The course will be organised as presented below, if a sufficient number of Spanish exchange students enrol. Otherwise the course will focus on Finnish culture.</b>	
<b>Lecturer</b> <b>Aims</b>	Lecturer Sari Pärssinen Students learn to talk about Finns, Finland and Finnish culture and compare these to Spain.	

<b>Contents</b>	We will study the cultural characteristics of the two countries and their influence and how they are manifest. Topics include history, geography and society.
<b>Instruction</b>	We will discuss and compare these issues together with Spanish exchange students and supervised by a Finnish lecturer. Students work in pairs and give a presentation that compares the two cultures. Lessons 48 (24+ 24): independent work 30 h Period I-II: 1 group Language of instruction: Spanish Continuous assessment Evaluation: Pass/Fail
<b>Literature</b>	Handouts given by the lecturer.
<b>Prerequisites</b>	Spanish 3 or equivalent skills

<b>Ki7163400</b>	<b>DATOS SOBRE AMÉRICA LATINA</b>	<b>3 ECTS cr</b>
<b>Period 3 -4</b>	Lecturer Yasna Bravo	
<b>Lecturer</b>	Students learn about Latin American countries and cultures and complete reading and writing exercises.	
<b>Aims</b>	Topics on history, customs, geography and society.	
<b>Contents</b>	Work in pairs and groups, reading and writing exercises, simple conversations. Each student gives a presentation on a Latin American country.	
<b>Instruction</b>	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 Evaluation: Pass/Fail Part of the course can be carried out in a Latin American country. In such cases assignments are discussed with the lecturer in advance.	
<b>Literature</b>	Handouts given by the lecturer.	
<b>Prerequisites</b>	Spanish 3 or equivalent skills	

<b>Ki7189100</b>	<b>FINNISH FOR FOREIGNERS 1</b>	<b>2 ECTS cr</b>
<b>Periodi 1, 3</b>	M.A. Raija Hietaranta	
<b>Lecturer</b>	To give the students the ability	
<b>Aims</b>	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.	
<b>Contents</b>	The phonetic, intonation and orthographic systems of the Finnish language, plus basic structures, notions and vocabulary.	
<b>Instruction</b>	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.	
<b>Prerequisites</b>	A written examination. No previous knowledge of the Finnish language is expected.	

<b>Ki7189200</b>	<b>FINNISH FOR FOREIGNERS 2</b>	<b>2 ECTS cr</b>
<b>Periodi 2, 4</b>	M.A. Raija Hietaranta	
<b>Lecturer</b>	To give the students the ability	
<b>Aims</b>	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	
<b>Contents</b>	The course will broaden the already learnt grammar and increase the vocabulary (for example expressions).	
<b>Instruction</b>	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.	
<b>Prerequisites</b>	A written examination Finnish for Foreigners 1 or corresponding knowledge	

<b>Ki7189300</b>	<b>FINNISH FOR FOREIGNERS 3</b>	<b>2 ECTS cr</b>
<b>Period 3 - 4</b> <b>Lecturer</b> <b>Aims</b>	M.A. Raija Hietaranta 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	
<b>Contents</b>	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.	
<b>Instruction</b>	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	
<b>Prerequisites</b>	Finnish for Foreigners 1 and 2 or corresponding knowledge.	
<b>Ki7189800</b>	<b>GERMAN-FINNISH LINGUAL AND CULTURAL TANDEM</b>	<b>1 ECTS cr</b>
<b>Period 1, 3</b> <b>Lecturer</b>	Lecturer N. N. Lecturer Karita Riekkö	
<b>Aims</b>	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.	
<b>Instruction</b>	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. Assessment: Pass/Fail.	
<b>Ki7190100</b>	<b>BEGINNING CHINESE 1</b>	<b>3 ECTS cr</b>
<b>Period 1-2, 3-4</b> <b>Lecturer</b> <b>Aims</b> <b>Contents</b>	Ms Matina Ma To introduce students to the basics of Chinese. Chinese phonetics and the tone system, followed by an introduction to the skills of reading, writing and speaking Chinese.	
<b>Instruction</b>	56 contact hours, meeting three times a week. Each lessons lasts one full hour. I - II period, 2 groups III - IV period, 2 groups All staff-members and students of the university are welcome. Enrolment is limited to twelve participants. Evaluation: Regular class tests.	
<b>Literature</b>	Provided by the teacher.	
<b>Ki7190200</b>	<b>BEGINNING CHINESE 2</b>	<b>3 ECTS cr</b>
<b>Period 3 - 4</b> <b>Lecturer</b> <b>Aims</b>	Ms Matina Ma To offer those who have completed 070990000 / Ki7190100 Beginning Chinese 1 an opportunity to continue reading, writing and speaking Chinese.	
<b>Contents</b> <b>Instruction</b>	Emphasis is on polishing pronunciation and expanding vocabulary and usage. 56 contact hours, meeting three times a week. Each lesson lasts one full hour. III - IV period. Those who have successfully completed Beginning Chinese 1 are welcome. Enrolment is limited to 12 students. Evaluation: Regular class tests.	
<b>Literature</b> <b>Prerequisites</b>	Provided by the teacher. Successful completion of Beginning Chinese 1.	