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Lappeenranta University of Technology

Lappeenrannan teknillinen yliopisto  
Lappeenranta University of Technology

STUDY PROGRAMMES AND COURSES IN ENGLISH

Study Guide 2010-2011

# **STUDY GUIDE 2010-2011**

**STUDY PROGRAMMES AND COURSES IN ENGLISH**

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**Open your mind. LUT.**  
Lappeenranta **University of Technology**

### **University of Technology and Economics - science across boundaries since 1969**

Lappeenranta University of Technology (LUT) is an international community which conducts scientific research and academic education. LUT has more than 6 500 students and employees in positions that require a high level of expertise. Ever since its establishment in 1969, the university has been ahead of its time in combining two fields of science that complement each other – technology and business. By the beginning of 2010, over 8 500 LUT students have completed the degree of Master of Science in Technology or Master of Science in Economics and Business Administration. In addition, over 350 have obtained the postgraduate degree of Doctor of Science in Technology, Doctor of Science in Economics and Business Administration, or Doctor of Philosophy.

LUT comprehends the Faculty of Technology, the Faculty of Technology Management, and the School of Business. Nine different degree programmes are available to students.

The following strategic areas of expertise will be developed: energy efficiency and the energy market, strategic management of business and technology, scientific computing and modelling of industrial processes, and expertise in Russian affairs in these strategic areas of expertise.

LUT graduates are educated, business-minded professionals who master their professional field and find careers in the public and industry sectors.

## THE UNIVERSITY'S ACADEMIC YEAR 1 August 2010 – 31 July 2011

The periods and exam and intensive course weeks for the academic year 2010-2011:

### AUTUMN SEMESTER 2010

#### Periods

1 <sup>st</sup>	30 Aug. – 15 Oct. 2010
2 <sup>nd</sup>	25 Oct. – 10 Dec. 2010

#### Intensive Week

Week 42	18 – 22 Oct. 2010
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#### Exam Weeks

Week 34	23 – 27 Aug. 2010
Week 42	18 – 22 Oct. 2010
Week 50	13 – 17 Dec. 2010

### SPRING SEMESTER 2011

#### Periods

3 <sup>rd</sup>	10 Jan. – 25 Feb. 2011
4 <sup>th</sup>	7 Mar. – 29 Apr. 2011

#### Intensive Weeks

Week 1	3 - 5 Jan. and 7 Jan. 2011
Week 9	28 Feb – 4 Mar. 2011
Week 18	2 – 6 May 2011

#### Exam Weeks

Week 1	3 - 5 Jan. and 7 Jan. 2011
Week 9	28 Feb. – 4 Mar. 2011
Week 14	5 - 7 Apr. 2011 *
Week 18	2 - 6 May 2011
Week 19	9 - 13 May 2011

**Examinations during the teaching periods are arranged according to the examination schedule** on Mondays, Tuesdays, Wednesdays and Thursdays from 16:15 to 19:15 (five-hour lectures from 15:15 to 20:15).

**On examination weeks** in August, October, December, January, March and May, examinations are arranged from Monday to Friday:

8:30-11:30

12:00-16:00 only Language Centre exams

16:15-19:15 (five-hour examinations 15:15-20:15)

**\*On 5-7 April 2011**, examinations will be arranged 8:30-11:30 and 16:15-20:15 (five-hour exams 15:15-20:15). **No lectures are given during this time.**

Examinations may be arranged on the **Saturdays** 13 November 2010 and 26 March 2011. The decision to arrange exams on these days will be made later.

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

# 1 Studying at Lappeenranta University of Technology

## Study Right and Registration

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

Registration for the academic year 2010-2011 starts 1 June 2010 and ends 23 August 2010. **The student union membership fee must be paid by all undergraduate students registered as attending. You may not register for courses or exams before you have registered for the academic year and paid the student union fee.** Students who have not registered by the deadline will be removed from the student register and will no longer be entitled to study at LUT.

Under the Universities Act, students who have been admitted to only the Master's degree (120 ECTS cr) must carry out their studies in 4 years. LUT's Master's programmes in English may have their own restrictions regarding the duration of the programme and the right to study.

For further information on registration, please contact the Student Affairs Office.

## WebOodi

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

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

You should primarily register through WebOodi. If for some reason you cannot 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).

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

## Registration for Courses

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

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

Students can register for courses through WebOodi.

Enrolment for courses in the autumn semester 2010 starts on 1 August 2010, and for courses in the spring semester 2011 on 1 December 2010. Enrolment for each period ends as follows:

Registration for courses in Period 1 ends	Sat, 28 Aug 2010 at 20:00
Registration for courses in Period 2 ends	Mon, 18 Oct. 2010 at 23:59
Registration for courses in Period 3 ends	Mon, 3 Jan. 2011 at 23:59
Registration for courses in Period 4 ends	Mon, 28 Feb. 2011 at 23:59

In the autumn semester, lectures start on 30 August 2010, and in the spring semester on 10 January 2011.

Remember to register for both courses and exams separately.

## Registration for Exams and Midterms

The dates of examinations (incl. final exams, midterms, Language Centre written, oral and listening comprehension tests) are available in the examination schedule on the university web site. Students register for examinations through WebOodi.

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

Three examination dates are set for each course. Students may take part in only two of them. Students may choose any two of the exam dates they wish. WebOodi limits the registrations for a final exam for a given course to two times per academic year.

**Students who have registered for an exam but are unable to take it must cancel their registration through WebOodi at least two working days before the exam. It is very important that you cancel your registration because each registration is considered an exam taken. If a student is suddenly taken ill after the cancellation deadline and is unable to take the examination, the student must provide a doctor's certificate to the Student Affairs Office in order to be able to retake the exam.**

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

In exam sessions according to the examination schedule, students may only take one examination. Two or more examinations may not be completed in the same session.

## Noppa

The study and teaching portal Noppa is a handy tool for both students and lecturers of Lappeenranta University of Technology for everyday course work and communication. Noppa is composed of course home pages that include e.g. course overviews, dates of lectures and exercises, course materials, information about assignments and exams, news and results. Noppa is available at [noppa.lut.fi](http://noppa.lut.fi).

## 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 study guide.

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



## Regulations on Studies

LUT is a university pursuant to the Universities Act (558/2009).

Provisions on education, studying and degrees are laid down in the Government Decree on University Degrees (794/2004) and LUT's regulations for teaching and studying (approved by the rector, enter into force 1 August 2010). The decree and regulations are available on the university web site.

LUT's regulations on teaching and studying define the framework within which studies are arranged and completed at LUT – how teaching and studies are organised and degrees are completed. The regulations set obligations for both university staff and students. The regulations aim to guarantee students' rights and equal treatment. In addition to students' rights, the regulations naturally include obligations for students.

### Disciplinary Measures

LUT accepts no offences against teaching. Offences (e.g. cheat-sheets in exams or plagiarism in assignments or theses) lead to a failing grade and may result in disciplinary measures. The Universities Act and LUT's regulations on teaching and studying include provisions on disciplinary measures.

A suspected or observed offence is reported to the director of administration and the dean of the student's faculty, and all offences are dealt with.

The rector together with the director of administration decides on the appropriate measure depending on the case. 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. The rector may decide to caution the student, or the matter may be brought before the LUT senate and the student may be suspended for a maximum of one year. As for exchange students, the home university will be notified of the offence.

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

### Degree Certificates

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

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

The certificate will show e.g. the graduate's degree, Master's degree programme, major and minor subjects and the name and the grade for Master's 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, excluding the student's thesis. An overall grade is given only when a minimum of 40 ECTS credits in the degree (excluding the Master's thesis) have been completed at LUT and assessed on a scale of 1-5. The overall grades are determined as follows:

<b>Average</b>	<b>Grade</b>
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

Degree certificates include transcripts in Finnish and English indicating all courses completed for the degree and their grades. Also major and minor subjects are given an overall grade in the transcript according to the table above. The overall grade is the average of all the LUT courses completed by the student in the subject in question, weighted according to the workload of each course.

Students will receive a special mention in their Master's degree (120 ECTS cr) certificate of having carried out their studies *with distinction* if their overall grade is at least 4 and the grade for their Master's thesis is 5 (in technology) and at least *eximia cum laude approbatur* (in business). 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.

The degree certificates include a Diploma Supplement in English, and at request a transcript of courses completed at LUT but not included in the degree.

## 2 Study Guidance and Student Support Services

### Study Affairs at Faculties

#### Study Affairs Services at the Faculty of Technology

The study affairs services team of the Faculty of Technology assists degree students, doctoral students and LUT staff members in all matters of student administration. Study guidance for degree students is provided by study coordinators and study secretaries and for postgraduate students by the head of study affairs.

Study guidance for international degree students:

Ms. Minna Loikkanen, Study Coordinator, Faculty of Technology  
Phone +358 40 824 1096, [minna.loikkanen@lut.fi](mailto:minna.loikkanen@lut.fi)

More detailed information on study affairs services and study guidance is available in the Freshman's Survival Guide 2010-2011 by the Faculty of Technology.

[www.lut.fi/en/technology/studies/](http://www.lut.fi/en/technology/studies/)

#### Study Affairs Services at the Faculty of Technology Management

The study affairs services' staff of the Faculty of Technology Management serves degree students, doctoral students and LUT staff members in all of the faculty's study affairs matters. Study guidance for degree students is provided by the study coordinator and for postgraduate students by the head of study affairs. Also the study secretaries and student advisers are available.

Study guidance for international degree students:

Ms. Susanna Koponen, Study Coordinator  
Phone + 358 40 352 4002, office 4426, [susanna.koponen@lut.fi](mailto:susanna.koponen@lut.fi)

More detailed information on study affairs services and study guidance available in the Freshman's Survival Guide 2010 by the Faculty of Technology Management.

<http://www.lut.fi/en/technologymanagement/studies/>

## Study Affairs at the School of Business

The study affairs' services team of the School of Business assists degree students, doctoral students and LUT staff members in all study affairs matters. Study guidance for degree students is provided by study coordinators and study secretaries and for postgraduate students by the head of study affairs. The study affairs offices of the School of Business are located in the university's 7<sup>th</sup> building on the 3<sup>rd</sup> floor.

Contact information:

Ms Minna Ranta  
Head of Study Affairs  
Tel. +358 5 621 7226  
E-mail [minna.u.ranta\(a\)lut.fi](mailto:minna.u.ranta(a)lut.fi)

Ms Essi Reponen  
Coordinator, International Affairs  
Tel. +358 400 380 265  
E-mail [essi.reponen\(a\)lut.fi](mailto:essi.reponen(a)lut.fi)

More detailed information on study affairs [www.lut.fi/kati/lfb](http://www.lut.fi/kati/lfb).

## Study Affairs at the Language Centre

The study affairs services of the Language Centre help students with matters related to language studies related (e.g. enrolment for language courses, registration for language course exams). Study guidance is provided by the student adviser and study coordinator. The Language Centre office is located on the 4th floor of the main building. Check the contact hours at the Language Centre web page [www.lut.fi/kipa](http://www.lut.fi/kipa).

Contact information:

Ms. Jenni Ilmonen, Student Adviser, Language Centre  
Phone +358 40 822 8614, office 1412B, [kipa.opintoneuvoja\(at\)lut.fi](mailto:kipa.opintoneuvoja(at)lut.fi)

Ms. Sari Silventoinen, Study Coordinator, Language Centre  
Phone +358 40 822 8614, office 14005, [sari.silventoinen\(at\)lut.fi](mailto:sari.silventoinen(at)lut.fi)

## Student Affairs Office

The customer service of the Student Affairs Office helps students with registration-related matters (e.g. enrolment for the academic year, registration for courses and exams), and provides students with e.g. certificates of attendance, certificates entitling students to travel discounts, and official transcripts of records. You should contact the Student Affairs Office whenever you have questions regarding e.g. your right to study or the entry of grades into the student register. The Student Affairs Office is located on the 1<sup>st</sup> floor of the main building.

You may visit the customer service 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 contact the office staff by telephone. The telephone numbers are +358 5 621 6062 and +358 5 621 6063, and the e-mail address is [opinto@lut.fi](mailto:opinto@lut.fi).

### Transcript of Records and Registration Certificate

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

The registration certificate or certificate of attendance is available in Finnish or English. There are different registration certificates for different purposes, so please mention why you need it.

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## International and Career Services

The International and Career Services of Lappeenranta University of Technology provide services supporting student and staff mobility. Career Services offer local and international students channels and tools to create contacts with the business world.

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

Students of Master's degree programmes in English are entitled to participate in student exchange ONLY IF the exchange studies are fully integrated into the programme. Fully integrated means that all studies at the exchange university are included as compulsory core studies or core elective studies in the study plan of the exchange student.

International Services coordinate the International Business and Technology Management programme. Both international exchange students and LUT degree students may take courses in the programme.

**Career Services** provide students with tools for looking for employment. In practice, this means facilities and tools for searching for information on jobs, employers and looking for work or international internships. Students may use the telephone, copy machine, fax and computers free of charge. Furthermore, Career Services annually organise various recruitment and corporate events where also LUT alumni participate.

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

Contact information of International Services:

Support Services for Incoming Master's Degree Students

Ms Pirkko Pesu, International Coordinator

Phone +358 40 738 1318

E-mail Pirkko.Pesu(at)lut.fi

Incoming Exchange Students

Ms Virpi Maunuksela, International Coordinator

Phone +358 40 738 1315

E-mail Virpi.Maunuksela(at)lut.fi

Incoming Exchange Students

Ms Johanna Härkönen, International Study Secretary

Phone +358 40 738 1303

E-mail Johanna.Harkonen(at)lut.fi

## Library

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

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

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

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

## Origo

Origo provides LUT students a working and study environment complete with information services. Origo houses both the LUT library and the student help desk. The facilities are equipped with top-of-the-line technology and software for e.g. group work, online studies, electronic exams, information retrieval, assignments, and finan theses.

The Origo help desk ([www.lut.fi](http://www.lut.fi) --> Opiskelu --> Helpdesk Origo) provides services over the phone 040 1590 777, by e-mail [origo@lut.fi](mailto:origo@lut.fi) or in person at the fourth floor service desk. The Origo help desk provides students information and communication technology support and assistance in the use of the university's electronic services. The service desk also lends out equipment needed for studies. The Origo help desk also sees to the use of the exam aquarium.

## Study Councillng Psychologist

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

### 3 Master's Degree Programmes in English at LUT

At Lappeenranta University of Technology, the higher university degrees are Master of Science in Technology (120 ECTS credits) and Master of Science in Economics and Business Administration (120 ECTS credits).

Students are admitted into Master's degree programmes, which lead to these degrees. A degree programme is an entity of courses with scholarly and often also professional aims. Students specialise in a professional field of technology or business and its development.

The Master's degree programmes in English at LUT are:

- Master's Degree Programme in Energy Technology
- Master's Degree Programme in Chemical and Process Engineering
- Master's Degree Programme in Mechanical Engineering
- Master's Degree Programme in Technomathematics and Technical Physics
- Master's Degree Programme in Industrial Management
- Master's Degree Programme in Information Technology
- CBU Master's Degree Programme in Information and Communications Technology
- Fenno-Russian Master's Degree Programme in Information Technology
- Master's Degree Programme (CBU) in Business and Administration in International Technology and Innovation Management (MITIM)
- Master's Degree Programme in International Marketing Management

#### Measurement of Studies

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

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

#### Major and Minor Subjects

The degree programmes are divided into major subjects. In the Master's degree, the major studies are advanced studies.

The degrees also include minor studies. There may be restrictions in selecting a minor subject in certain degree programmes. Further details on these restrictions are provided in the section of each Master's degree programme.

#### Personal Study Plan

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

The study plan is made for the entire duration of the studies. At LUT, the personal study plans are reviewed and revised two times during the studies (Master's Degree students): at the beginning of studies and when applying for the Master's thesis topic. For further information, please contact the study guidance staff of the degree programmes.

#### Master's Thesis

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

The Master's thesis is related to the student's major subject and its topic is agreed on by the supervisor and the student together. In the Master's thesis, the student must demonstrate the ability to carry out the project independently and to follow a plan.

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

The dean of the faculty approves and grades the final thesis. The Master's thesis in technology is evaluated on the scale excellent (5), very good (4), good (3), very satisfactory (2), satisfactory (1) and failed (0). The Master's thesis in business is evaluated on the scale laudatur, eximia cum laude approbatur, magna cum laude approbatur, cum laude approbatur, non sine laude approbatur, lubenter approbatur, approbatur, improbatur (failed).

The vice-rector in charge of education issues university-wide general instructions regarding the final thesis. In addition, faculties may also give their own instructions for the theses. The general instructions and the instructions issued by the School of Business can be found at the end of this study guide and on the university web site.

## **Postgraduate Degrees**

After the Master's degree, LUT offers good possibilities for completing a postgraduate degree. The postgraduate degrees of the university are the degrees of Licentiate of Science in Technology, Licentiate of Science in Economics and Business Administration, Doctor of Science in Technology, Doctor of Science in Economics and Business Administration, and Doctor of Philosophy.

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

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

Details are available from the faculty study guidance staff and on the university web site [www.lut.fi/en/lut/studies/postgraduate/Pages/Default.aspx](http://www.lut.fi/en/lut/studies/postgraduate/Pages/Default.aspx) .

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## 4 Faculty of Technology

### 4.1. Master's Degree Programme in Chemical and Process Engineering

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

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

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

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

#### Careers for Graduates

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

#### Major and Minor Subjects

##### **Major Subject: Sustainable Process Engineering**

*The person responsible for major in Sustainable Process Engineering is professor, D.Sc. (Tech.) Ilkka Turunen*

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

##### **Minor Subject: Advanced Design Methodology**

*The person responsible for minor in Advanced Design Methodology is professor, Ph.D. Andrzej Kraslawski*

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



**The Degree Structure**

A General studies	9	ECTS cr
B Major subject	70	ECTS cr
C Minor subject	20	ECTS cr
D Elective studies	21	ECTS cr
<i>Total</i>	<i>120 (min.)</i>	<i>ECTS cr</i>

**General Studies**

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

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

**Major Subject**
**Sustainable Process Engineering**

<i>Obligatory Studies (59 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BJ20A1801	Chemical Engineering Unit Operations II	M.Sc. (Tech.) 1	1-2	5
BJ30A0500	Project on Process and Plant Design	M.Sc. (Tech.) 2	1-2	11
BJ40A0100	Product Design	M.Sc. (Tech.) 1	4	5
BJ90A0720	Chemical Separation Methods	M.Sc. (Tech.) 1	3-4	8
Thesis	Master's Thesis and Seminar			30

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

<i>List of selectable courses</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BJ10A0400	Process Control Systems in Pulp and Paper Industry	M.Sc. (Tech.) 2	1-2	3
BJ20A0800	Treatment Processes of Industrial Discharges	B.Sc. (Tech.) 3	3-4	5
BJ20A1100	Filtration and Mixing	M.Sc. (Tech.) 1	3-4	6
BJ60A1000	Fiber and Paper Technology; Personal Assignment	M.Sc. (Tech.) 1-2	3-4/1-2	6
BJ60A1400	Chemical Pulping Technology	M.Sc. (Tech.) 1	1-2	5

**Minor Subject**
**Advanced Design Methodology**

<i>Min. 20 ECTS credits should be selected</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BJ30A0700	Computational Fluid Dynamics in Chemical Engineering	M.Sc. (Tech.) 2	1	6
BJ30A1600	Advanced Process Simulation	M.Sc. (Tech.) 1	3-4	8
BJ40A0000	Creative Design	M.Sc. (Tech.) 1	1	3
BM20A3900	Modelling Methodology in Process Engineering	M.Sc. (Tech.) 1	1-2	6

## Elective Studies

Elective studies are needed to attain the full 120 ECTS credits. All the courses included in the IPPE-programme support the objectives of the programme. Consequently, it is recommended that students would choose their elective studies among the courses that are listed under selectable courses in the major subject. However, elective studies can include any courses offered by LUT if the required prerequisites are completed. Studies in other universities may be included upon application. Elective studies may also include internship improving expertise.

## Major Subjects for Double Degree Students

### Pulp and Paper Technology

The person responsible for major in Pulp and Paper Technology is professor, D.Sc. (Tech.) Isko Kajanto

<i>Obligatory Studies (60 - 64 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BJ30A1401	Process and Product Innovations	M.Sc. (Tech.) 1-2	1-4	10
BJ60A1000 <sup>1)</sup>	Fiber and Paper Technology; Personal Assignment	M.Sc. (Tech.) 1-2	3-4/1-2	6
BJ60A1100 <sup>1)</sup>	Fiber and Paper Technology; Personal Assignment	M.Sc. (Tech.) 1-2	3-4/1-2	10
BJ60A1300	Usage and Properties of Paper	M.Sc. (Tech.) 1	3-4	5
BJ60A1400	Chemical Pulping Technology	M.Sc. (Tech.) 1	1-2	5
BJ60A1500	Fiber and Paper Basics	M.Sc. (Tech.) 1	1-2	4
Thesis	Master's Thesis and Seminar			30

<sup>1)</sup> Exchangeable

Min. 10 ECTS credits should be selected to attain 70 ECTS credits.

<i>List of selectable courses</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BJ30A0700	Computational Fluid Dynamics in Chemical Engineering	M.Sc. (Tech.) 2	1	6
BJ30A1600	Advanced Process Simulation	M.Sc. (Tech.) 1	3-4	8
BJ40A0000	Creative Design	M.Sc. (Tech.) 1	1	3
BM20A3900	Modelling Methodology in Process Engineering	M.Sc. (Tech.) 1	1-2	6

### Process Metallurgy

The person responsible for major in Process Metallurgy is senior assistant, D.Sc. (Tech.) Kimmo Klemola

<i>Obligatory Studies (59 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BJ20A0800	Treatment Processes of Industrial Discharges	B.Sc. (Tech.) 3	3-4	5
BJ20A1100	Filtration and Mixing	M.Sc. (Tech.) 1	3-4	6
BJ30A1401	Process and Product Innovations	M.Sc. (Tech.) 1-2	1-4	10
BJ90A0720	Chemical Separation Methods	M.Sc. (Tech.) 1	3-4	8
Thesis	Master's Thesis and Seminar			30

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

<i>List of selectable courses</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BJ30A0700	Computational Fluid Dynamics in Chemical Engineering	M.Sc. (Tech.) 2	1	6
BJ30A1600	Advanced Process Simulation	M.Sc. (Tech.) 1	3-4	8
BJ40A0000	Creative Design	M.Sc. (Tech.) 1	1	3

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### Minor in Chemical Engineering (min. 20 ECTS cr):

Minor in Chemical Engineering can be studied by students of other Master's Degree programmes.

<i>Obligatory for all</i>	<i>per.</i>	<i>op</i>
BJ20A1600 <sup>1)</sup> Chemical Engineering Unit Operations I	1-2	4

<sup>1)</sup> literature exam: Coulson&Richardson, Chemical Engineering (particular chapters)

<i>Obligatory Studies, choose one course:</i>	<i>per.</i>	<i>ECTS cr</i>
BJ30A0600 Modelling of Unit Processes	3-4	6
BJ30A0700 Computational Fluid Dynamics in Chemical Engineering	2	6
BJ30A1600 Advanced Process Simulation	3-4	8
BM20A3900 Modelling Methodology in Process Engineering	1-2	6
BJ70AJ105 Multivariate Methods in Analytical Chemistry		4

<i>Elective Studies, choose enough courses to attain 20 ECTS cr together with the chosen obligatory courses</i>	<i>per.</i>	<i>ECTS cr</i>
BJ20A1100 Filtration and Mixing	3-4	6
BJ20A1801 Chemical Engineering Unit Operations II	1-2	5
BJ20A1901 Advanced Course in Environmental Technology and Unit Operations	3-4,1	6

## Additional Information

### Master's Thesis

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

### Language Studies

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

### Personal Study Plans

The personal study plan (PSP) is the student's own plan how s/he is going to complete the Master's degree. The degree structure of the Master's programme determines the frame of the studies. At the Master's level, the student makes the PSP by the end of 1<sup>st</sup> period, and submits it to Study Coordinator for approval. The electronic personal study plan (ePSP, in Finnish eHOPS) is a tool for drawing the plan up. The students of the Faculty of Technology are recommended to compile the PSP in an electronic form by using the ePSP tool at WebOodi.

### Credit Transfers

ECTS credits can be transferred from the student's previous university level studies or higher university degrees from Finnish or foreign universities. More information on credit transfer is available from Study Coordinator.

### Complementary Studies

Students with a Finnish degree from the University of Applied Sciences or equivalent may have to study complementary studies. The extent of these studies depends on the content of the previous degree. More information is available from Study Coordinator.

### Maturity Test

Students must take a maturity test to show how well they know the topic of their Master's thesis. The test evaluates the student's familiarity with the theories and problems of the thesis. The students are asked to contact their supervising professors to agree how the maturity test is taken, that is, as a seminar presentation or as a written test. The maturity test is evaluated on a scale of passed/failed by the supervising professor of the thesis.

**Further Information**

Programme Coordinator:

Professor, Ph.D. Andrzej Kraslawski

Phone +358 5 621 2139, room 2362, andrzej.kraslawski(at)lut.fi

Study Coordinator, Faculty of Technology:

Ms. Minna Loikkanen

Phone +358 40 824 1096, minna.loikkanen(at)lut.fi

**The Courses Offered in English**

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		<i>ECTS cr</i>
BJ10A0001	Laboratory Work Course in Chemical Technology	10 - 30
BJ10A0201	Master's Thesis and Seminar	30
BJ10A0400	Process Control Systems in Pulp and Paper Industry	3
BJ10A0500	Cross-Cultural Communication for Working Life	2
BJ20A0301	Introduction to Process Simulation	5
BJ20A0800	Treatment Processes of Industrial Discharges	5
BJ20A1100	Filtration and Mixing	6
BJ20A1801	Chemical Engineering Unit Operations II	5
BJ20A1901	Advanced Course in Environmental Technology and Unit Operations	6
BJ30A0500	Project on Process and Plant Design	11
BJ30A0700	Computational Fluid Dynamics in Chemical Engineering	6
BJ30A1401	Process and Product Innovations	10
BJ30A1600	Advanced Process Simulation	8
BJ40A0000	Creative Design	3
BJ40A0100	Product Design	5
BJ40A0300	Management of Technical Information in Export of Processing Equipment to Russian Federation	5
BJ50A0400	Advanced Course in Membrane Technology and Technical Polymer Chemistry	10
BJ60A1000	Fiber and Paper Technology; Personal Assignment	6
BJ60A1100	Fiber and Paper Technology; Personal Assignment	10
BJ60A1300	Usage and Properties of Paper	5
BJ60A1400	Chemical Pulping Technology	5
BJ60A1500	Fiber and Paper Basics	4
BJ90A0400	Catalysis	4
BJ90A0710	Chemical Separation Methods	4
BJ90A0720	Chemical Separation Methods	8
BJ90A1100	Hydrometallurgy	4

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<b>BJ10A0001</b>	<b>LABORATORY WORK COURSE IN CHEMICAL TECHNOLOGY</b>	<b>10 - 30 ECTS cr</b>
	<b>Laboratory Work Course in Chemical Technology</b>	
	<b>The course is mainly intended for foreign visiting students. The students register for the course by contacting the supervisor.</b>	
<b>Teacher(s)</b>	N. N. Person in Charge: Head of the Laboratory	
<b>Aims</b>	To give the student a deeper understanding on chemical technology in a specialized area.	
<b>Content</b>	A specific project which is done in one of the laboratories of the department. The project is planned together with the supervisor(s) and consists mainly of laboratory work, literature work and report writing. The course may contain lectures and seminars. The project may also be planned together with industry and then carried out at some industrial location.	
<b>Modes of Study</b>	The amount of work hours in the project will determine the amount of credits, e.g. three months of work would give 15 ECTS cr. Credits will be granted when the final report is delivered. Extra credits can be received if specific examinations are made.	
<b>Evaluation</b>	0-5 or pass/fail, depending on the project carried out.	
<b>Study materials</b>	Literature related to the project.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BJ10A0201</b>	<b>MASTER'S THESIS AND SEMINAR</b>	<b>30 ECTS cr</b>
	<b>Diplomityö ja seminaari</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-4	
<b>Teacher(s)</b>	Professor of the major subject.	
<b>Aims</b>	The Master's thesis is the final project of the Master's degree, which demonstrates the student's knowledge of a topic of scientific or societal importance in the professional field in question.	
<b>Content</b>	The thesis is a research or planning project. Students must demonstrate the ability to complete the project independently and following a plan. A report is prepared following the instructions for the Master's thesis.	
<b>Modes of Study</b>	The thesis is connected to a seminar with other thesis students and their instructors. Each student gives a brief presentation on the results of his/her project. The presentations are then discussed, and teachers pose questions on them to the entire group.	
<b>Evaluation</b>	0-5, Master's thesis 100%.	
<b>BJ10A0400</b>	<b>PROCESS CONTROL SYSTEMS IN PULP AND PAPER INDUSTRY</b>	<b>3 ECTS cr</b>
	<b>Process Control Systems in Pulp and Paper Industry</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-2	
<b>Teacher(s)</b>	Lic.Sc. (Tech.) Merja Mäkelä Professor, Ph.D. Andrzej Kraslawski (contact person)	
<b>Content</b>	Processes and instrumentation. Need of measurements, open loop and closed loop control. Distributed control systems, programmable logic controllers and open control networks. Communication from process sensors, transmitters and actuators to control rooms. Process plant visualization and control room operation. System configuration, engineering and documentation. Single-input, single-output and multiple-input, multiple-output control strategies. Use of PID, fuzzy logic, model predictive and optimization control principles. Paper and board quality online measurement and control. Automation in original and	

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<b>Modes of Study</b>	renewal plant investment projects. Maintenance and innovative development in automation. Lectures 16 h, 1st period. Lectures 12 h, 2nd period.
<b>Evaluation</b>	Individual or team project work with supervision 12 h, 2nd period.
<b>Study materials</b>	0-5, written examination 60%, project work 40%. Learning Environment for Papermaking and Automation, KnowPap, Licentia 2004, Espoo Finland. Learning Environment for Chemical Pulping and Automation, KnowPulp, Licentia 2004, Espoo Finland. Matlab-Simulink simulation environment, Process Control, System Identification and Fuzzy Control toolboxes, Mathworks 1984 - 2004. Leiviskä, K., Process control, Book 14, in Papermaking Science and Technology, Fapet, 1999, 297 p., ISBN 952-5216-00-4. Sell, Nancy J., Process Control Fundamentals for the Pulp and Paper Industry, Tappi, 1995, Atlanta, USA, 612 p., ISBN 0-89852-294-3. Blackboard.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BJ10A0500</b>	<b>CROSS-CULTURAL COMMUNICATION FOR WORKING LIFE</b>	<b>2 ECTS cr</b>
	<b>Cross-Cultural Communication for Working Life</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3	
<b>Teacher(s)</b>	M.Sc. (Tech.) Mark Middleton 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>Content</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>Modes of Study</b>	Intensive course. Lectures 16 h, exercises 16 h, 3rd period. No examination. The number of participants is limited. Priority is given to the students of the Master's Degree Programme in Chemical and Process Engineering (IPPE).	
<b>Evaluation</b>	Pass/Fail. Active participation in lectures and exercises.	
<b>Study materials</b>	Blackboard.	

<b>BJ20A0301</b>	<b>INTRODUCTION TO PROCESS SIMULATION</b>	<b>5 ECTS cr</b>
	<b>Introduction to Process Simulation</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 3, Period 1-2	
<b>Teacher(s)</b>	Researcher/Teacher, D.Sc. (Tech.) Ritva Tuunila	
<b>Aims</b>	The student understands basics of process simulation, can draw an information (simulation) flowsheet, choose decision parameters and define iterative streams. A student knows a basic structure of a process simulator and is capable to simulate simple chemical and paper processes with suitable commercial simulators.	
<b>Content</b>	Theoretical basics of steady state process simulation, calculation of mass and energy balances by using commercial simulators (ASPEN, BALAS).	
<b>Modes of Study</b>	Lectures and exercises 28 h, 1st period. Simulation exercises 21 h, 2nd period. Individual assignments 45 h, 2nd period.	
<b>Evaluation</b>	0-5, exam 80%, assignments 20%.	
<b>Study materials</b>	Course notes.	

<b>Further Information</b>	Blackboard. This course has 6-10 places for open university students. More information on the web site for open university instruction.
<b>BJ20A0800</b>	<b>TREATMENT PROCESSES OF INDUSTRIAL DISCHARGES</b> <b>5 ECTS cr</b>
<b>Year and Period</b>	<b>Treatment Processes of Industrial Discharges</b> B.Sc. (Tech.) 3, Period 3-4
<b>Teacher(s)</b>	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>Content</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>Modes of Study</b>	Lectures and exercises 21 h, 3rd period. Lectures and exercises 21 h, 4th period.
<b>Evaluation</b>	0-5, written examination 100%.
<b>Study materials</b>	Peavy, H.S., Rowe, D.R., Tchobanoglous, G., Environmental Engineering, McGraw-Hill, 1st ed., 1985.
<b>Prerequisites</b>	Recommended: BJ20A1400 Partikkeliteknikka ja kiintoaineiden käsittely BH40A1400 Virtaustekniikka I BJ20A0100 Mekaaniset erotusmenetelmät BH40A0250 Pumput, puhaltimet ja kompressorit (Kete) BJ20A1600 Kemiantekniikan yksikköoperaatiot I
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.
<b>BJ20A1100</b>	<b>FILTRATION AND MIXING</b> <b>6 ECTS cr</b>
	<b>Filtration and Mixing</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Antti Häkkinen Researcher/Teacher, D.Sc. (Tech.) Ritva Tuunila Docent, D.Sc. (Tech.) Tuomas Koiranen Professor, D.Sc. (Tech.) Marjatta Louhi-Kultanen Person in Charge: Professor, D.Sc. (Tech.) Marjatta Louhi-Kultanen
<b>Aims</b>	Filtration: A student can list different methods and equipment used for solid-liquid separation and is able to choose and size suitable equipment to separation process based on knowledge of the suspension and data from laboratory tests. A student understands the effect of characteristics of solid and liquid to the separation and post treatment process. A student can also define different filter mediums used in filters and preliminarily select a type of medium to different cases. Mixing: A student is able to select different mixing device for a specific application. Besides blending of liquids and mixing of solids, the applications can cover multi-phase systems, such as gas-liquid, liquid-liquid, solid-liquid and gas-solid-liquid systems. A student is able to size the basic mixing devices. A student has knowledge on the fundamentals of heat and mass transfer of stirred tanks.
<b>Content</b>	The topics are as follows:



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<b>Modes of Study</b>	Filtration: fundamentals of filtration, filtration methods, operation of filters, cake formation and washing, deliquoring, design and modeling of filters. Filter medium. Mixing: fundamentals of mixing, rheology, mixing equipment, design of mixers and scale-up. Lectures 18 h, exercises 18 h, filtration laboratory work 20 h, 3rd period.
<b>Evaluation</b>	Lectures 9 h, exercises 9 h, mixing case study 21 h, 4th period.
<b>Study materials</b>	0-5, written examination 80%, laboratory work and case study work 20%. Additional material will be informed at lectures. Blackboard.
<b>Prerequisites</b>	BJ20A0100 Mekaaniset erotusmenetelmät passed.
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b>BJ20A1801</b>	<b>CHEMICAL ENGINEERING UNIT OPERATIONS 5 ECTS cr II</b>
	<b>Chemical Engineering Unit Operations II</b>
	<b>Replaces the course BJ20A1800 Chemical Engineering Unit Operations IIB.</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Marjatta Louhi-Kultanen Researcher/Teacher, D.Sc. (Tech.) Harri Niemi Person in Charge: Professor, 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 BJ20A1600 Kemiantechniikan yksikköoperaatiot I.
<b>Content</b>	The topics are as follows: 1. 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. 2. Membrane separation: Mass transfer, modelling, process design, simulation of industrial membrane processes. 3. Industrial crystallization: theory, operation and design of crystallizers. Mass transfer of dissolution.
<b>Modes of Study</b>	Lectures 18 h, exercises 42 h, laboratory work, Matlab case study, 1st-2nd period.
<b>Evaluation</b>	0-5, exam 80%, assignments 20%.
<b>Study materials</b>	Davey, R. J., Garside, J., From Molecules to Crystallizers, Oxford, Oxford University Press, 2000. Lecture notes.
<b>Prerequisites</b>	BJ20A1600 Kemiantechniikan yksikköoperaatiot I and BJ80A1000 Kemiallinen termodynamiikka passed.
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b>BJ20A1901</b>	<b>ADVANCED COURSE IN ENVIRONMENTAL TECHNOLOGY AND UNIT OPERATIONS 6 ECTS cr</b>
	<b>Advanced Course in Environmental Technology and Unit Operations</b>
	<b>Replaces the course BJ20A1900 Advanced Course in Environmental Technology and Unit Operations.</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4,1
<b>Teacher(s)</b>	Docent, Ph.D. Sergei Preis Professor, D.Sc. (Tech.) Antti Häkkinen Professor, D.Sc. (Tech.) Marjatta Louhi-Kultanen

<b>Aims</b>	Researcher/Teacher, D.Sc. (Tech.) Harri Niemi Researcher/Teacher, D.Sc. (Tech.) Ritva Tuunila Person in Charge: Professor, D.Sc. (Tech.) Marjatta Louhi-Kultanen A student is able to apply unit operations and green chemistry concepts to solve environmental technology problems. The course employs problem-based learning for solving case studies.
<b>Content</b>	Green Chemistry in technology and in treatment of industrial and municipal wastes. Case studies of various unit operations and green chemistry applications.
<b>Modes of Study</b>	Lectures 12 h, 3rd period. Seminars 16 h, 4th period. Literature review or experimental/simulation work, report and seminar presentation. The student has to attend 80% of seminar presentations.
<b>Evaluation</b>	0-5, exam 30%, assignments 70%.
<b>Study materials</b>	Lecture notes.
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b>BJ30A0500</b>	<b>PROJECT ON PROCESS AND PLANT DESIGN 11 ECTS cr</b>
	<b>Project on Process and Plant Design</b>
	<b>HUOM! Suomenkielisille työryhmille opintojakso opetetaan suomeksi.</b>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-2
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Ilkka Turunen
<b>Aims</b>	The student learns to carry out a typical process design project. He will become familiar with different stages of process and plant design, as well as with the common methodology.
<b>Content</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), layout, cost and profitability estimation. Different aspects are emphasized in different projects, depending on the topic. Suitable also for postgraduate studies.
<b>Modes of Study</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. No examination.
<b>Evaluation</b>	0-5, design reports 100%.
<b>Prerequisites</b>	BJ30A0302 Prosessi- ja tehdassuunnittelu passed. Recommended BJ30A0400 Prosessisuunnittelun seminaari.
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.

<b>BJ30A0700</b>	<b>COMPUTATIONAL FLUID DYNAMICS IN CHEMICAL ENGINEERING 6 ECTS cr</b>
	<b>Computational Fluid Dynamics in Chemical Engineering</b>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1
<b>Teacher(s)</b>	Person in Charge: Professor, D.Sc. (Tech.) Ilkka Turunen
<b>Aims</b>	The student learns to use CFD (computer-aided fluid dynamics) to solve simple chemical engineering problems, e.g. in equipment design and trouble shooting.
<b>Content</b>	Theoretical basis of CFD. Introduction of CFX software. Applications of CFD in process industry. Solving chemical engineering problems with CFD.
<b>Modes of Study</b>	Lectures 28 h, 1st period. Exercises with CFD software 120 h, 2nd period. Seminar presentation. No examination.

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<b>Evaluation</b>	0-5, seminar presentation 70%, exercise report 30%. At least 90% presence at lectures required.
<b>Study materials</b>	To be announced later. Blackboard.
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.

<b>BJ30A1401</b>	<b>PROCESS AND PRODUCT INNOVATIONS</b>	<b>10 ECTS cr</b>
	<b>Process and Product Innovations</b>	
	<b>Mainly for Finnish and international students from the departments of Chemical Technology, Mechanical Engineering, Electrical Engineering and Industrial Engineering and Management. The number of participants is limited and the applicants will be interviewed.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Tuomo Kässi Associate Professor, D.Sc. (Tech.) Ville Ojanen Associate Professor, D.Sc. (Tech.) Kimmo Kerkkänen Person in Charge: Professor, D.Sc. (Tech.) Ilkka Turunen	
<b>Aims</b>	To become familiar with the generation of innovations and new technology, the typical methods, problems and their solutions. To learn project and teamwork in interdisciplinary, international environment. To get acquainted with product and process development. To train and deepen many skills learned in other connections.	
<b>Content</b>	Methods of product and process development. Interdisciplinary R & D activities as project and teamwork. Development of new technology, patenting. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Informational lectures, 6 h/period. Project meetings, 6 h/period. Independent project and teamwork in groups of 4-8 students.	
<b>Evaluation</b>	0-5, project work 100%.	
<b>Study materials</b>	Blackboard.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BJ30A1600</b>	<b>ADVANCED PROCESS SIMULATION</b>	<b>8 ECTS cr</b>
	<b>Advanced Process Simulation</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4	
<b>Teacher(s)</b>	Senior Assistant, D.Sc. (Tech.) Yury Avramenko Person in Charge: Professor, Ph.D. Andrzej Kraslawski	
<b>Aims</b>	Learning outcomes: <ul style="list-style-type: none"><li>- Representation of process flowsheet in digital form based on textual process description or printed flow diagram.</li><li>- Drawing the process diagrams using available widely used software like MS Visio.</li><li>- Skills of work in simulation software: mainly BALAS and ASPEN Plus – however, the skills can be applied for other simulation software.</li><li>- Translation of real process unit operations to model blocks of simulation software with adjustment of important parameters.</li><li>- Experience on computing chemical processes when solving various practical tasks.</li></ul>	
<b>Content</b>	- Team work during fulfillment of complex computational projects. Introduction to process modeling and process simulation. Levels of process representation and reading process diagrams. Overview of existing simulation software. Practice in use of ASPEN and BALAS-software. Examples of simulation cases for process development, design, retrofit and optimisation of flowsheets. Suitable also for postgraduate studies.	

<b>Modes of Study</b>	Lectures and exercises 42 h, 3rd-4th period. Project work 120 h.
<b>Evaluation</b>	0-5, project 60%, class work 40%.
<b>Study materials</b>	Lecture notes, BALAS and ASPEN Plus manuals.
<b>Prerequisites</b>	BJ20A0301 Introduction to Process Simulation
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BJ40A0000</b>	<b>CREATIVE DESIGN</b>	<b>3 ECTS cr</b>
	<b>Creative Design</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1	
<b>Teacher(s)</b>	Professor, Ph.D. Andrzej Kraslawski	
<b>Content</b>	Types of innovation. Product, process, service innovation. Innovations in process engineering. Models of creativity. Enhancement of creativity (brainstorming, synergetics, morphological analysis, case-based reasoning, quality function deployment, TRIZ).	
<b>Modes of Study</b>	Lectures and exercises 56 h, 1st period.	
<b>Evaluation</b>	0-5, written examination 50%, exercises and presence at the lectures 50%.	
<b>Study materials</b>	Lecture notes.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BJ40A0100</b>	<b>PRODUCT DESIGN</b>	<b>5 ECTS cr</b>
	<b>Product Design</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 4	
<b>Teacher(s)</b>	Professor, Ph.D. Andrzej Kraslawski	
<b>Content</b>	Types of products. Identification of consumer needs. Product functional and physical-chemical properties. High-throughput experiments. Knowledge-based systems for product design. Computer-aided product design.	
<b>Modes of Study</b>	Lectures 15 h, exercises 20 h, 4th period.	
<b>Evaluation</b>	0-5, written examination 50%, exercises and presence at the lectures 50%.	
<b>Study materials</b>	Lecture notes.	

<b>BJ40A0300</b>	<b>MANAGEMENT OF TECHNICAL INFORMATION 5 ECTS cr IN EXPORT OF PROCESSING EQUIPMENT TO RUSSIAN FEDERATION</b>	
	<b>Management of Technical Information in Export of Processing Equipment to Russian Federation</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 4	
<b>Teacher(s)</b>	Professor, Ph.D. Andrzej Kraslawski N.N. (St. Petersburg State Mining Institute) N.N. (St. Petersburg Plant Polymers University)	
<b>Aims</b>	Person in Charge: Professor, Ph.D. Andrzej Kraslawski To present students knowledge about technical and organizational aspects of exporting processes and equipment to Russian Federation.	
<b>Content</b>	Technical documentation needed for export of basic processing equipment to Russian Federation (safety, environment, technical norms, role of climatic regions). Differences between the European and Russian norms and standards for the processing equipment. Flow of documents between the EU companies and Russian institutions (e.g. Rostekhnadzor) and certification organizations. Examples of exporting the processing equipment for chemical, mineral and pulp & paper industry.	
<b>Modes of Study</b>	Intensive course. Lectures 28 h, exercises 28 h, 4th period. Several projects. No examination.	

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<b>Evaluation</b>	0-5, active participation in lectures and exercises. Successful project works.
<b>Study materials</b>	Lecture notes.
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.

<b>BJ50A0400</b>	<b>ADVANCED COURSE IN MEMBRANE TECHNOLOGY AND TECHNICAL POLYMER CHEMISTRY</b>	<b>10 ECTS cr</b>
	<b>Membranitekniiikan ja teknillisen polymeerikemian syventävä opintojakso</b>	
	<b>The course will be given in English if required.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Mika Mänttari Researcher/Teacher, D.Sc. (Tech.) Arto Pihlajamäki Postdoctoral Researcher, D.Sc. (Tech.) Mari Kallioinen	
<b>Aims</b>	At the end of the course a student is expected to know in the project-like research work how to: -draw up a research plan for the assigned topic - perform high quality measurements - interpret results and draw conclusions based on them - report in writing and orally.	
<b>Content</b>	Membrane processes and their special characters, optimization and characterization of materials. Exploitation of polymeric materials. Yearly changing project subjects.	
<b>Modes of Study</b>	Lectures, seminars and personal guidance 8 h, 1st period. Lectures, seminars and personal guidance 8 h, 2nd period. Personal research project 165 h laboratory work and reporting, 1st–2nd period. Lectures, laboratory work, seminar lectures and possibly a test. Obligatory seminars.	
<b>Evaluation</b>	Enrolling to the course using the WebOodi but also in the laboratory's noticeboard preferably on preceding spring.	
<b>Further Information</b>	0-5, personal laboratory research work 25%, seminars 75%. This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BJ60A1000</b>	<b>FIBER AND PAPER TECHNOLOGY; PERSONAL ASSIGNMENT</b>	<b>6 ECTS cr</b>
	<b>Fiber and Paper Technology; Personal Assignment</b>	
	<b>Opintojakson voi suorittaa joko englannin tai suomen kielellä.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 3-4/1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Isko Kajanto Professor, M.Sc. (Tech.) Kaj Henricson Research Director, D.Sc. (Tech.) Jari Käyhkö University Lecturer, Lic.Sc. (Tech.) Kati Turku Assistant, M.Sc. (Tech.) Mika Pulkkinen	
<b>Aims</b>	To give the student a deeper understanding of a specialized area of fiber, paper or coating technology or paper chemistry and to give the student training in working independently on a specified subject and to provide the readiness for writing a scientific literature report.	
<b>Content</b>	An individual and independent literature work and seminar on fiber, paper or coating technology or paper chemistry. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	The course is held both during the autumn and the spring semester. Literature work 3rd-4th period/1st-2nd period. Seminar 4th/2nd period.	

<b>Evaluation</b>	Registration with WebOodi but also required to register at the bulletin board of the Laboratory of Paper Technology.	
<b>Study materials</b>	0-5, literature work and seminar 100%. Literature related to the project.	
<b>Prerequisites</b>	Course material. BJ60A0001 Paperitekniiikan perusteet or BJ60A1500 Fiber and Paper Basics and BJ60A0900 Kuidun ja paperin valmistus (attended) or corresponding knowledge. BJ80A0500 Pinta- ja kolloidikemia is recommended.	
<b>BJ60A1100</b>	<b>FIBER AND PAPER TECHNOLOGY; PERSONAL ASSIGNMENT</b>	<b>10 ECTS cr</b>
	<b>Fiber and Paper Technology; Personal Assignment</b>	
	<b>Opintojakson voi suorittaa joko englannin tai suomen kielellä.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 3-4/1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Isko Kajanto University Lecturer, Lic.Sc. (Tech.) Kati Turku Person in Charge: Professor, D.Sc. (Tech.) Isko Kajanto	
<b>Aims</b>	The students gain a deeper understanding of a specialized area of fiber, paper or coating technology or paper chemistry and have the readiness to carry out an independent experimental work and result analysis involved in product and process development and for the preparation of a scientific report. The student is capable to prepare the Master´s thesis.	
<b>Content</b>	An individual and independent assignment on fiber, paper or coating technology or paper chemistry including literature and experimental part. A seminar presentation is to be given on the assignment. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	The course is held both during the autumn and the spring semester. Assignment including ca. 200 h practical work and a final report, 3rd-4th period/1st-2nd period. Seminar 4th/2nd period. Registration with WebOodi but also required to register at the bulletin board of the Laboratory of Paper Technology.	
<b>Evaluation</b>	0-5, consists of the performing of the research work, final report and seminar.	
<b>Study materials</b>	Literature related to the project. Course material.	
<b>Prerequisites</b>	BJ60A0001 Paperitekniiikan perusteet and BJ60A0800 Kuitu- ja paperitekniiikan laborioriotyöt or BJ60A1500 Fiber and Paper Basics and BJ60A0900 Kuidun ja paperin valmistus (attended) or corresponding knowledge. BJ80A0500 Pinta- ja kolloidikemia is recommended.	
<b>BJ60A1300</b>	<b>USAGE AND PROPERTIES OF PAPER</b>	<b>5 ECTS cr</b>
	<b>Usage and Properties of Paper</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Isko Kajanto Assistant, M.Sc. (Tech.) Mika Pulkkinen Visiting lecturer(s)	
<b>Aims</b>	Person in Charge: Professor, D.Sc. (Tech.) Isko Kajanto Understanding how the properties of paper are linked to its structure and its manufacturing process. Knowledge of the most typical uses of paper and how various properties of paper are taken advantage of in various end uses. Knowledge of printing methods.	
<b>Content</b>	Paper physics: fibrous networks, paper strength, interaction of water with paper, dimensional stability. Improvement of surface properties of paper - coating and calendering. Printing methods: offset, gravure, inkjet, electrophotography. Interactions with printing	

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<b>Modes of Study</b>	ink and the paper surface. Paperboard packaging and converted paper products. Future trends. Suitable also for postgraduate studies. Lectures 28 h, 3rd period. Lectures 28 h, 4th period. Blackboard support.
<b>Evaluation</b>	Seminar presentation and a written report. Examination.
<b>Study materials</b>	0-5, the grade consists of the examination and the seminar work. Lectures and lecture material. Named parts of the books: Gullichsen, J., Paulapuro, H. (eds), Papermaking Science and Technology, Fapet Oy, vol. 11, vol. 12, vol. 13, vol. 16.
<b>Prerequisites</b>	BJ60A0001 Paperiteknikan perusteet and BJ60A0900 Kuidun ja paperin valmistus or BJ60A1500 Fiber and Paper Basics or corresponding knowledge of forest industry. BJ80A0500 Pinta- ja kolloidikemia is recommended.
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.

<b>BJ60A1400</b>	<b>CHEMICAL PULPING TECHNOLOGY</b>	<b>5 ECTS cr</b>
	<b>Chemical Pulping Technology</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Professor, M.Sc. (Tech.) Kaj Henricson Doctoral Student, M.Sc. (Tech.) Katriina Kolhonen	
<b>Aims</b>	To familiarize the students with the process and equipment technology used in the manufacture of chemical pulp and the recovery of cooking chemicals and in bio-refineries combined with chemical pulp mills. To develop understanding of mill emissions, energy and mass balances.	
<b>Content</b>	Machinery and processes used in the fiberline with special focus on the sulfate process. Recovery of cooking chemicals and mill energy systems. Alternative cooking methods. Bio-refineries in combination with pulp mills. Mill emissions related to the manufacture of chemical pulp. Available wood resources. Properties of chemical fibers. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures, exercises and seminars 14 h, 1st period. Lectures, exercises and seminars 14 h, 2nd period. Blackboard-support.	
<b>Evaluation</b>	Lectures, personal assignment and seminar.	
<b>Study materials</b>	0-5, written examination 75%, personal assignment 25%. Gullichsen, J., Paulapuro, H. (eds), vol. 1 (1998), vol. 3 (2000), vol. 6A (1999), vol. 6B (1999), Papermaking Science and Technology, Fapet Oy. Sixta, H., Handbook of Pulp, Volume 1 and 2, Wileys - VCH (2006). Dence, C., Reeve, D. (eds), Pulp Bleaching - Principles and Practice, Tappi Press (1996). Adams, Terry N. et. al., Kraft Recovery Boilers, Tappi Press (1997). Vakkilainen, Esa K., Kraft Recovery Boilers: Principles and Practice, Suomen Soodakattilayhdistys (2005).	
<b>Prerequisites</b>	Blackboard course material, handouts and other specified reading. BJ60A0900 Kuidun ja paperin valmistus or BJ60A1500 Fiber and Paper Basics attended or corresponding knowledge of forest industry.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	

<b>BJ60A1500</b>	<b>FIBER AND PAPER BASICS</b>	<b>4 ECTS cr</b>
	<b>Fiber and Paper Basics</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Isko Kajanto D.Sc. (Tech.) Päivi Rousu University Lecturer, Lic.Sc. (Tech.) Kati Turku	

<b>Aims</b>	Assistant, M.Sc. (Tech.) Mika Pulkkinen Visiting lecturers Person in Charge: Professor, D.Sc. (Tech.) Isko Kajanto The student has an overview of pulping and papermaking processes and properties of paper and board. The student knows principles of paper technical laboratory work and methods of analysis used in the paper industry.
<b>Content</b>	Chemical and mechanical pulp, recycled fiber. Basic properties of papermaking fibres: structure, interactions with water and bonding. Filtration of fibre suspension and flow properties. Papermaking processes: Defibration and refining of pulp, web forming, web pressing, drying and coating. Structure and properties of paper web. Paper and board grades. Sheet making and analytics of paper laboratory. Pulp and paper testing exercises in pairs.
<b>Modes of Study</b>	Lectures 21 h, 1st period. Guided laboratory work 30 h and report, 1st-2nd period. Support on web-based learning environment platform (Blackboard).
<b>Evaluation</b>	0-5, exam 100% and passed laboratory work.
<b>Study materials</b>	Lectures. Course material on Blackboard. Other literature given on lectures.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BJ90A0400</b>	<b>CATALYSIS</b>	<b>4 ECTS cr</b>
	<b>Catalysis</b>	
	<b>The course will be lectured every other year, next during the academic year 2010 - 2011.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-2	
<b>Teacher(s)</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>Content</b>	The focus during the course is on the structures, properties and applications of heterogeneous catalysts. Homogeneous and enzyme catalysts are briefly described. The mechanisms of catalytic reactions and the derivation of rate expressions. How to choose the catalyst and the reactor. Applications in environmental engineering. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Intensive course. Lectures and exercises 28 h, 1st-2nd period. Laboratory demonstration and homework.	
<b>Evaluation</b>	0-5, written examination 100%, homework passed.	
<b>Study materials</b>	Thomas, J.M. & Thomas, W.J., Principles and Practice of Heterogeneous Catalysis, John Wiley & Sons, Inc., 1997.	
<b>Prerequisites</b>	BJ90A1000 Luonnonvarat ja niiden prosessointi kemian- ja energiateollisuudessa passed.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	



<b>BJ90A0710</b>	<b>CHEMICAL SEPARATION METHODS</b>	<b>4 ECTS cr</b>
	<b>Chemical Separation Methods</b>	
	<b>The lectures are included as a part in BJ90A0200 Teknillinen kemia.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Erkki Paatero Post-Doctoral Researcher, D.Sc. (Tech.) Tuomo Sainio Senior Assistant, D.Sc. (Tech.) Kimmo Klemola	
<b>Aims</b>	The course gives the theoretical basis for chemically assisted separation methods.	
<b>Content</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 especially in hydrometallurgy, food industry, pharmaceutical industry and chemical industry. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures and seminars 28 h, 3rd period. Lectures and seminars 7 h, 4th period. Oral presentation of a literature study. Written examination.	
<b>Evaluation</b>	0-5, examination 80%, seminar presentation 20%.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BJ90A0720</b>	<b>CHEMICAL SEPARATION METHODS</b>	<b>8 ECTS cr</b>
	<b>Chemical Separation Methods</b>	
	<b>The lectures are included as a part in BJ90A0200 Teknillinen kemia.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Erkki Paatero Senior Assistant, D.Sc. (Tech.) Kimmo Klemola Post-Doctoral Researcher, D.Sc. (Tech.) Tuomo Sainio	
<b>Aims</b>	The course gives the theoretical basis for chemically assisted separation methods.	
<b>Content</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 especially in hydrometallurgy, food industry, pharmaceutical industry and chemical industry. The students have a possibility to get training in scientific reporting and oral presentation.	
<b>Modes of Study</b>	Lectures and seminars 28 h, 3rd period. Lectures and seminars 14 h, 4th period. Oral and written presentation of a literature study. Laboratory work of approximately 40 h. Written examination.	
<b>Evaluation</b>	0-5, examination 70%, report 20% and seminar presentation 10%.	

<b>BJ90A1100</b>	<b>HYDROMETALLURGY</b>	<b>4 ECTS cr</b>
	<b>Hydrometallurgy</b>	
	<b>The course will be lectured every other year, next during the academic year 2011 - 2012.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Erkki Paatero	
<b>Aims</b>	The course gives the theoretical basis for hydrometallurgy and the technology applied in hydrometallurgical processes.	
<b>Content</b>	Solution chemistry in metallurgical solutions and use of the Eh-pH diagram. Leaching and treatment of leach solutions by adsorption, ion exchange, solvent extraction and precipitation. Electrochemical methods.	
<b>Modes of Study</b>	Intensive course. Lectures and exercises 28 h, 1st-2nd period.	
<b>Evaluation</b>	0-5, written examination 100%, exercises passed.	
<b>Study materials</b>	Fathi Habashi, Textbook of Hydrometallurgy, Metallurgie Extractive Quebec, 2nd edition, 1999.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

### 4.2. Master's Degree Programme in Energy Technology

The Master's Degree Programme in Energy Technology is a leading provider of advanced energy studies. From a broad energy perspective including the wide ranging disciplines of renewable energy technology, environmental energy technology and management, electrical drives and automation technology, and electricity market, it focuses on professional relevance and offers students various study options to specialize in the field of their interest.

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

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

The LUT Energy Institute is the largest energy research and education unit in Finland. It has all the required expertise to answer the future challenges associated with energy. The Institute trains Masters of Science in Technology specialized in energy markets, environmental issues and the energy industry.

The Master's Degree Programme in Energy Technology is specifically aimed at students who wish to receive multiple and goal-directed training in energy technology. It focuses on educating students to be professionally and academically prepared to address the needs of international entrepreneurial organizations seeking for networking opportunities in a globalizing market.

Our aim is to educate industrially orientated, world-class professionals with firm theoretical understanding and profound expertise in the following fields of specialization:

- Bio-Energy Technology - includes topics such as biofuel production and refining technologies, bioenergy end-use technologies and international trade of biofuels.
- Environmental Energy Technology - focuses on reducing the environmental impacts of energy production, such as energy production technologies using different types of renewable fuels and new pollution control technologies.
- Industrial Electronics – includes studies in electrical drives technology and control engineering, focusing on the management of electromagnetism, power electronics, electromechanical and electrothermal processes, on industrial applications of real-time control systems, embedded software, digital signal processing, and on the application of these to the modeling and control of electric drives and power electronics.
- Electricity Distribution and Market - focuses on studies in electricity distribution automation and power transmission, network business technology, regulation, and economy.

## The Degree Structure of the Programme

Depending on the degree and/or on the level and extent of previous studies, and based on the student's field of interest and specialization, a personal study plan (PSP) will be composed for every admitted student. The PSP in energy technology is structured of the following subject blocks:

<b>Master's Degree Programme in Energy Technology 120 ECTS cr</b>					
Master's thesis on major subject 30 ECTS cr					
<b>Master of Science (Technology)</b>	<b>Major Studies</b> Environmental Energy Technology	<b>Major Studies</b> Bio-Energy Technology	<b>Major Studies</b> Industrial Electronics	<b>Major Studies</b> Electricity Distribution and Market	<b>Minor Studies</b> 20-22 ECTS cr - Bio-Energy Technology - Environmental Energy Technology - Industrial Embedded Systems - Power Electronics and Electrical Drives - Modelling of Energy Systems
					<b>Elective Studies</b> 10-18 ECTS cr
	Select a major subject (60-66 ECTS cr) and a minor subject (20-22 ECTS cr)				
General Studies 22 ECTS cr					

### Degree Structure

General Studies	22	ECTS cr
Major Subject	30-36	ECTS cr
Minor Subject	20-22	ECTS cr
Elective Studies	10-18	ECTS cr
Master's Thesis and Seminar	30	ECTS cr

### General Studies

<i>Obligatory Studies (22 ECTS cr)</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
AB30A0301 International Finance and Emerging Markets	M.Sc. (Econ. & Bus. Adm.) 1	2	6
BM20A1300 Complex Analysis	M.Sc. (Tech.) 1-2	1	3
BM20A2701 Numerical Methods II	M.Sc. (Tech.) 1	4	3
FV11A6500 Presenting in English	B.Sc. (Tech.) 2-3	1, 2, 2	
	M.Sc. (Tech.) 1-2	3, 4	
	B.Sc. (Econ. & Bus. Adm.) 2-3		
	M.Sc. (Econ. & Bus. Adm.) 1-2		
FV11A8900 Academic Writing in English	B.Sc. (Tech.) 3	1-2, 4	
	M.Sc. (Tech.) 1-2	3-4	
	B.Sc. (Econ. & Bus. Adm.) 3		
	M.Sc. (Econ. & Bus. Adm.) 1-2		
FV18A9101 Finnish 1		1, 3	2
FV18A9201 Finnish 2		2, 4	2

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### Major Studies

#### 1. Major Subject in Industrial Electronics

The person responsible for major in Industrial Electronics is professor, D.Sc. (Tech.) Juha Pyrhönen

<i>Obligatory Studies (66 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BH50A1200	Energy Systems Engineering	M.Sc. (Tech.) 1	1-2	6
BL30A0400	Design of an Electrical Machine	M.Sc. (Tech.) 1	1	6
BL30A0600	Power Electronics	M.Sc. (Tech.) 1	1-2	6
BL30A1001	Electrical Drives	M.Sc. (Tech.) 2	2-3	8
BL30A1200	Numerical Methods in Electromagnetism	M.Sc. (Tech.) 2	3	4
BL40A1100	Embedded System Programming	M.Sc. (Tech.) 1	1-2	4
BL50A0600	Electromagnetic Compatibility in Power Electronics	M.Sc. (Tech.) 1	1	2
Thesis	Master's Thesis and Seminar			30

#### 2. Major Subject in Electricity Distribution and Market

The person responsible for major in Industrial Electronics is professor, D.Sc. (Tech.) Jarmo Partanen

<i>Obligatory Studies (61 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BH50A1200	Energy Systems Engineering	M.Sc. (Tech.) 1	1-2	6
BH60A2000	Emission Trading	B.Sc. (Tech.) 3	3-4	3
BL20A02001	Power Exchange Game for Electricity Markets	M.Sc. (Tech.) 1	2-3	3
BL20A04001	Electricity Market	M.Sc. (Tech.) 1	1	5
BL20A05001	Electricity Distribution Technology	M.Sc. (Tech.) 1	1-2	8
BL30A0600	Power Electronics	M.Sc. (Tech.) 1	1-2	6
Thesis	Master's Thesis and Seminar			30

#### 3. Major Subject in Bio-Energy Technology

The person responsible for major in Bio-Energy Technology is professor, D.Sc. (Tech.) Esa Vakkilainen

<i>Obligatory (60 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BH40A1300	Power Engines in Renewable Energy	M.Sc. (Tech.) 2	2	5
BH50A1200	Energy Systems Engineering	M.Sc. (Tech.) 1	1-2	6
BH50A1300	Maintenance Management	M.Sc. (Tech.) 2	1-2	4
BH50A1400	Steam Boilers	M.Sc. (Tech.) 2	1-2	6
BH80G0000	Bioenergy	M.Sc. (Tech.) 1	1	3
BH50A1500	Bioenergy Technology Solutions	M.Sc. (Tech.) 1	2-3	6
Thesis	Master's Thesis and Seminar			30

#### 4. Major Subject in Environmental Energy Technology

The person responsible for major in Environmental Energy Technology is professor, D.Sc. (Econ.) Lassi Linnanen

<i>Obligatory Studies (60 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BH40A1300	Power Engines in Renewable Energy	M.Sc. (Tech.) 2	2	5
BH60A1600	Basic Course on Environmental Management and Economics	B.Sc. (Tech.) 2	1-2	5
BH60A2000	Emission Trading	M.Sc. (Tech.) 1	3-4	3
BH60A2101	Advanced Course in Life Cycle Assessment	M.Sc. (Tech.) 2	1-2	7
BH60A2200	Air Pollution Control	M.Sc. (Tech.) 1	3-4	3
BH60A2401	Energy Recovery from Solid Waste	M.Sc. (Tech.) 2	1-2	4
BH80G0000	Bioenergy	M.Sc. (Tech.) 1	1	3
Thesis	Master's Thesis and Seminar			30

## Minor Studies

The recommended major and minor subject combination is shown in the table below. However, the student may choose any of the minor subjects offered by LUT Energy.

Subject Combination	
Major Subject	Minor Subject
Industrial Electronics	Industrial Embedded Systems
Electricity Distribution and Market	Power Electronics and Electrical Drives
Environmental Energy Technology	Bio-Energy Technology
Bio-Energy Technology	Environmental Energy Technology OR Modelling of Energy Systems

### 1. Minor Subject in Industrial Embedded Systems

<i>(21 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BL40A1000	Real-time Operating Systems and Programs	M.Sc. (Tech.) 2	1-2	5
BL40A1200	Digital Control Design	M.Sc. (Tech.) 1	1-2	4
BL40A1810	Microprocessors A	B.Sc. (Tech.) 3	3-4	6
BL50A1300	Advanced Course in Electronics	M.Sc. (Tech.) 1	3-4	6

### 2. Minor Subject in Power Electronics and Electrical Drives

<i>Select a minimum of 20 ECTS cr</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BL30A1200	Numerical Methods in Electromagnetism	M.Sc. (Tech.) 2	3	4
BL40A1100	Embedded System Programming	M.Sc. (Tech.) 1	1-2	4
BL40A1810	Microprocessors A	B.Sc. (Tech.) 3	3-4	6
BL50A0600	Electromagnetic Compatibility in Power Electronics	M.Sc. (Tech.) 1	1	2
BL50A1300	Advanced Course in Electronics	M.Sc. (Tech.) 1	3-4	6

### 3. Minor Subject in Bio-Energy Technology

<i>(22 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BH50A1300	Maintenance Management	M.Sc. (Tech.) 2	1-2	4
BH50A1400	Steam Boilers	M.Sc. (Tech.) 2	1-2	6
BH50A1600	Waste Heat Recovery Techniques	M.Sc. (Tech.) 2	3-4	6
BH50A1500	Bioenergy Technology Solutions	M.Sc. (Tech.) 1	2-3	6

### 4. Minor Subject in Environmental Energy Technology

<i>(22 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BH60A1600	Basic Course on Environmental Management and Economics	B.Sc. (Tech.) 2	1-2	5
BH60A2000	Emission Trading	B.Sc. (Tech.) 3	3-4	3
BH60A2101	Advanced Course in Life Cycle Assessment	M.Sc. (Tech.) 2	1-2	7
BH60A2200	Air Pollution Control	M.Sc. (Tech.) 1	3-4	3
BH60A2401	Energy Recovery from Solid Waste	M.Sc. (Tech.) 2	1-2	4

### 5. Minor Subject in Modelling of Energy Systems

<i>(21 op)</i>		<i>vsk</i>	<i>per.</i>	<i>op</i>
BH40A1500	Turbulence Models	DI 2	3-4	4
BH70A0001	Numerical Methods in Heat Transfer	DI 1	1-2	6
BH70A0101	Advanced Modeling Tools For Transport Phenomena	DI 1	3-4	5
BH70A0200	Advanced Topics in Modelling of Energy Systems	DI 1	1-2	6

### Elective Studies

Elective studies can include any courses offered by LUT if the required prerequisites are completed. Studies in other universities may be included upon application. Elective studies may include internship improving expertise.

### Additional Information

#### Personal Study Plans

The personal study plan (PSP) is the student's own plan how s/he is going to complete the Master's degree. The degree structure of the Master's programme determines the frame of the studies. At the Master's level, the student makes the PSP by the end of 1<sup>st</sup> period, and submits it to Study Coordinator for approval. The electronic personal study plan (ePSP, in Finnish eHOPS) is a tool for drawing the plan up. The students of the Faculty of Technology are recommended to compile the PSP in an electronic form by using the ePSP tool at WebOodi.

#### Credit Transfers

ECTS credits can be transferred from the student's previous university level studies or higher university degrees from Finnish or foreign universities. More information on credit transfer is available from Study Coordinator.

#### Complementary Studies

Students with a Finnish degree from the University of Applied Sciences or equivalent may have to study complementary studies. The extent of these studies depends on the content of the previous degree. More information is available from Study Coordinator.

#### Maturity

Students must take a maturity test to show how well they know the topic of their Master's thesis. The test evaluates the student's familiarity with the theories and problems of the thesis. The students are asked to contact their supervising professors to agree how the maturity test is taken, that is, as a seminar presentation or as a written test. The maturity test is evaluated on a scale of passed/failed by the supervising professor of the thesis.

#### Test

#### Further Information

Industrial Electronics, Electricity Market and Distribution:

Prof. D.Sc. (Tech.) Pertti Silventoinen, Department of Electrical Engineering  
Phone +358 40 774 9930, [pertti.silventoinen\(at\)lut.fi](mailto:pertti.silventoinen(at)lut.fi)

Bio-Energy Technology:

Prof. D.Sc. (Tech.) Esa Vakkilainen, Department of Energy Technology  
Phone +358 40 357 8684, [esa.vakkilainen\(at\)lut.fi](mailto:esa.vakkilainen(at)lut.fi)

Environmental Energy Technology:

Prof. D.Sc. (Econ.), M.Sc. (Tech) Lassi Linnanen, Department of Environmental Engineering  
Phone +358 50 550 3305, [lassi.linnanen\(at\)lut.fi](mailto:lassi.linnanen(at)lut.fi)

Study Coordinator, Faculty of Technology:

Ms. Minna Loikkanen  
Phone +358 40 824 1096, [minna.loikkanen\(at\)lut.fi](mailto:minna.loikkanen(at)lut.fi)

## The Courses Offered in English

		<i>ECTS cr</i>
BH10A1100	Master's Thesis and Seminar	30
BH10A1200	Master's Thesis and Seminar	30
BH10A2000	Master's Thesis and Seminar	30
BH40A1300	Power Engines in Renewable Energy	5
BH40A1500	Turbulence Models	4
BH50A1200	Energy Systems Engineering	6
BH50A1300	Maintenance Management	4
BH50A1400	Steam Boilers	6
BH50A1500	Bioenergy Technology Solutions	6
BH50A1600	Waste Heat Recovery Techniques	6
BH60A1101	Environmental Technology Project Work	2 - 7
BH60A1600	Basic Course on Environmental Management and Economics	5
BH60A2000	Emission Trading	3
BH60A2101	Advanced Course in Life Cycle Assessment	7
BH60A2401	Energy Recovery from Solid Waste	4
BH70A0001	Numerical Methods in Heat Transfer	6
BH70A0200	Advanced Topics in Modelling of Energy Systems	6
BH80G0000	Bioenergy	3
BL20A0201	Power Exchange Game for Electricity Markets	3
BL20A0401	Electricity Market	5
BL20A0501	Electricity Distribution Technology	8
BL20A0601	Electrical Power Transmission	5
BL30A0400	Design of an Electrical Machine	6
BL30A0600	Power Electronics	6
BL30A1001	Electrical Drives	8
BL30A1200	Numerical Methods in Electromagnetism	4
BL40A1000	Real-time Operating Systems and Programs	5
BL40A1100	Embedded System Programming	4
BL40A1200	Digital Control Design	4
BL40A1810	Microprocessors A	6
BL40A2201	Process and Product Innovations	10
BL50A0600	Electromagnetic Compatibility in Power Electronics	2
BL50A1300	Advanced Course in Electronics	6



<b>BH10A1100</b>	<b>MASTER'S THESIS AND SEMINAR</b>	<b>30 ECTS cr</b>
	<b>Diplomityö ja seminaari</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-4	
<b>Teacher(s)</b>	professors of the degree programme Person in Charge: Professor, D.Sc. (Tech.) Esa Vakkilainen	
<b>Aims</b>	The Master's thesis is the final project of the Master's degree, which demonstrates the student's knowledge of a topic of scientific or societal importance in the professional field in question.	
<b>Content</b>	The thesis is a research or a planning project. Students must demonstrate the ability to complete the project independently and following a plan. A report is prepared following the instructions for the Master's thesis.	
<b>Modes of Study</b>	The presentation of the thesis will be arranged with the supervising professor.	
<b>Evaluation</b>	There will be no separate seminar. 0-5, Master's thesis 100 %	
<b>BH10A1200</b>	<b>MASTER'S THESIS AND SEMINAR</b>	<b>30 ECTS cr</b>
	<b>Diplomityö ja seminaari</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-4	
<b>Teacher(s)</b>	Professor of the major subject Person in Charge: Professor, D.Sc. (Econ. & Bus. Adm.), M.Sc. (Tech.) Lassi Linnanen	
<b>Aims</b>	The Master's thesis is the final project of the Master's degree, which demonstrates the student's knowledge of a topic of scientific or societal importance in the professional field in question.	
<b>Content</b>	The thesis is a research or a planning project. Students must demonstrate the ability to complete the project independently and following a plan. A report is prepared following the instructions for the Master's thesis.	
<b>Modes of Study</b>	The presentation of the thesis will be arranged with the supervising professor.	
<b>Evaluation</b>	There will not be a separate seminar. 0-5, Master's thesis 100 %.	
<b>BL10A2000</b>	<b>MASTER'S THESIS AND SEMINAR</b>	<b>30 ECTS cr</b>
	<b>Diplomityö ja seminaari</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-4	
<b>Teacher(s)</b>	Person in Charge: Professor, D.Sc. (Tech.) Pertti Silventoinen	
<b>Aims</b>	Upon completion of the course the student will be able to <ul style="list-style-type: none"> <li>• delineate a research problem,</li> <li>• select research methodology suitable for the study,</li> <li>• find relevant reference material and assess the credibility of sources,</li> <li>• apply the material correctly to his/her own work and</li> <li>• write a scientific report according to scientific practices with a special reference to electrical engineering.</li> </ul>	
<b>Content</b>	Fundamentals of scientific work. Good scientific conduct associated with definition of a research problem, selection of research methodology, problem solving and scientific reporting with special focus on electrical engineering practices. Application of scientific knowledge to problem solving. Good information processing skills. Scientific reporting. Information search. Scientific writing skills. Writing the M.Sc. thesis.	
<b>Modes of Study</b>	Writing the M.Sc. thesis. The seminar part of the course is completed by presenting the M.Sc. thesis to the examiner and/or to the commissioner of the thesis.	
<b>Evaluation</b>	0–5, M.Sc. thesis 100 %.	

<b>BH40A1300</b>	<b>POWER ENGINES IN RENEWABLE ENERGY</b>	<b>5 ECTS cr</b>
	<b>Power Engines in Renewable Energy</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 2	
<b>Teacher(s)</b>	Person in Charge: Professor, D.Sc. (Tech.) Jari Backman	
<b>Aims</b>	After the course the students are able to choose and calculate the main performance of wind turbines, reciprocative engines, gas turbines, steam turbines and organic rankine cycles. They also understand, where fuel cells can be used.	
<b>Content</b>	Gas turbines, compressors, turbines, fuel cells, reciprocative engines.	
<b>Modes of Study</b>	4 combined lecture and exercise events, each 4 hours. The students are expected to familiarize in advance with the Material Notebook and Blackboard, to make the expected exercises and quizzes.	
<b>Evaluation</b>	0-5. The evaluation is based on the quizzes and final exam, which will be done in the Exam Aquarium. Approved (50%) performance in the quizzes and exercises may add extra points to the final exam assessment.	
<b>Study materials</b>	Material Notebook, Blackboard course material: summary, exercises, quizzes	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	
<b>BH40A1500</b>	<b>TURBULENCE MODELS</b>	<b>4 ECTS cr</b>
	<b>Turbulence Models</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 3-4	
<b>Teacher(s)</b>	Docent, D.Sc. (Tech.) Teemu Turunen-Saaresti	
<b>Aims</b>	Student will get acquainted with turbulence models used in computational fluid dynamics. Different characteristics of the turbulence models are discussed and student is able to estimate how different turbulence models are suited to different fluid mechanical problems. In addition, student will know the physical basis of the turbulence models.	
<b>Content</b>	Navier-Stokes equations, RANS equations, eddy viscosity, Algebraic, one equation and two equation models, Reynolds stress model, Large Eddy Simulation and Detached eddy model.	
<b>Modes of Study</b>	Lectures 12 h and exercises 12 h, 3rd period. Lectures 12 h and exercises 12 h, 4th period. Examination.	
<b>Evaluation</b>	0-5, examination 50%, home works 50%.	
<b>Prerequisites</b>	BH70A0001 Numerical Methods in Heat Transfer	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BH50A1200</b>	<b>ENERGY SYSTEMS ENGINEERING</b>	<b>6 ECTS cr</b>
	<b>Energy Systems Engineering</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Esa Vakkilainen	
<b>Aims</b>	The course gives a comprehensive view towards different types of energy production processes. The course introduces systems engineering. The student understands how plant requirements affect the planning and implementation phases of small energy systems.	
<b>Content</b>	History and fundamentals of thermodynamics and energy engineering. Modern problems of power plant engineering, combined heat and power production especially from biomass. Fundamentals of steam and gas turbines in energy production. Systems engineering. Planning and implementation of energy systems. Economic optimization of energy system projects.	
<b>Modes of Study</b>	Lectures and case exercises 14 h, 1st period. Lectures and case exercises 14 h, 2nd period. Written assignment, examination.	

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<b>Evaluation</b>	0-5, examination 70%, written assignment 30%.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>BH50A1300</b>	<b>MAINTENANCE MANAGEMENT</b> <b>4 ECTS cr</b>
	<b>Maintenance Management</b>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-2
<b>Teacher(s)</b>	Docent, D.Sc. (Tech.) Juha Kaikko Person in Charge: Professor, D.Sc. (Tech.) Esa Vakkilainen
<b>Aims</b>	The course gives a comprehensive view towards organising, planning and diagnosing maintenance especially in power plants.
<b>Content</b>	Terminology. Maintenance strategies and monitoring. Failure mechanisms and reliability. Organisation and functions of maintenance management. Preventive maintenance. Spare part management. Maintenance information systems.
<b>Modes of Study</b>	Lectures and case exercises 14 h, 1st period. Lectures and case exercises 6 h, 2nd period. Written assignment. Examination.
<b>Evaluation</b>	0-5, written assignment 30%, examination 70%
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>BH50A1400</b>	<b>STEAM BOILERS</b> <b>6 ECTS cr</b>
	<b>Steam Boilers</b>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-2
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Esa Vakkilainen
<b>Aims</b>	Ability to understand steam generation. Understanding the construction of steam boilers. The course gives a comprehensive view towards steam boilers using different types of fuels. The course concentrates on boilers utilising biofuels.
<b>Content</b>	Characteristics of fuels especially biofuels. Combustion and gasification. Design of a steam boiler and its components. Energy balances. Solving steam boiler problems by mathematical modeling and algorithmization. Operation and maintenance of boilers: Corrosion, Fouling, Emissions.
<b>Modes of Study</b>	Lectures and case exercises 14 h, 1st period. Lectures and case exercises 14 h, 2nd period. Demonstrations with modeling programs. Written assignment.
<b>Evaluation</b>	0-5, written assignment 70%, work with programs 30%.
<b>Study materials</b>	Lecture notes. Teir, Sebastian: Steam Boiler Technology, 2nd ed. 2006.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>BH50A1500</b>	<b>BIOENERGY TECHNOLOGY SOLUTIONS</b> <b>6 ECTS cr</b>
	<b>Bioenergy Technology Solutions</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 2-3
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Esa Vakkilainen
<b>Aims</b>	The course gives a detailed view into the technological solutions used in the bioenergy sector, the fuel production and bioenergy end-use technologies. Students will learn about the fundamental aspects of the technology for using biofuels in the energy system.
<b>Content</b>	Comparison of various bioenergy visions. Technological solutions and case studies from biomass supply and biofuel refining, end-use technologies of biofuels in different sectors.
<b>Modes of Study</b>	Lectures 14 h. Assignment, seminar presentation. Written examination.
<b>Evaluation</b>	Examination 60%, assignment 40%.
<b>Study materials</b>	Energy Visions 2050 for Finland, VTT Energy, 2009. Additional material will be announced later during lectures.

<b>Prerequisites</b>	BH80G0000 Bioenergy	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BH50A1600</b>	<b>WASTE HEAT RECOVERY TECHNIQUES</b>	<b>6 ECTS cr</b>
	<b>Waste Heat Recovery Techniques</b>	
	<b>Examination language can also be Finnish. Tenttiin voi vastata myös suomeksi</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Esa Vakkilainen	
<b>Aims</b>	The course gives a comprehensive view towards different waste heat recovery techniques. Students familiarize themselves with industrial energy efficiency. Opportunities and drivers to recover waste heat. Dimensioning of waste heat recovery equipment. Economics of heat recovery units. Heat recovery in a heating and ventilation systems. Managing industrial energy efficiency programs. Suitable also for postgraduate studies.	
<b>Content</b>	Lectures 12 h, seminar work, written assignment, written examination.	
<b>Modes of Study</b>	0-5, 75% exam, 25 % seminar work and written assignment.	
<b>Evaluation</b>	Course material will be announced during lectures.	
<b>Study materials</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>Further Information</b>		
<b>BH60A1101</b>	<b>ENVIRONMENTAL TECHNOLOGY PROJECT WORK</b>	<b>2 - 7 ECTS cr</b>
	<b>Ympäristötekniikan erikoistyöt</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-4	
<b>Teacher(s)</b>	Person in Charge: Professor, D.Sc. (Econ. & Bus. Adm.), M.Sc. (Tech.) Lassi Linnanen	
<b>Aims</b>	The aim of the course is that students will learn how to apply research methodology to subjects relating to environmental technology, environmental management and/or environmental effects, and how to produce a research report.	
<b>Content</b>	Producing a research report on a given subject on the basis of a literature review. The subject of the research can also be assigned by an enterprise.	
<b>Modes of Study</b>	Advanced practical or seminar work 50-180 h, 1st-4th periods. The method of completion is agreed on with the supervising professor. No contact teaching.	
<b>Evaluation</b>	0-5, project work 100%	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BH60A1600</b>	<b>BASIC COURSE ON ENVIRONMENTAL MANAGEMENT AND ECONOMICS</b>	<b>5 ECTS cr</b>
	<b>Basic Course on Environmental Management and Economics</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 2, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.), M.Sc. (Tech.) Lassi Linnanen	
<b>Aims</b>	The aim of the course is to introduce students to the challenges that sustainable development poses to business and to the methods that control those challenges. After the course the student understands, what sustainable development means on business. The student identifies corporate stakeholders and is able to analyse their importance. The student is able to use and compare the tools for measuring eco-efficiency. The student recognises basic environmental	

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<b>Content</b>	labels and environmental management systems and understands the reasons for their use. The student is able to explain the basics of life cycle analysis. Identifying the influence of sustainable development on business. Identifying corporate stakeholders and their importance. Recognising tools and indicators of environmental management. Knowing the basics of LCA and environmental product design. Recognising eco labels, eco profiles and indicators of environmental load. Knowing the basics of building and maintaining an environmental management system.
<b>Modes of Study</b>	Intensive course. Lectures 24 h, 1st period. Written assignment, 1st and/or 2nd period.
<b>Evaluation</b>	Examination. Blackboard.
<b>Study materials</b>	0-5, examination 70 %, written assignment 20 %, case-exercises 10 %
<b>Further Information</b>	Literature will be announced later. This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BH60A2000</b>	<b>EMISSION TRADING</b>	<b>3 ECTS cr</b>
<b>Year and Period</b>	<b>Emission Trading</b>	
<b>Teacher(s)</b>	B.Sc. (Tech.) 3, Period 3-4	
<b>Aims</b>	Professor, D.Sc. (Econ. & Bus. Adm.), M.Sc. (Tech.) Lassi Linnanen	
<b>Content</b>	The goal of the course to provide students with the basics of different emission trading schemes and their effects on industry as well as consumers.	
<b>Modes of Study</b>	Topics include: greenhouse effect and climate change, the Kyoto protocol and Kyoto mechanisms, the EU emission trading scheme, the effect of EU emission trading on different industries.	
<b>Evaluation</b>	Lectures 14 h, 3rd period.	
<b>Study materials</b>	Assignment and seminars, 4th period.	
<b>Further Information</b>	Examination. Blackboard.	
<b>Prerequisites</b>	0-5, examination 75%, assignment 25 %	
	Course material will be announced later.	
	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BH60A2101</b>	<b>ADVANCED COURSE IN LIFE CYCLE ASSESSMENT</b>	<b>7 ECTS cr</b>
<b>Year and Period</b>	<b>Advanced Course in Life Cycle Assessment</b>	
<b>Teacher(s)</b>	<b>Replaces the course BH60A2100 Elinkaarimallintaminen. Teaching is conducted in Finnish/English.</b>	
<b>Aims</b>	M.Sc. (Tech.) 2, Period 1-2	
<b>Content</b>	Person in Charge: Professor, D.Sc. (Tech.) Risto Soukka	
<b>Modes of Study</b>	The aim of the course is for students to learn how to examine environmental and economic impacts during a life cycle (LCA and LCC).	
<b>Evaluation</b>	Drafting life cycle models using software and analysing the results competently.	
<b>Study materials</b>	Collecting data for life cycle inventory and delimiting the data collection in an applicable way. Choosing an operational unit and using open allocation in a closed system. Life cycle costing.	
<b>Prerequisites</b>	Lectures 14 h, written assignment, 1st period.	
	Written assignment, 2nd period.	
	Examination.	
	0-5, written assignments 75%, examination 25%.	
	Possible literature will be announced later.	
	Understanding the basics of life cycle thinking. BH60A1500 Basic Course on Environmental Management, BH60A0250 Solid Waste Management, BH60A0450 Air Pollution Management, BH60A0450 Air Pollution Management and BH60A0650 Wastewater Management Economics attended or	

<b>Further Information</b>	<p>corresponding knowledge.</p> <p>This course has 1-5 places for open university students. More information on the web site for open university instruction.</p>
<b>BH60A2401</b>	<b>ENERGY RECOVERY FROM SOLID WASTE 4 ECTS cr</b>
	<b>Energy Recovery from Solid Waste</b>
	<b>Replaces the course BH60A2400 Solid Waste Management related to Energy Production</b>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-2
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Mika Horttanainen
<b>Aims</b>	The course gives a comprehensive view on the waste-to-energy technologies. After completing the course students are expected to know principal waste-to-energy technologies and their main characteristics. It is also expected that students have formed a general view of the role of energy recovery in municipal waste management.
<b>Content</b>	Waste-to-energy in Finland and other countries, properties of waste as a fuel, waste handling before thermal conversion, preparation of recycled fuel, mass combustion of waste, combustion of recycled fuel, gasification of waste, energy recovery in combustion of waste, emission reduction during combustion, flue gas treatment, utilisation and treatment of ash, anaerobic digestion of waste, landfill gas utilisation in energy production.
<b>Modes of Study</b>	Lectures 16 h, exercises 14 h, 1 practical assignment, assignment info 2 h, examination.
<b>Evaluation</b>	Exam 60 %, practical assignment 40 %.
<b>Study materials</b>	Course book (to the appropriate extent): Niessen, W., 2002. Combustion and incineration processes. Marcel Dekker, Inc., New York. SBN: 0-8247-0629-3. Blackboard.
<b>Prerequisites</b>	Basic knowledge on thermodynamics, chemistry and power plant technology.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>BH70A0001</b>	<b>NUMERICAL METHODS IN HEAT TRANSFER 6 ECTS cr</b>
	<b>Numerical Methods in Heat Transfer</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2
<b>Teacher(s)</b>	Docent, D.Sc. (Tech.) Teemu Turunen-Saaresti Person in Charge: Professor, D.Sc. (Tech.) Timo Hyppänen
<b>Aims</b>	This course acquaints students with the key numerical methods in heat and mass transfer and with the use of these methods. After completing this course, students will understand the basic principles of numerical computation, the opportunities for their application as well as their limitations and know what sorts of methods exist. Students will also be able to use at least one method as well as one computation software for the computation of simple cases.
<b>Content</b>	Numerical solution methods for the conservation of mass, momentum and energy. Solutions for heat conduction and convection. The finite volume method. Formulation of discretised conservation equations. The solution of equation sets. Unsteady Stability analyses. Setting boundary conditions. The basics of fluid dynamics software: the grid generation, solution and post-processing of results.
<b>Modes of Study</b>	Lectures 12 h, exercises 12 h, 3rd period. Lectures 12 h, exercises 12 h, 4th period. Homework 20 h. Oral examination.
<b>Evaluation</b>	0-5, examination 100%.
<b>Study materials</b>	Noppa –portaali (noppa.lut.fi) Patankar, Suhas V.: Numerical Heat Transfer and fluid flow. Versteeg, H.K.: An introduction to Computational Fluid Dynamics, The Finite Volume Method.

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<b>Prerequisites</b>	BH20A0450 Heat Transfer and BH40A0000 Fluid Dynamics.	
<b>BH70A0200</b>	<b>ADVANCED TOPICS IN MODELLING OF ENERGY SYSTEMS</b>	<b>6 ECTS cr</b>
	<b>Advanced Topics in Modelling of Energy Systems</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Timo Hyppänen, Docent, D.Sc. (Tech.) Teemu Turunen-Saaresti, Docent, D.Sc. (Tech.) Juha Kaikko, D.Sc. (Tech.) Jouni Ritvanen, Lic.Tech. Juhani Vihavainen	
<b>Aims</b>	Person in Charge: Professor, D.Sc. (Tech.) Timo Hyppänen To introduce advanced problems in modeling of energy systems needed by engineers and researchers. The students are trained to perform design tasks, to utilize mathematical software in calculation, and to analyze the energy systems characteristics. Students will learn how to include material property definitions to mathematical software or to own code when simulating energy systems. Students will learn how various computer packages can be used to solve and analyze mass, heat and energy balances. The course lectures provide mathematical basis for problem formulation, and exercises providing a chance to work with various computational packages. Students will also learn how to solve simplified cases using their own codes. After this course, they will be able to start working on various topics in energy systems engineering.	
<b>Content</b>	Students will learn how to create stationary and time dependent mass, momentum and energy balances for various kinds of energy systems. Students will learn how to solve the set of balance equations using different kinds of solvers with mathematical software like Excel and MATLAB. Excel is mainly used to solve the set of stationary balance equations with user defined material property definitions using self-written solve algorithm. Students will learn the basic usage of Excel in addition to include Visual Basic macros for user defined material property definition at Excel and calling macros at Excel sheet. Students will learn how to introduce the set of time dependent balance equations at MATLAB and how to solve the set of time dependent equations using built-in solvers. Students will learn data post-processing techniques in case of time dependent data. IPSEpro is software for steady state simulation of industrial processes. It can be used for simulating the performance at design as well as outside design conditions. The software is based on a graphical user interface. The process model can be constructed using standard components and fluids from the software or they can be developed by the user. APROS (Advanced Process Simulation Environment) is used to simulate dynamic industrial processes (power plants and/or nuclear plants). APROS can be used to model gas and liquid flows with heat transfer, connected to automation and control circuits. Processes can be built using graphical user interface, where all the necessary system and input data can be defined. Several different solvers can be used at APROS. Students will learn how to create transient industrial processes at APROS, and to simulate and analyze the dynamic energy systems.	
<b>Modes of Study</b>	Lectures 12 h and case exercises 12 h, 1st period. Lectures 12 h and case exercises 12 h, 2nd period. Work with modeling programs. Written assignment.	
<b>Evaluation</b>	0-5, written assignment 70%, work with programs 30%.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BH80G0000</b>	<b>BIOENERGY</b>	<b>3 ECTS cr</b>
	<b>Bioenergy</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Tapio Ranta	
<b>Aims</b>	The course gives a comprehensive view into the whole bioenergy chain – biofuel production, refining and end use. Students will gain an overview of the	

<b>Content</b>	biofuel-based energy systems. The role of bioenergy in the EU energy policy, incentive programmes and future plans. Raw-material sources of bioenergy, resources and current use. Biomass supply systems and biofuel refining technologies, logistics and international trade. Quality control and standards. Biogas, solid and liquid biofuels.
<b>Modes of Study</b>	Lectures 14 h. Written examination.
<b>Evaluation</b>	Examination 100%.
<b>Study materials</b>	Blackboard. Energy Visions 2030 for Finland, VTT Energy, 2001. Additional material will be announced later during lectures.

<b>BL20A0201</b>	<b>POWER EXCHANGE GAME FOR ELECTRICITY 3 ECTS cr MARKETS</b>
	<b>Power Exchange Game for Electricity Markets</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 2-3
<b>Teacher(s)</b>	Doctoral student, M.Sc. (Tech.) Mari Makkonen Person in Charge: Professor, D.Sc. (Tech.) Satu Viljainen
<b>Aims</b>	Upon completion of the course the student will be able to <ul style="list-style-type: none"> <li>• plan electricity purchase and sale in an economically viable way,</li> <li>• recognise the most common risk management instruments,</li> <li>• exploit financial products of the power exchange in risk management and</li> <li>• trade electricity on day ahead and intraday markets.</li> </ul> These skills will be practised in a power exchange game, after which the student will be able to analyse and interpret the game results.
<b>Content</b>	Electricity purchase/sale, OTC markets, physical products on the power exchange (spot and elbas), financial products on the power exchange (forwards, futures and options), risk management.
<b>Modes of Study</b>	Lectures 8 h, weekly game situation practice 40 h, 2nd and 3rd period. Written homework, intermediate report and final report.
<b>Evaluation</b>	0 - 5, written report 100%.
<b>Study materials</b>	Material handed out in class.
<b>Prerequisites</b>	BL20A0400 Electricity market
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BL20A0401</b>	<b>ELECTRICITY MARKET</b>	<b>5 ECTS cr</b>
	<b>Electricity Market</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1	
<b>Teacher(s)</b>	Person in Charge: Professor, D.Sc. (Tech.) Jarmo Partanen, Professor, D.Sc. (Tech.) Satu Viljainen	
<b>Aims</b>	Upon completion of the course the student will be able to <ul style="list-style-type: none"> <li>• describe the characteristics of the different business sectors in the Nordic electricity market,</li> <li>• explain electricity price formation,</li> <li>• model electricity consumption,</li> <li>• explain the operation principle of the power exchange,</li> <li>• identify and describe the products of the power exchange,</li> <li>• select the right risk management method for electricity trade,</li> <li>• describe the tasks of the different parties in an electric power system in maintaining technical and commercial power balance,</li> <li>• conduct the balance settlement,</li> <li>• price the products of electricity trade and distribution and</li> <li>• describe why and how electricity distribution business is regulated.</li> </ul>	



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<b>Content</b>	The development of electricity markets, loads on the electricity network and load forecasts, power exchange, electricity trade, balance management, the fundamentals of pricing and regulation of distribution business.
<b>Modes of Study</b>	28 h of lectures, 14 h of tutorials, 1st period. Independent studies. Written examination.
<b>Evaluation</b>	0 - 5, examination 100%.
<b>Study materials</b>	Material distributed in class.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BL20A0501</b>	<b><i>ELECTRICITY DISTRIBUTION TECHNOLOGY 8 ECTS cr</i></b>
	<b>Electricity Distribution Technology</b>
	<b>The course is part of the Master's Degree Programme in English. Teaching is conducted in Finnish and English.</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Jarmo Partanen, Postdoctoral Researcher, D.Sc. (Tech.) Jukka Lassila
<b>Aims</b>	Upon completion of the course the student will be able to <ul style="list-style-type: none"><li>• perform technical and financial calculations related to electricity distribution networks: voltages, currents, losses, fault currents, reliability, investment, outage and maintenance costs,</li><li>• compile long-term strategic development plans related to electricity distribution networks,</li><li>• carry out techno-economic dimensioning of an electricity distribution network.</li><li>• explain the targets and principles of the use of electricity distribution networks</li><li>• utilise the distribution automation applications in the operation of a distribution network and</li><li>• design short circuit and earth fault protection in electricity distribution networks.</li></ul>
<b>Content</b>	Network design; the use, protection and automation of distribution networks; information systems of distribution companies. Network design; the use, protection and automation of distribution networks; information systems of distribution companies.
<b>Modes of Study</b>	42 h of lectures, 28 h of tutorials, 1st and 2nd period. Written examination.
<b>Evaluation</b>	0–5, examination 100 %.
<b>Study materials</b>	Lakervi, E. & Partanen, J.: Sähkönjakeluteknikka (Otatieto, moniste 609).
<b>Prerequisites</b>	BL20A0700 Introduction to Electrical Power Systems, BL20A0601 Electrical Power Transmission and BL20A0401 Electricity Market attended.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BL20A0601</b>	<b><i>ELECTRICAL POWER TRANSMISSION 5 ECTS cr</i></b>
	<b>Electrical Power Transmission</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 2
<b>Teacher(s)</b>	Person in Charge: Professor, D.Sc. (Tech.) Jarmo Partanen
<b>Aims</b>	Upon completion of the course the student will be able to <ul style="list-style-type: none"><li>• describe the operation principle of an electric power system,</li><li>• explain and determine the principles of frequency and voltage control in an electric power system, including the special features of the Nordel system,</li><li>• calculate the power flow and fault currents in meshed power transmission systems,</li><li>• calculate the static and transient stability of a single generator,</li><li>• describe the basic techniques and application targets of DC transmission and</li><li>• explain the implementation principles of fault protection in a meshed power transmission network.</li></ul>
<b>Content</b>	The description of the electricity transmission system. Frequency and voltage

<b>Modes of Study</b>	control. Calculation of load flow, fault currents and stability in a meshed network. DC power transfer. Relay protection.
<b>Evaluation</b>	24 h of lectures, 14 h of tutorials, 2nd period. Written examination.
<b>Study materials</b>	0 - 5, examination 100%.
<b>Prerequisites</b>	Kothari, Nagrath: Modern Power System Analysis
<b>Further Information</b>	Students are required to have completed BL30A0000 Electric Circuits and attended the lectures of BL20A0700 Introduction to Electrical Power Systems. This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BL30A0400</b>	<b>DESIGN OF AN ELECTRICAL MACHINE</b>	<b>6 ECTS cr</b>
	<b>Design of an Electrical Machine</b>	
	<b>The Course will be given in English. Suomenkielinen opetusmoniste sekä suomenkieliset harjoitustehtävät ovat saatavilla. Tenttiin saa vastata suomeksi.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Juha Pyrhönen	
<b>Aims</b>	Upon completion of the course the student will be able to <ul style="list-style-type: none"> <li>• perform a basic design of a rotating electrical machine,</li> <li>• name the simplest winding arrangements and other components of the machine,</li> <li>• explain the torque production process in electrical machines,</li> <li>• calculate the main data (equivalent circuit parameters) of an electrical machine from machine geometric and winding designs,</li> <li>• list the most important materials used in magnetic circuits and windings,</li> <li>• model the machine with an equivalent circuit,</li> <li>• compare machine designs with each other by using the per unit presentation of machines,</li> <li>• use phasor diagrams in the machine analysis and</li> <li>• discuss the problems of insulation systems and heat transfer.</li> </ul>	
<b>Content</b>	Electromagnetic principles used in machine design, the magnetic circuit of an electric machine, the windings of an electric machine, impacts of the structure of the electric motor on the motor characteristics, calculation of the parameters of an equivalent circuit from the dimensions of the machine (resistances, inductances), effective-value phasor diagrams for different machine types, principles of electric machine design, insulation materials and systems heat transfer. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	28 h of lectures, 28 h of tutorials, 1st period.	
<b>Evaluation</b>	The design assignment of an electric machine. Written examination.	
<b>Study materials</b>	0–5, written examination 100 %. Satisfactorily completed assignment required. Pyrhönen, Jokinen, Hrabovcova: Design of Rotating Electrical Machines (Pyörivän sähkökoneen suunnittelu).	
<b>Prerequisites</b>	Students are recommended to have completed BL30A0000 Electric Circuits, BL10A0100 Basics of Electric Engineering.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BL30A0600</b>	<b>POWER ELECTRONICS</b>	<b>6 ECTS cr</b>
	<b>Power Electronics</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Researcher/Teacher, D.Sc. (Tech.) Lasse Laurila	
<b>Aims</b>	Upon completion of the course the student will be able to <ul style="list-style-type: none"> <li>• demonstrate good general knowledge of the different basic main circuits in modern power electronics,</li> <li>• describe the features and functions of different rectifiers, switch-mode converters and inverters,</li> </ul>	

<b>Content</b>	<ul style="list-style-type: none"> <li>• calculate and simulate typical design tasks of the aforementioned circuits and</li> <li>• describe the joint operation of static converters and loads as well as the network interferences caused by converters and alternatives to reduce these interferences.</li> </ul> <p>Operation of the main circuits of different power converters: rectifiers (single and three-phase), DC-DC switch mode converters and power supplies (buck, boost, buck-boost, Cúk, flyback, forward), inverters (single and three-phase), resonance converters (ZVS, ZCS). Characteristics and operation. Pulse width modulation (PWM). Harmonic components. Simulation of power electronic circuits. This course is also suitable for postgraduate students.</p>
<b>Modes of Study</b>	14 h of lectures, 14 h of tutorials, 1st period. 14 h of lectures, 14 h of tutorials, 2nd period. Written examination.
<b>Evaluation</b>	0–5, examination 100 %.
<b>Study materials</b>	Mohan, Undeland, Robbins: Power Electronics, converters, applications, and design, where applicable.
<b>Prerequisites</b>	BL30A0000 Electric Circuits. Integration and derivation (esp. sine and cosine functions). FFT. Laplace transforms.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BL30A1001</b>	<b>ELECTRICAL DRIVES</b>	<b>8 ECTS cr</b>
	<b>Electrical Drives</b>	
	<b>The Course will be given in English. Suomenkielinen opetusmoniste sekä suomenkieliset harjoitustehtävät ovat saatavilla. Tenttiin saa vastata suomeksi.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 2-3	
<b>Teacher(s)</b>	Person in Charge: Professor, D.Sc. (Tech.) Juha Pyrhönen	
<b>Aims</b>	Upon completion of the course the student will be able to	
	<ul style="list-style-type: none"> <li>• describe the principles of scalar, vector and direct torque control of rotating field machines,</li> <li>• model the behaviour of different synchronous and asynchronous machines by using vector equivalent circuits and vector diagrams,</li> <li>• name the main ideas of the electromagnetic design and performance of different rotating machines,</li> <li>• select a suitable electrical machine for a certain purpose and evaluate their thermal limits in cyclic operation,</li> <li>• define the most important power electronic converters and their properties in different applications,</li> <li>• discuss the principles of PWM, space vector modulation and DTC and</li> <li>• discuss the adverse effects of PWM systems on motor behaviour and the wave nature of the motor cable.</li> </ul>	
<b>Content</b>	Theory of electric motor drives, operation and vector equivalent circuits. Synchronous machine drives, asynchronous machine drives, synchronous reluctance machine drives, permanent magnet synchronous machine drives, switched reluctance motor drives. Torque production in different machines. Power electronic converters suitable for motor and generator drives. Scalar control, vector control, direct flux linkage control and direct torque control (DTC). Motor cable wave nature, bearing currents. Suitable also for post graduate studies.	
<b>Modes of Study</b>	Lectures and seminars 28 h, tutorials 20 h, 2nd period. Lectures and seminars 28 h, tutorials 20 h, 3rd period.	
<b>Evaluation</b>	0–5, written examination 100 %.	
<b>Study materials</b>	Pyrhönen, Juha: Electrical Drives, lecture material.	
<b>Prerequisites</b>	The students are recommended to have completed the courses BL30A0000 Electric Circuits, BL10A0100 Basics of Electric Engineering, BL30A0200 Laboratory Course in Electrical Engineering, BL30A0500 Introduction to Electrical Drives and BL30A0800 Electromagnetic Components and to have	

<b>Further Information</b>	attended the courses BL30A0400 Design of an Electrical Machine and BL30A0900 Power Electronic Components. This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BL30A1200</b>	<b>NUMERICAL METHODS IN ELECTROMAGNETISM</b>	<b>4 ECTS cr</b>
<b>Year and Period</b>	<b>Numerical Methods in Electromagnetism</b>	
<b>Teacher(s)</b>	M.Sc. (Tech.) 2, Period 3	
<b>Aims</b>	Assistant professor, D.Sc. (Tech.) Janne Nerg Upon completion of the course the student will be able to	
<b>Content</b>	<ul style="list-style-type: none"> <li>• model and analyse electrical machines using commercial finite element based calculation software.</li> </ul> The fundamentals of the element method, boundary conditions, modelling of materials, post-processing of results. Iron loss models. Eddy current problems, utilisation of circuit model in calculation. This course is also suitable for postgraduate students.	
<b>Modes of Study</b>	28 h of supervised tutorials. 3rd period. Course requirements: participation in tutorials and a satisfactorily completed assignment.	
<b>Evaluation</b>	0–5, assignment 100 %.	
<b>Prerequisites</b>	BL30A0500 Introduction to Electrical Drives and BL30A0400 Design of an Electrical Machine.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BL40A1000</b>	<b>REAL-TIME OPERATING SYSTEMS AND PROGRAMS</b>	<b>5 ECTS cr</b>
<b>Year and Period</b>	<b>Real-time Operating Systems and Programs</b>	
<b>Teacher(s)</b>	M.Sc. (Tech.) 2, Period 1-2	
<b>Aims</b>	Assistant professor, D.Sc. (Tech.) Julius Luukko Upon completion of the course the student will be able to	
<b>Content</b>	<ul style="list-style-type: none"> <li>• utilise the services of a real-time operating system,</li> <li>• design the architecture of an application program using a real-time operating system as its basis and</li> <li>• implement a simple real-time operating system using the C language.</li> </ul> Basic concepts of a real-time system. Services provided by a real-time operating system: task management, time management, semaphores, mutual exclusion semaphores (mutex), event flags, mailboxes, message queues, and memory management. Implementation of a real-time operating system: context switch, interrupt management. Processor-specific parts of a real-time operating system and adapting the real-time operating system to a new processor.	
<b>Modes of Study</b>	21 h of lectures, 14 h of tutorials, 1st period. 21 h of lectures, 14 h of tutorials, assignment, 2nd period. Written examination.	
<b>Evaluation</b>	0–5, examination 100 %. Satisfactorily completed assignment required.	
<b>Study materials</b>	Labrosse, J.J.: MicroC/OS-II The Real-Time Kernel (2nd Edition).	
<b>Prerequisites</b>	BL40A1100 Embedded System Programming.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BL40A1100</b>	<b>EMBEDDED SYSTEM PROGRAMMING</b>	<b>4 ECTS cr</b>
<b>Year and Period</b>	<b>Embedded System Programming</b>	
<b>Teacher(s)</b>	M.Sc. (Tech.) 1, Period 1-2 Assistant professor, D.Sc. (Tech.) Tuomo Lindh	

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<b>Aims</b>	Upon completion of the course the student will be able to <ul style="list-style-type: none"><li>• apply C language and its structures to embedded system programming,</li><li>• form complex data types such as structures, unions and buffers and use these in order to maintain information of different entities (e.g. processing units),</li><li>• control the registers of a micro controller using C-language and</li><li>• use different PUs of a micro controller.</li></ul>
<b>Content</b>	Design tools, C-language in embedded system programming, utilisation of microcontroller environment (registers, timers, buses, A/D conversion etc.). Typical data structures, typical program structures in real-time applications. Programming the Windows interface, basic properties of real-time operating systems.
<b>Modes of Study</b>	14 h of lectures, 14 h of tutorials, 1st period. 14 h of lectures, 14 h of tutorials, 2nd period. Assignment. Written examination.
<b>Evaluation</b>	0–5, examination 100 %. Satisfactorily completed assignment required.
<b>Study materials</b>	Wolf, W.: Computers as components: principles of embedded computing system design. Lecture notes.
<b>Prerequisites</b>	Basics of C language.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BL40A1200</b>	<b>DIGITAL CONTROL DESIGN</b>	<b>4 ECTS cr</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Postdoctoral Researcher, D.Sc. (Tech.) Rafal Jastrzebski	
<b>Aims</b>	Upon completion of the course the student will be able to <ul style="list-style-type: none"><li>• design digital state-space controllers (pole placement, optimal control) and transfer function controllers,</li><li>• compare and discriminate between different discretisation techniques and different control design methods,</li><li>• relate knowledge from the areas such as system modelling, model discretisation, designing digital control in a discrete time domain, computer simulation, and digital implementation</li><li>• describe and explain the exemplary control systems and interpret system responses</li><li>• apply the selected control design methods and system modelling concepts to new control problems that involve electromechanical systems.</li></ul>	
<b>Content</b>	State feedback, state estimator, design of a state-space controller, polynomial control design, optimal control, disturbance estimation. Fundamentals of a multivariable control system. Simulation of a digital control system with Simulink. Programming of digital control for a microprocessor. Control design examples including control of real MIMO industrial systems. Utilisation of MATLAB in control design.	
<b>Modes of Study</b>	14 h of lectures, 14 h of tutorials, 1st period. 6–10 h of demonstration lectures and laboratory demonstrations, 14 h of tutorials in computer class, 2nd period. Assignment. Written examination.	
<b>Evaluation</b>	0–5, examination 100 %. Satisfactorily completed assignment required.	
<b>Prerequisites</b>	BL40A0200 Control Systems Introduction and BL40A0501 Digital Control, Introduction.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	

<b>BL40A1810</b>	<b>MICROPROCESSORS A</b>	<b>6 ECTS cr</b>
<b>Year and Period</b>	B.Sc. (Tech.) 3, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Jero Ahola	
<b>Aims</b>	The course is an introductory to embedded systems. Upon completion of the	

<b>Content</b>	<p>course the student will be able to</p> <ul style="list-style-type: none"> <li>• identify different microprocessor types and peripheral components,</li> <li>• describe the operation principles of microprocessor and its' peripheral components</li> <li>• program and test applications to embedded microcontroller by using both assembly and C languages.</li> </ul>
<b>Modes of Study</b>	<p>Architecture of microprocessor, instruction set and operation, microcontrollers, memories, peripherals, embedded system design, programming and development of applications, embedded system design examples.</p> <p>Lectures 14 h, exercises, 14 h, 3rd period.</p>
<b>Evaluation</b>	<p>Lectures 14 h, exercises, 14 h, 4th period, assignment, examination.</p> <p>0–5, examination 100 %. Satisfactorily completed assignment required.</p>
<b>Study materials</b>	<p>Vahid/Givargis: Embedded System Design - A Unified Hardware/Software Introduction.</p> <p>Lecture material.</p>
<b>Prerequisites</b>	<p>Basics of digital design, basics of electronics, basics of programming.</p>
<b>Further Information</b>	<p>This course has 11-15 places for open university students. More information on the web site for open university instruction.</p>

<b>BL40A2201</b>	<b>PROCESS AND PRODUCT INNOVATIONS</b>	<b>10 ECTS cr</b>
	<b>Process and Product Innovations</b>	
	<b>Intended mainly for Finnish and international students from the departments of Chemical Technology, Mechanical Engineering, Electrical Engineering and Industrial Engineering and Management. The number of participants is limited and the applicants will be interviewed.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Olli Pyrhönen, Professor, D.Sc. (Tech.) Tuomo Kässi, Associate Professor, D.Sc. (Tech.) Kimmo Kerkkänen, Associate Professor, D.Sc. (Tech.) Ville Ojanen	
<b>Aims</b>	<p>Person in Charge: Professor, D.Sc. (Tech.) Ilkka Turunen</p> <p>Upon completion of the course the student will be able to</p> <ul style="list-style-type: none"> <li>• recognise and describe the generation of innovations and new technology, typical methods, problems and their solutions,</li> <li>• work in projects and teams in interdisciplinary, international environments,</li> <li>• describe and explain product and process development and</li> <li>• apply and deepen many skills learned in other connections.</li> </ul>	
<b>Content</b>	<p>Methods of product and process development. Interdisciplinary R &amp; D activities as project and teamwork. Development of new technology, patenting. Suitable also for postgraduate studies.</p>	
<b>Modes of Study</b>	<p>Informational lectures, 6 h/period.</p> <p>Project meetings, 6 h/period.</p> <p>Independent project and team work in groups of 4–8 students.</p>	
<b>Evaluation</b>	0–5, project work 100 %.	

<b>BL50A0600</b>	<b>ELECTROMAGNETIC COMPATIBILITY IN POWER ELECTRONICS</b>	<b>2 ECTS cr</b>
	<b>Electromagnetic compatibility in power electronics</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Pertti Silventoinen	
<b>Aims</b>	<p>Upon completion of the course the student will be able to</p> <ul style="list-style-type: none"> <li>• describe the coupling mechanisms of electromagnetic interferences in power electronics,</li> <li>• name the most significant sources of electromagnetic emissions in power electronic systems,</li> <li>• recognise and be aware of cable reflection in electrical drives and</li> </ul>	

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<b>Content</b>	<ul style="list-style-type: none"><li>list the suitable filter types for common mode filtering, du/dt filtering and harmonics filtering.</li></ul> The course can also be included in post-graduate studies.
<b>Modes of Study</b>	Power electronics as an interference source, network harmonics, reflection phenomena of cables, conductive RF interference, interference radiation of power electronics, filtering techniques of conductive interferences.
<b>Evaluation</b>	14 h of lectures, 1st period.
<b>Further Information</b>	An assignment to be completed as pair work. Written examination. 0–5, written examination 100 %. Satisfactorily completed assignment required. This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b>BL50A1300</b>	<b>ADVANCED COURSE IN ELECTRONICS</b>	<b>6 ECTS cr</b>
	<b>Advanced Course in Electronics</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Pertti Silventoinen, Professor, D.Sc. (Tech.) Jero Ahola	
<b>Aims</b>	The student prepares a seminar presentation on a new topic in electronics. Upon completion of the course the student will be able to <ul style="list-style-type: none"><li>demonstrate in-depth knowledge of a new topic in electronics.</li></ul> The course is suitable also for postgraduate studies.	
<b>Content</b>	The course contents are subject related and will be specified during the introductory lectures.	
<b>Modes of Study</b>	2h of introductory lectures 2 h, 12 h of seminar presentations, 3rd period. 14 h of seminar presentations, 4th period. No written examination.	
<b>Evaluation</b>	0–5, seminar presentation 100 %.	
<b>Study materials</b>	The material will be specified in the introductory lecture.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

### 4.3. Master's Degree Programme in Mechanical Engineering

In the Master's degree programme in Mechanical Engineering there is a possibility to select between two majors, major in Design and Manufacturing or major in Packaging Technology. The major in "Design and Manufacturing" corresponds to 120 ECTS credits and two years of full-time studies in which all lectures and laboratory work are conducted in English. The first three semesters include 90 ECTS credits of classroom and laboratory instruction. The Master's thesis of 30 ECTS credits is conducted in the fourth semester, after other courses have been completed. The major in "Packaging Technology" is a part-time programme leading to the degree of Master of Science in Technology. Teaching is organized as intensive teaching periods (4-5 days at a time) during the academic year, and distance learning solutions are widely used. Students have two years (90 ECTS credits) of coursework in which all lectures, exercises and laboratory work are conducted in English. The Master's thesis (30 ECTS credits) will be conducted after the other courses have been completed. Both majors in the programme leads to the degree of Master of Science in Technology.

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

The objective in both majors is to educate experts in their own areas. In the "Design and Manufacturing" major particular emphasis is placed on future product design and production technologies. The aim is 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.

In the "Packaging Technology" major the emphasis is on packaging materials, converting and packaging technologies and the skills to work throughout the whole packaging chain. This is aimed at students already working in packaging related businesses or wishing to pursue a career in the industry dealing with packaging.

#### Careers for Graduates

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

#### The Degree Structure of the Programme

<b>Degree Structure</b>		
General Studies	7-9	ECTS cr
Major Subject	30 (min.)	ECTS cr
Minor Subject	20 (min.)	ECTS cr
Elective Studies	31-33 (min.)	ECTS cr
Master's Thesis and Seminar	30	ECTS cr
<i>Total</i>	<i>120 (min.)</i>	<i>ECTS cr</i>

#### General Studies (7-9 ECTS cr):

General studies are common to all the students in the programme. The studies provide a brief introduction to the field of mechanical engineering as well as language skills essential for M.Sc. studies.



### Major Subject Design and Manufacturing (min 60 ECTS cr):

The person responsible for major in Design and Manufacturing is professor, D.Sc. (Tech.) Aki Mikkola

In the mechanical engineering programme, students focus on machine design and manufacturing aspects. In the machine design studies, students learn both the theory and practice of developing mechanical engineering systems for performance, strength and durability. They learn to use state-of-the-art computer tools for creating and testing virtual prototypes in such that complex mechatronic systems and structures can be designed, tested and optimized before a prototype is fabricated. In the manufacturing studies, students learn about modern production systems and production planning. Special emphasis is given to welding technology, laser processes (welding, cutting and heat treatment), high technology machining operations and sheet metal and plate forming. In addition, studies on new metallic and non-metallic materials are included in the programme.

The person responsible for major in Design and Manufacturing is professor Aki Mikkola (Machine design). Other professors for major studies in the programme are professor Jukka Martikainen (Welding technology), professor Veli Kujanpää or professor Antti Salminen (Laser processes) and professor Juha Varis (Production technology).

### Major Subject Packaging Technology (min 60 ECTS cr):

The person responsible for major in Packaging Technology is professor, Ph.D Henry Lindell

In the mechanical engineering programme, students focus on machine design and manufacturing aspects. In the packaging technology the viewpoint is the packaging machine. Students learn about packaging materials, the converting of packaging materials into packages and the interaction of the package and the content. The design part is focused both on the design of packages and machine constructions needed to convert the packaging material into packages. The legislation influencing the packaging value chain is considered as well as the environmental impact of the various packaging materials and production methods.

The person responsible for major in Packaging Technology is professor Henry Lindell (Packaging Technology). Other professors for major studies in the programme are professor professor Juha Varis (Production technology) and visiting professor Jurkka Kuusipalo (Converting Technology).

### General Studies 7-9 ECTS cr

<i>General Studies</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BK10A0300 Introduction to M.Sc. Studies	M.Sc. (Tech.) 1	1	1
FV11A6500 Presenting in English	B.Sc. (Tech.) 2-3 M.Sc. (Tech.) 1-2 B.Sc. (Econ. & Bus. Adm.) 2-3 M.Sc. (Econ. & Bus. Adm.) 1-2	1, 2, 3, 4	2
FV11A8900 Academic Writing in English	B.Sc. (Tech.) 3 M.Sc. (Tech.) 1-2 B.Sc. (Econ. & Bus. Adm.) 3 M.Sc. (Econ. & Bus. Adm.) 1-2	1-2, 3-4, 5	4
FV18A9101 <sup>c</sup> Finnish 1		1, 3	2

<sup>c</sup> Foreign students are required to study at least one course of Finnish language

### Major in Design and Manufacturing

<i>Min. 30 ECTS cr (+ Master's Thesis and Seminar 30 ECTS cr) should be selected.</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BK10A0100 Individual Project Work	M.Sc. (Tech.) 1	1-4	6
BK20A0100 Materials Science	M.Sc. (Tech.) 1	1-2	6
BK20A0400 Modern Welding Technology	M.Sc. (Tech.) 1	1-2	7
BK30A0500 Laser Processing	M.Sc. (Tech.) 1	1-2	5
BK50A0700 Advanced Production Engineering	M.Sc. (Tech.) 1	1-2	7
BK60A0300 Servo Control Engineering	M.Sc. (Tech.) 1	1-2	6
BK70A0000 Simulation of a Mechatronic Machine	M.Sc. (Tech.) 1	3-4	6
BK80A1200 FE-analysis course	M.Sc. (Tech.) 1	3-4	5

Thesis <sup>c</sup>	Master's Thesis and Seminar	30
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<sup>c</sup>) Obligatory for all

### Major in Packaging Technology

<i>Min. 30 ECTS cr (+ Master's Thesis and Seminar 30 ECTS cr) should be selected.</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BK10A0100	Individual Project Work	M.Sc. (Tech.) 1	1-4	6
BK20A1300	Packaging Materials	M.Sc. (Tech.) 1	1-2	4
BK20A1400	Coating and Lamination of Fibre Based Packaging Materials	M.Sc. (Tech.) 1	1-3	5
BK50A1201	Machine Design for Packaging Technology	M.Sc. (Tech.) 1	Intensive	4
BK50A1300	Converting and Forming of Fibre Based Packaging	M.Sc. (Tech.) 2	1-2	5
BK50A1401	Packaging Lines and Machinery	M.Sc. (Tech.) 2	3-4	7
BK50A2000	Legislation on Packaging, Interaction of Package and the Content, Environmental Issues and Sustainability	M.Sc. (Tech.) 1	3-4	5
BK50A2100	Printing and Package Design	M.Sc. (Tech.) 2	1-2	6
Thesis <sup>c</sup>	Master's Thesis and Seminar			30

<sup>c</sup>) Obligatory for all

### Minor in Packaging Technology

<i>Obligatory Studies (20 ECTS cr)</i>		<i>per.</i>	<i>ECTS cr</i>
BK20A1300	Packaging Materials	1-2	4
BK20A1500	Principles of Chemistry, Paper Technology and Food Technology	1-4	5
BK50A1201	Machine Design for Packaging Technology	Intensive	4
BK50A1401	Packaging Lines and Machinery	3-4	7

### Minor in Manufacturing

<i>Obligatory Studies (21 op)</i>		<i>per.</i>	<i>op</i>
BK20A0100	Materials Science	1-2	6
BK20A2200	Basics of Welding Technology	2	3
BK30A0500	Laser Processing	1-2	5
BK50A0700	Advanced Production Engineering	1-2	7

#### Minor Subject (min. 20 ECTS cr):

Students can choose any minor subject taught at LUT if the required prerequisites are completed.

#### Elective Studies (min. 31-33 ECTS cr):

Elective studies can include any courses offered by LUT if the required prerequisites are completed. Studies in other universities may be included upon application. Elective studies may include a maximum of 6 ECTS credits of internship improving expertise.

#### Master Thesis and Seminar (30 ECTS cr):

The Master's thesis is a research or design project, which will be written after the other courses have been completed. It is carried out in the field of the student's major subject.

## Additional Information

### Personal Study Plans

The personal study plan (PSP) is the student's own plan how s/he is going to complete the Master's degree. The degree structure of the Master's programme determines the frame of the studies. At the Master's level, the student makes the PSP by the end of 1<sup>st</sup> period, and submits it to Study Coordinator for approval. The electronic personal study plan (ePSP, in Finnish eHOPS) is a tool for drawing the plan up. The students of the Faculty of Technology are recommended to complete the PSP in an electronic form by using the ePSP tool at WebOodi.

### **Credit Transfers**

ECTS credits can be transferred from the student's previous university level studies or higher university degrees from Finnish or foreign universities. More information on credit transfer is available from Study Coordinator.

### **Complementary Studies**

Students with a Finnish degree from the University of Applied Sciences or equivalent may have to study complementary studies. The extent of these studies depends on the content of the previous degree. More information is available from Study Coordinator.

### **Maturity Test**

Students must take a maturity test to show how well they know the topic of their Master's thesis. The test evaluates the student's familiarity with the theories and problems of the thesis. The students are asked to contact their supervising professors to agree how the maturity test is taken, that is, as a seminar presentation or as a written test. The maturity test is evaluated on a scale of passed/failed by the supervising professor of the thesis.

### **Further Information**

Professor, D.Sc. (Tech.) Aki Mikkola  
Phone +358 5 621 2447, room 1560, aki.mikkola(at)lut.fi

Study Coordinator, Faculty of Technology:  
Ms. Minna Loikkanen  
Phone +358 40 824 1096, minna.loikkanen(at)lut.fi

## The Courses Offered in English

		<i>ECTS cr</i>
BK10A0100	Individual Project Work	6
BK10A0300	Introduction to M.Sc. Studies	1
BK10A1100	Laboratory Work Course in Mechanical Engineering	10 - 30
BK20A0100	Materials Science	6
BK20A0400	Modern Welding Technology	7
BK20A1300	Packaging Materials	4
BK20A1400	Coating and Lamination of Fibre Based Packaging Materials	5
BK20A1500	Principles of Chemistry, Paper Technology and Food Technology	5
BK20A2200	Basics of Welding Technology	3
BK30A0500	Laser Processing	5
BK50A0700	Advanced Production Engineering	7
BK50A1201	Machine Design for Packaging Technology	4
BK50A1300	Converting and Forming of Fibre Based Packaging	5
BK50A1401	Packaging Lines and Machinery	7
BK50A1601	Functions of Package, Packaging Formats and Package Design	5
BK50A2000	Legislation on Packaging, Interaction of Package and the Content, Environmental Issues and Sustainability	5
BK50A2100	Printing and Package Design	6
BK60A0300	Servo Control Engineering	6
BK60A0601	Process and Product Innovations	10
BK70A0000	Simulation of a Mechatronic Machine	6
BK80A1200	FE-analysis course	5
BK80A1401	Fatigue Design	6

<b>BK10A0100</b>	<b>INDIVIDUAL PROJECT WORK</b>	<b>6 ECTS cr</b>
	<b>Individual Project Work</b>	
	<b>Only for the students of Master's Degree Programme in Mechanical Engineering</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-4	
<b>Teacher(s)</b>	Professors of the Degree Programme of Mechanical Engineering	
<b>Aims</b>	To prepare the student for a scientific approach in the M.Sc. thesis work.	
<b>Content</b>	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>Modes of Study</b>	10 h of lectures, 1st-4th period. 150 h of tutorials and independent projects, 1st-4th period.	
<b>Evaluation</b>	Pass/Fail, based on written report and oral presentation.	
<b>Prerequisites</b>	Consent of supervising professor.	
<b>BK10A0300</b>	<b>INTRODUCTION TO M.SC. STUDIES</b>	<b>1 ECTS cr</b>
	<b>Introduction to M.Sc. Studies</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1	
<b>Teacher(s)</b>	N. N. Information Specialist, M.Sc. (Tech.) Marja Talikka Study Coordinator, M.A. Minna Loikkanen	
<b>Aims</b>	Person in Charge: Study Coordinator, M.A. Minna Loikkanen As an introductory course at Master's level, the course provides the student with basic knowledge of studying at LUT in general and particularly at his/her faculty and degree programme. The course helps the student to plan his/her studies at LUT and follow the progress of his studies with a help of the personal study plan.	
<b>Content</b>	The student learns to use the Blackboard learning base which is widely used at LUT. The key topic of the web course is to learn about information searching and the information sources available at LUT. After completing the course, the student knows how to search the Library online catalog Wilma and how to find printed and electronic material from the library collections and databases. The Orientation Days activities. Degree requirements. Planning of Master's studies. Making of the personal study plan. Use of the Blackboard learning base. LUT library collections and databases.	
<b>Modes of Study</b>	Participation in Orientation Days activities, Orientation Days. Library tour 1 h, 1st period. Assignments of information searching, library use and databases on Blackboard, 1st period. Personal study plan, 1st period.	
<b>Evaluation</b>	Pass/Fail	
<b>Study materials</b>	The Orientation Days, Study Guide, Blackboard, LUT library collections and databases.	
<b>BK10A1100</b>	<b>LABORATORY WORK COURSE IN MECHANICAL ENGINEERING</b>	<b>10 - 30 ECTS cr</b>
	<b>Laboratory Work Course in Mechanical Engineering</b>	
	<b>The course is mainly intended for foreign visiting students. The students register for the course by contacting the supervisor.</b>	
<b>Teacher(s)</b>	N. N. Person in Charge: Head of the Laboratory	

<b>Aims</b>	To give the student a deeper understanding on mechanical engineering in a specialized area.
<b>Content</b>	A specific project which is done in one of the laboratories of the department. The project is planned together with the supervisor(s) and consists mainly of laboratory work, literature work and report writing. The course may contain lectures and seminars. The project may also be planned together with industry and then carried out at some industrial location.
<b>Modes of Study</b>	The amount of work hours in the project will determine the amount of credits, e.g. three months of work would give 15 ECTS cr. Credits will be granted when the final report is delivered. Extra credits can be received if specific examinations are made.
<b>Evaluation</b>	0-5 or pass/fail, depending on the project carried out.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BK20A0100</b>	<b>MATERIALS SCIENCE</b>	<b>6 ECTS cr</b>
	<b>Materials Science</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Researcher/Teacher, Lic.Sc. (Tech.) Raimo Suoranta	
<b>Aims</b>	The student understands the basics of physical metallurgy and understands the relationship between physical metallurgy and material properties. The student is capable to select proper material according to functionality and economics.	
<b>Content</b>	The structure of steel, plastic deformation, restoration, hardening, heat treatment methods. Selecting materials according to strength, toughness, corrosion resistance, wear resistance. Manufacturability. Light metals and non-metallic materials. LCC. Systems for selecting materials.	
<b>Modes of Study</b>	Lectures 24 h, 1st-2nd period. Independent work 42 h, 1st-2nd period.	
<b>Evaluation</b>	0-5, examination 80%, tutorials 20%.	
<b>Study materials</b>	Blackboard.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BK20A0400</b>	<b>MODERN WELDING TECHNOLOGY</b>	<b>7 ECTS cr</b>
	<b>Modern Welding Technology</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Researcher/Teacher, Lic.Sc. (Tech.) Raimo Suoranta M.Sc. (Tech.) Paul Kah	
<b>Aims</b>	The student understands the special features welding in production and product design. The student knows how to select proper process and welding procedure for different materials.	
<b>Content</b>	Productivity, economy and quality in welding. Welding costs. Productive and efficient new welding processes. Weldability of the most common materials. Mechanization and robotization of welding. Basics of design of welded structures. Beveling methods. The quality, environmental and safety in welding workshop.	
<b>Modes of Study</b>	Lectures 28 h, 1st-2nd period. Tutorials 14 h, seminar, 1st-2nd period. Exam.	
<b>Evaluation</b>	0-5, examination 80%, seminar 20%.	
<b>Study materials</b>	Lecture notes. Blackboard.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BK20A1300</b>	<b>PACKAGING MATERIALS</b>	<b>4 ECTS cr</b>
	<b>Packaging Materials</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Professor, Ph.D. Henry Lindell	
<b>Aims</b>	To provide understanding of the packaging related properties of various packaging materials.	
<b>Content</b>	The manufacture, physical and chemical properties (relevant for packaging) of the major packaging materials: paper, paperboard, corrugated board, wood, glass, metals, polymers including biopolymers and adhesives. Foreseeable future development of each material. Material composite possibilities and their use. Capability to select material alternatives or combinations for specific packaging solutions based on their possible performance characteristics.	
<b>Modes of Study</b>	Lectures total 16 h, 1st-2nd period. Exercises total 7 h, 1st-2nd period.	
<b>Evaluation</b>	0-5, examination 70%, exercises 30%.	
<b>Study materials</b>	Course material. Handouts. Blackboard.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	
<b>BK20A1400</b>	<b>COATING AND LAMINATION OF FIBRE BASED PACKAGING MATERIALS</b>	<b>5 ECTS cr</b>
	<b>Coating and Lamination of Fibre Based Packaging Materials</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-3	
<b>Teacher(s)</b>	Visiting lecturer, Professor, Jurkka Kuusipalo Professor, Ph.D. Henry Lindell	
<b>Aims</b>	To provide understanding of various ways to combine materials with paper and board and of their properties in packaging applications.	
<b>Content</b>	Raw materials, for main coating and laminating methods. Main properties (including proniting) of the finished products. Focus in extrusion coating process. The main applications of paper based packaging materials in packaging sector. Combined packaging structures and their manufacturing techniques. Capability to run extrusion coating line and utilize fibre materials on the packaging solutions.	
<b>Modes of Study</b>	Lectures total 18 h, 1st-3rd period. Exercises total 8 h, 1st-3rd period. Seminar 1st-3rd period.	
<b>Evaluation</b>	0-5, examination 70%, exercises 30%.	
<b>Study materials</b>	Course material. Handouts. Lecturers' comments. Kuusipalo, J. ed., Paper and Paperboard Converting. In series of books: Papermaking Science and Technology, part 12, 2nd edition, Fapet, Helsinki. Blackboard.	
<b>BK20A1500</b>	<b>PRINCIPLES OF CHEMISTRY, PAPER TECHNOLOGY AND FOOD TECHNOLOGY</b>	<b>5 ECTS cr</b>
	<b>Principles of Chemistry, Paper Technology and Food Technology</b>	
	<b>Belongs only to complementary studies and minor subject in Packaging Technology. Course registrations during 1st period.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-4	
<b>Teacher(s)</b>	Professor, Ph.D. Henry Lindell	
<b>Aims</b>	Understanding basic general, organic and biochemical phenomena.	

<b>Content</b>	Understanding basics of paper technology and products. Understanding packaging related features of processed food. Basic phenomena of general, organic and biochemistry. Main fibre grades and other raw materials and their role in paper products, the main part processes of paper production, typical properties of the main paper and board grades.
<b>Modes of Study</b>	The basic principles of foods and processing theory, the main food processes and their effect on foods considering packaging.
<b>Evaluation</b>	Essays with specific instruction. Pass/Fail.
<b>Study materials</b>	Smook G.A., Handbook for Pulp & Paper Technologists, 2nd edition, p 1-7, 36-44, 194-324 or Smook G.A., Handbook for Pulp & Paper Technologists, 3rd edition, p 1-9, 37-45, 190-324 or Herbert Holik, Handbook of Paper and Board, Wiley-VCH Verlag GmbH & Co. KgaA, Wennheim, Germany. Bettelheim & March, Introduction to General, Organic and Biochemistry Saunders College Publishing Fellows P., Food processing technology - Principles and Practice, 2nd edition, Part I p 7-62, III and IV, p 229-452. Blackboard.

<b>BK20A2200</b>	<b>BASICS OF WELDING TECHNOLOGY</b>	<b>3 ECTS cr</b>
	<b>Basics of Welding Technology</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 2	
<b>Teacher(s)</b>	Researcher/Teacher, Lic.Sc. (Tech.) Raimo Suoranta	
<b>Aims</b>	The student understands the special features of quality management in production of welded constructions and the influence of welding to material properties.	
<b>Content</b>	Productivity, economy and quality in welding. Welding costs. Weldability of the most common materials. Basics of mechanization and robotization of welding. Basics of design of welded structures. Quality management.	
<b>Modes of Study</b>	Lectures 14 h, 2nd period. Exam.	
<b>Evaluation</b>	0-5, examination 100%.	
<b>Study materials</b>	Lecture notes.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BK30A0500</b>	<b>LASER PROCESSING</b>	<b>5 ECTS cr</b>
	<b>Laser Processing</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Antti Salminen	
<b>Aims</b>	Understanding the special features of laser processing in production and product design.	
<b>Content</b>	Knowledge on different laser processing systems and processes and the interaction between laser beam and materials. Knowledge on most common laser processes like laser welding, cutting, marking, micro processing and surface treatment. Optical components used with laser processing, safety and quality assurance. Practical cases. Interaction between laser beam and materials, absorption, keyhole and its usefulness on laser welding and cutting. Readiness to utilize laser processing possibilities on the tasks of product design. Special features of laser processing methods for product design.	
<b>Modes of Study</b>	Lectures 28 h, 1st-2nd period. Tutorials 14 h, 1st-2nd period. Exam.	



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<b>Evaluation</b>	0-5, exam 70%, seminar 30%.
<b>Study materials</b>	Steen W., Laser Material Processing. Blackboard.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BK50A0700</b>	<b>ADVANCED PRODUCTION ENGINEERING</b>	<b>7 ECTS cr</b>
	<b>Advanced Production Engineering</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Juha Varis Researcher/Teacher, Lic.Sc. (Tech.) Inga Sihvo	
<b>Aims</b>	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. 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>Content</b>	The manufacturing methods for modern metal cutting, sheet metal production and basics of paperboard forming. 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). DFMA and costs functions of products, production controlling and simulation. The operation of a factory as part of a principal-supplier network. The technology and methods for improving production. The material handling, production and information systems of a workshop.	
<b>Modes of Study</b>	The development of the operations of a workshop and quality technology. Lectures 2 h, 1st period. Instructions will be given at start-up lecture. Self study material, exercises and an exam.	
<b>Evaluation</b>	0-5, examination 100%, exercises pass/fail.	
<b>Study materials</b>	Materials to be announced during the start-up lecture.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BK50A1201</b>	<b>MACHINE DESIGN FOR PACKAGING TECHNOLOGY</b>	<b>4 ECTS cr</b>
	<b>Machine Design for Packaging Technology</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period Intensive	
<b>Teacher(s)</b>	Researcher/Teacher, D.Sc. (Tech.) Harri Eskelinen	
<b>Aims</b>	Student knows how to dimension the most essential machine elements of a packaging machine according to requirements of their strength, reliability, lifetime and wear. Student knows how to carry out mechanisms synthesis and analysis for typical applications in packaging machines. Student knows how to handle the design process of a simple machine or mechanisms for packaging operations and means to estimate functional aspects of applied technology.	
<b>Content</b>	Basic mechanisms types, mechanisms analysis and synthesis, reliability-based machine design, wear and lifetime analysis of selected machine parts and elements. Different methodologies of DFM(A) and means to apply them in packaging technology. Knowledge about how to design a simple machine or mechanisms for packaging operations and means to estimate functional aspects of applied technology.	
<b>Modes of Study</b>	Intensive weeks 18 and 19.	

<b>Evaluation</b>	Lectures total 14 h, intensive period. Exercises total 26 h, intensive period. Seminar 28 h, intensive period. 0-5, examination 70%, exercises and seminar 30%
<b>Study materials</b>	Erdman A.G., Mechanism Design. Norton R.L., Design of Machinery.
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b>BK50A1300</b>	<b>CONVERTING AND FORMING OF FIBRE BASED PACKAGING</b>	<b>5 ECTS cr</b>
	<b>Converting and Forming of Fibre Based Packaging</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-2	
<b>Teacher(s)</b>	Professor, Ph.D. Henry Lindell Professor, D.Sc. (Tech.) Juha Varis Researcher, M.Sc. (Tech.) Panu Tanninen Laboratory Engineer, M.Sc. (Tech.) Jari Selesvuo	
<b>Aims</b>	To provide understanding of various paper and board converting technologies and their developments in package production.	
<b>Content</b>	The main technologies of carton forming: die cutting, scoring, folding of blanks and other forming technologies. Tool design (3D-systems) and tool manufacturing technologies in modern workshops. Machines and equipment for listed converting processes, and their integration into effective production systems. Sealing, gluing and closing technologies of fibre based packaging materials. The special requirements various paper based materials for converting processes. Features to be considered in multimaterial converting. Knowledge of the main paper package forming technologies. The requirements of various paper and board grades set for the processes.	
<b>Modes of Study</b>	Lectures.	
<b>Evaluation</b>	Written examination 100%.	
<b>Study materials</b>	Lecture handouts. Blackboard.	

<b>BK50A1401</b>	<b>PACKAGING LINES AND MACHINERY</b>	<b>7 ECTS cr</b>
	<b>Packaging Lines and Machinery</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 3-4	
<b>Teacher(s)</b>	Professor, Ph.D. Henry Lindell Researcher, D.Sc. (Tech.) Jari Varis Associate Professor, D.Sc. (Tech.) Kimmo Kerkkänen Researcher, D. Sc. (Tech.) Huapeng Wu Visiting lecturer, M.Sc. (Tech.) Tapani Sarin	
<b>Aims</b>	To provide understanding for operations and functions of packaging lines and their development aspects.	
<b>Content</b>	The unit processes in packaging line, the main components of packaging line. The main filling technologies in food packaging, for example liquid packaging, aseptic packaging, MAP packaging, autoclave packaging. The main filling technologies in non-food packaging like pharma, electronics, industrial packaging. Technologies used in carton packaging and flexible packaging: pouch, wrapping, form-fill-seal. The focus in fibre based packaging. Instrumentation, automation, robotics in packaging lines.	
<b>Modes of Study</b>	Lectures 20 h, group work and seminars 30 h.	
<b>Evaluation</b>	0-5, seminar 100%.	
<b>Study materials</b>	Handouts provided on Blackboard.	
<b>Further</b>	This course has 6-10 places for open university students. More information on	

<b>Information</b>	the web site for open university instruction.
<b>BK50A1601</b>	<b>FUNCTIONS OF PACKAGE, PACKAGING FORMATS AND PACKAGE DESIGN</b> <b>5 ECTS cr</b>
	<p><b>Functions of Package, Packaging Formats and Package Design</b></p> <p><b>The course will be lectured last time during the academic year 2010-2011.</b></p>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-2
<b>Teacher(s)</b>	Professor, Ph.D. Henry Lindell
<b>Aims</b>	To provide understanding of various functions of packaging and packages and their future trends. To provide understanding of various formats of packages, their merits and shortfalls in logistic chain and end-use. To provide understanding of challenges of packages in specific end uses.
<b>Content</b>	Aspects of the role of packaging throughout the value chain. The main categories packages and their use. Aspects for understanding of the main opportunities of various packaging formats in specific end uses when developing new solutions.
<b>Modes of Study</b>	Lectures 16 h. Exercises/seminars 24 h.
<b>Evaluation</b>	0-5, seminar work.
<b>Study materials</b>	Blackboard.
<b>BK50A2000</b>	<b>LEGISLATION ON PACKAGING, INTERACTION OF PACKAGE AND THE CONTENT, ENVIRONMENTAL ISSUES AND SUSTAINABILITY</b> <b>5 ECTS cr</b>
	<p><b>Legislation on Packaging, Interaction of Package and the Content, Environmental Issues and Sustainability</b></p> <p><b>Replaces the course BK20A1201 Interaction of the Package and the Content, Passive and Active Packaging (4 ECTS cr) and BK50A1701 Food Packaging Hygiene, Legislation on Packaging, Sustainability and Environmental Issues Related to Packaging (4 ECTS cr).</b></p>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4
<b>Teacher(s)</b>	Professor, Ph.D. Henry Lindell Visiting lecturer, M. Sc. (Tech.) Päivi Harju-Eloranta Person in Charge: Professor, Ph.D. Henry Lindell
<b>Aims</b>	To provide understanding of the EU-legislation on packaging. To understand the interaction of the package and the content and the relation to the regulation. To provide understanding of the legislative aspects on the environmental and sustainability issues related to packaging.
<b>Content</b>	The main content on EU legislation on food contact material and environmental issues. Legislation on active packaging. Fundamentals of the interaction of packaging and the content. The main analyzing methods of packages and packaging materials. Environmental issues of packaging and packaging waste. The environmental standardization of packages in EU. Sustainability concerning packaging legislation on product safety aspects and traceability.
<b>Modes of Study</b>	Lectures total 24 h, 3rd-4th period. Exercises/seminars 16 h.
<b>Evaluation</b>	0-5, examination 50%, seminar work 50%.
<b>Study materials</b>	Handouts.
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b>BK50A2100</b>	<b>PRINTING AND PACKAGE DESIGN</b>	<b>6 ECTS cr</b>
	<b>Printing and Package Design</b>	
	<b>The course will be lectured first time during the academic year 2011-2012.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-2	
<b>Teacher(s)</b>	Professor, Ph.D. Henry Lindell M.Sc. (Tech.), B.Sc. (Arts) Noora Nylander Visiting lecturer, M.Sc. (Tech.) Risto Vesanto Industry lecturers	
<b>Aims</b>	Person in Charge: Professor, Ph.D. Henry Lindell To provide understanding of printing methods used in packaging industry. Capability to select proper printing methods for a certain packaging solution. Capability to solve printing problems and to control print quality. To provide understanding of the importance of graphic design process in packaging. Capability to communicate with the various partners involved in a design process. Capability to act as a producer for a dedicated product.	
<b>Content</b>	Pre-press operations. The main printing technologies and their use in packaging industry. Printing of various substrates. Composition of printing inks. Emerging printing technologies and their potential use in packaging industry. Future trends of printing technologies. Aspects of the role of package in the value chain. Demands set on the lay-out of a package. Various ways for idea generation of a package lay-out.	
<b>Modes of Study</b>	Lectures total 20 h, 1st-2nd period. Exercises/seminars 30 h.	
<b>Evaluation</b>	0-5, examination 40%, seminarwork 60%.	
<b>Study materials</b>	Handouts. Saarelma, H., Oittinen, P., Printing. In series of books: Papermaking Science and Technology, Book 13, Fapet, Helsinki 1989.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	
<b>BK60A0300</b>	<b>SERVO CONTROL ENGINEERING</b>	<b>6 ECTS cr</b>
	<b>Servo Control Engineering</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Huapeng Wu	
<b>Aims</b>	Ability to select components and controllers for servosystems. Ability to use frequency and time domain methods in the design of hydraulic, pneumatic and electrical servo systems. Ability to use commercial software in analysis and design of servosystems.	
<b>Content</b>	Introduction to modelling and frequency domain analysis of control systems. Control of hydraulic, pneumatic, and electrical servodrives. Structures and properties of basic types of servo-drives. Selection of appropriate control methods for different drive types. Ability to design and control of different types of servodrives. Ability to evaluate the achievable properties of different servodrives. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	42 h of lectures, 1st-2nd period. 42 h of tutorials, 1st-2nd period. 30 h of exercises, 2nd period.	
<b>Evaluation</b>	0-5, examination 100%.	
<b>Study materials</b>	Lecture notes. Blackboard.	
<b>Prerequisites</b>	The student must have completed BK60A0001 Mekatroniikan peruskurssi. Recommended BK60A0100 Hydrauliteknikka (not required from students of Master's Degree Programme in Mechanical Engineering).	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	

<b>BK60A0601</b>	<b>PROCESS AND PRODUCT INNOVATIONS</b>	<b>10 ECTS cr</b>
	<b>Process and Product Innovations</b>	
	<b>Mainly for Finnish and international students from the departments of Chemical Technology, Mechanical Engineering, Electrical Engineering and Industrial Engineering and Management. The number of participants is limited and the applicants will be interviewed.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-4	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Tech.) Kimmo Kerkkänen Professor, D.Sc. (Tech.) Tuomo Kässi Associate Professor, D.Sc. (Tech.) Ville Ojanen Person in Charge: Professor, D.Sc. (Tech.) Ilkka Turunen	
<b>Aims</b>	At the end of the course a student is expected to know: - how to generate innovations and new technology using and deepening skills learned in other connections. - how to analyze typical methods, problems and their solutions - how to apply teamwork in interdisciplinary, international environment for a product and process development project.	
<b>Content</b>	Methods of product and process development. Interdisciplinary R & D activities as project and teamwork. Development of new technology, patenting. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Informational lectures, 6 h/period. Project meetings, 6 h/period. Independent project and teamwork in groups of 4-8 students.	
<b>Evaluation</b>	0-5, project work 100%.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BK70A0000</b>	<b>SIMULATION OF A MECHATRONIC MACHINE</b>	<b>6 ECTS cr</b>
	<b>Simulation of a Mechatronic Machine</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Aki Mikkola	
<b>Aims</b>	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>Content</b>	Principles of multibody dynamics, modelling of actuators, coupled simulation. The use of Lagrangian equation. Constraint equations and Lagrangian multipliers. Inertia of rigid bodies. Modeling of hydraulic components. Numerical integration of the equation of motion.	
<b>Modes of Study</b>	Lectures 28 h, 3rd-4th period. Supervised tutorials 28 h, 3rd-4th period.	
<b>Evaluation</b>	0-5, examination or mid-course examinations 80%, simulation work 20%.	
<b>Study materials</b>	Lecture notes. Blackboard.	
<b>Prerequisites</b>	Students are recommended to have completed BK60A0001 Mekatroniikan peruskurssi, BK80A0000 Statiikka, BK80A0100 Dynamiikka I BK80A2500 Dynamiikka II (not required from students of Master's Degree Programmes in Mechanical Engineering).	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	

<b>BK80A1200</b>	<b>FE-ANALYSIS COURSE</b>	<b>5 ECTS cr</b>
	<b>FE-analysis course</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4	
<b>Teacher(s)</b>	Researcher/Teacher, D.Sc. (Tech.) Pasi Tanskanen	
<b>Aims</b>	Students understand the mathematical foundations of finite element analysis and are able to use a commercial finite element program to analyse simple statically loaded mechanical structures.	
<b>Content</b>	The student will be acquainted with the procedure of static linear-elastic FE analysis with the aim of providing the student with a basic knowledge of the derivation of element stiffness matrices of elements, the assembly of a global stiffness matrix, the handling of boundary conditions and loading as well as the problem solving. In the tutorials the student will be acquainted with FE modelling using commercial software.	
<b>Modes of Study</b>	28 h of lectures, 3rd-4th period. 28 h of tutorials, 3rd-4th period.	
<b>Evaluation</b>	0-5, examination 50%, exercises 50%.	
<b>Study materials</b>	The material is to be specified during lectures.	
<b>BK80A1401</b>	<b>FATIGUE DESIGN</b>	<b>6 ECTS cr</b>
	<b>Väsymiskestävyys</b>	
	<b>The course will be lectured in Finnish. The foreign students read the course book (the particular chapters), carry out the home exercises and finally participate the exam in order to pass the course.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Senior Assistant, D.Sc. (Tech.) Timo Nykänen Professor, D.Sc. (Tech.) Timo Björk	
<b>Aims</b>	The aim of this course is for the student to learn how to design fatigue loaded structures and how to avoid fatigue failure.	
<b>Content</b>	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. Introduction to design and to the fatigue assessment of welded joints. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures 42 h, 1st-2nd period. Tutorials 40 h, 1st-2nd period.	
<b>Evaluation</b>	0-5, examination 60%, home exercises 40%.	
<b>Study materials</b>	Material prepared for the course in Blackboard. Dowling N.E., Mechanical Behavior of Materials 2nd ed., Prentice Hall.	
<b>Prerequisites</b>	BK80A0501 Lujusoppi II or BK20A0100 Materials Science.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	

### 4.4. Master's Degree Programme in Technomathematics and Technical Physics

The Master's Degree Programme in Technomathematics and Technical Physics takes two years, corresponds to 120 ECTS credits and leads to the degree of Master of Science in Technology. The language of tuition in the programme is English. The programme has two alternative major subjects: Technomathematics and Technical Physics.

#### Technomathematics

*Programme Coordinator in Technomathematics is professor, Ph.D. Matti Heiliö*

Technomathematics is the art and science of applying mathematics and computational models into real life problems in industrial research and applied science, such as

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

The professional scope is wide-ranging and growing rapidly, and therefore our aim is to develop the student's mathematical and computational skills for industry and other research and development tasks. We train our graduates to combine modeling, computational skills, advanced theory and data analysis in innovative ways. We provide solutions to questions of industrial R&D. Some examples of applications and research areas: inverse problems, stochastic methods, Bayesian methods with MCMC, fuzzy logic and systems, fuzzy methods in knowledge engineering, data assimilation techniques, computational fluid dynamics, wavelets and image/signal analysis, data intensive methods in weather models, forest inventory and environmental monitoring.

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

#### Requirements for Basic Studies

Students majoring in Technomathematics should have a Bachelor's degree in engineering, applied mathematics, computer science, information technology or equivalent discipline. The students should have basic knowledge in computing including data structures and some programming skills. Furthermore, the students must have familiarity with PC work stations and basic data manipulation tools.

Regarding mathematics the student should master calculus, also in functions of several variables. S/he is assumed to know basics of matrices, linear algebra, differential equations and optimization, numerical algorithms, statistics and probability. Knowledge of discrete models, fuzzy models and methods is of great advantage. The student should have knowledge in physics covering basic phenomena in mechanics, electricity, thermal and wave phenomena. Independence, team work and communication skills are important. As tuition is given in English, the students must have good oral and writing skills in the English language.

#### ECMI Masters in Industrial Mathematics (ECMIMIM) Project

The Laboratory of Mathematics is a partner in the ECMIMIM (the ECMI Masters in Industrial Mathematics) Erasmus curriculum development project. This European network of Master's programmes in mathematics is oriented towards applications in real world, industry, society and environment. The network has agreed on the European Model Curriculum, which will facilitate mobility at the European scale. The LUT students of Technomathematics have a possibility of studying as exchange students in another ECMIMIM partner university abroad.

For more information: [www.lut.fi/mathphysics/ecmimim](http://www.lut.fi/mathphysics/ecmimim)

**Degree Structure**

General Studies	9	ECTS cr
Major Subject	76	ECTS cr
Minor Subject	20	ECTS cr
Elective Studies	15	ECTS cr
<i>Total</i>	<i>120 (min.)</i>	<i>ECTS cr</i>

**General Studies 9 ECTS cr**

<i>Obligatory Studies (9 ECTS cr)</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BK10A0300 Introduction to M.Sc. Studies	M.Sc. (Tech.) 1	1	1
FV11A8900 Academic Writing in English	B.Sc. (Tech.) 3	1-2, 4	4
	M.Sc. (Tech.) 1-2	3-4,	5
	B.Sc. (Econ. & Bus. Adm.) 3	5	
	M.Sc. (Econ. & Bus. Adm.) 1-2		
BM20A5000 Principles of Technical Computing and Scientific Publishing	B.Sc. (Tech.) 2	1-2	4
	M.Sc. (Tech.) 1		

**Major Subject, obligatory studies 44 + 32 ECTS cr**

<i>Obligatory Studies (44 ECTS cr)</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BM20A2102 Differential Equations	M.Sc. (Tech.) 1-2	3	6
BM20A2500 Linear Algebra and Normed Spaces	M.Sc. (Tech.) 1-2	1	3
BM20A4000 Case Study Seminar	M.Sc. (Tech.) 1	1-4	5
BM10A0000 Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

**Major Subject, elective modules 32 ECTS cr**

Choose two modules from a-d. The extent of each module should be at least 15 ECTS cr, a total of 32 ECTS cr must be selected.

**a) Computational Modelling of Technical Systems**

<i>List of selectable courses</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BM20A2000 Simulation	M.Sc. (Tech.) 1	1	4
BM20A2600 Integral Transforms	B.Sc. (Tech.) 3	4	3
BM20A2701 Numerical Methods II	M.Sc. (Tech.) 1	4	3
BM20A2800 Nonlinear Optimization	M.Sc. (Tech.) 1-2	4	4
BM20A3202 Fuzzy Engineering	M.Sc. (Tech.) 1-2	3-4	6
BM20A3801 Advanced Mathematical Methods	M.Sc. (Tech.) 1	1-4	3-6
BM20A4201 Applied Functional Analysis	M.Sc. (Tech.) 1-2	2-3	4-6
BM20A4500 Evolutionary Computation	M.Sc. (Tech.) 1-2		5

**b) Data Analysis and Stochastics**

<i>List of selectable courses</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BM20A1900 Statistics II	M.Sc. (Tech.) 1-2		3
BM20A2000 Simulation	M.Sc. (Tech.) 1	1	4
BM20A2901 Discrete Optimization	M.Sc. (Tech.) 1-2	4	5
BM20A3001 Statistical Analysis in Modelling	M.Sc. (Tech.) 1	2	5



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BM20A3301	Stochastic Theory and Models	M.Sc. (Tech.) 1	4	3-5
BM20A3401	Design of Experiments	M.Sc. (Tech.) 1-	4	4
		2		
BM20A3602	Fuzzy Data Analysis	M.Sc. (Tech.) 1-	3	6
		2		
BM20A3801	Advanced Mathematical Methods	M.Sc. (Tech.) 1	1-4	3-6
BM20A4500	Evolutionary Computation	M.Sc. (Tech.) 1-	2	5
		2		

### c) Discrete and Fuzzy Models and Methods

<i>List of selectable courses</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BM20A2201	Logic and Discrete Methods	M.Sc. (Tech.) 1	1-4	4
BM20A2901	Discrete Optimization	M.Sc. (Tech.) 1-	4	5
		2		
BM20A3101	Fuzzy Sets and Fuzzy Logic	M.Sc. (Tech.) 1-	1-2	6
		2		
BM20A3202	Fuzzy Engineering	M.Sc. (Tech.) 1-	3-4	6
		2		
BM20A3602	Fuzzy Data Analysis	M.Sc. (Tech.) 1-	3	6
		2		
BM20A3801	Advanced Mathematical Methods	M.Sc. (Tech.) 1	1-4	3-6

### d) Theory of Applied Analysis

<i>List of selectable courses</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BM20A1300	Complex Analysis	M.Sc. (Tech.) 1-	1	3
		2		
BM20A1900	Statistics II	M.Sc. (Tech.) 1-	2	3
		2		
BM20A2600	Integral Transforms	B.Sc. (Tech.) 3	4	3
BM20A2701	Numerical Methods II	M.Sc. (Tech.) 1	4	3
BM20A2800	Nonlinear Optimization	M.Sc. (Tech.) 1-	4	4
		2		
BM20A2901	Discrete Optimization	M.Sc. (Tech.) 1-	4	5
		2		
BM20A3101	Fuzzy Sets and Fuzzy Logic	M.Sc. (Tech.) 1-	1-2	6
		2		
BM20A3301	Stochastic Theory and Models	M.Sc. (Tech.) 1	4	3-5
BM20A3801	Advanced Mathematical Methods	M.Sc. (Tech.) 1	1-4	3-6
BM20A4201	Applied Functional Analysis	M.Sc. (Tech.) 1-	2-3	4-6
		2		

### Minor Subject 20 ECTS cr

Students can choose any minor subject taught at LUT if the required prerequisites are completed. The choice of the minor subject should be discussed with the Programme Coordinator in Technomathematics.

### Elective Studies 15 ECTS cr

Elective studies can include any courses offered by LUT if the required prerequisites are completed. Studies in other universities may be included upon application. Elective studies may include a maximum of 6 ECTS credits of internship improving expertise. The student should discuss the choice of elective courses with the Programme Coordinator.

### Master's Thesis and Seminar 30 ECTS cr

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

**Minor in Technomathematics 20 ECTS cr**

Minor in Technomathematics can be studied by students of other Master's degree programmes. Courses for minor studies can be freely chosen from the courses that Laboratory of Applied Mathematics offers in English. However, suitable background knowledge is needed. This means basic knowledge about matrix calculation, optimization, statistics, numerical analysis and especially mathematical programming with some procedural language (preferably Matlab/Octave).

A minimum of 20 ECTS credits should be selected from the courses below:

<i>Minor Studies min. 20 ECTS cr</i>		<i>per.</i>	<i>ECTS cr</i>
BM20A1300	Complex Analysis	1	3
BM20A1900	Statistics II	2	3
BM20A2000	Simulation	1	4
BM20A2102	Differential Equations	3	6
BM20A2201	Logic and Discrete Methods	1-4	4
BM20A2500	Linear Algebra and Normed Spaces	1	3
BM20A2600	Integral Transforms	4	3
BM20A2701	Numerical Methods II	4	3
BM20A2800	Nonlinear Optimization	4	4
BM20A2901	Discrete Optimization	4	5
BM20A3001	Statistical Analysis in Modelling	2	5
BM20A3101	Fuzzy Sets and Fuzzy Logic	1-2	6
BM20A3202	Fuzzy Engineering	3-4	6
BM20A3301	Stochastic Theory and Models	4	3-5
BM20A3401	Design of Experiments	4	4
BM20A3602	Fuzzy Data Analysis	3	6
BM20A3801	Advanced Mathematical Methods	1-4	3-6
BM20A3900	Modelling Methodology in Process Engineering	1-2	6
BM20A4201	Applied Functional Analysis	2-3	4-6
BM20A4500	Evolutionary Computation	2	5
BM20A5000	Principles of Technical Computing and Scientific Publishing	1-2	4

**Technical Physics**

*Programme Coordinator in Technical Physics is professor, Ph.D. Erkki Lähderanta*

Students majoring in Technical Physics should have a Bachelor's degree from a related field. For every admitted student will be composed a personal study plan. The contents of the plan depend on the student's previous degree/studies and his field of interest and specialization.

The aim of the major subject in Technical Physics is to prepare the student professionally and academically in physics and other technical science skills in industry and R&D tasks. The programme also provides the student with capabilities for doctoral studies and independent research.

<b>Degree Structure</b>		
General Studies	9	ECTS cr
Major Subject	65-68	ECTS cr
Minor Subject	20	ECTS cr
Elective Studies	23-26	ECTS cr
<i>Total</i>	<i>120 (min.)</i>	<i>ECTS cr</i>

**General Studies 9 ECTS cr**

<i>Obligatory Studies (9 ECTS cr)</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BK10A0300 Introduction to M.Sc. Studies	M.Sc. (Tech.) 1	1	1
FV11A6500 Presenting in English	B.Sc. (Tech.) 2-3	1, 2,	2
	M.Sc. (Tech.) 1-2	3, 4	
	B.Sc. (Econ. & Bus. Adm.) 2-		

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	3	
	M.Sc. (Econ. & Bus. Adm.) 1-	
	2	
FV11A8900 Academic Writing in English	B.Sc. (Tech.) 3	1-2, 4
	M.Sc. (Tech.) 1-2	3-4,
	B.Sc. (Econ. & Bus. Adm.) 3	5
	M.Sc. (Econ. & Bus. Adm.) 1-	
	2	
FV18A9101 Finnish 1		1, 3 2

### Major Subject 65-68 ECTS cr

<i>Obligatory Studies (65-68 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BL50A0600	Electromagnetic Compatibility in Power Electronics	M.Sc. (Tech.) 1	1	2
BM30A0500	Applied Optics	M.Sc. (Tech.) 1	2	6
BM30A0601	Optoelectronics	M.Sc. (Tech.) 1	1	6
BM30A1500	Advanced Topics in Material Science	M.Sc. (Tech.) 2	2	6
BM30A1600	Microelectronics	M.Sc. (Tech.) 1	1	6
BM30A1700	Physics of Semiconductor Devices	M.Sc. (Tech.) 1-	1-2	3-6
		2		
BM30A2200	Semiconductor and Superconductor Physics	M.Sc. (Tech.) 1	1-2	6
BM10A0000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

### Minor Subject 20 ECTS cr

Students can choose any minor subject taught at LUT if the required prerequisites are completed. The choice of the minor subject should be discussed with the Programme Coordinator in Technical Physics.

### Elective Studies 23-26 ECTS cr

Elective studies can include any courses offered by LUT if the required prerequisites are completed. Studies in other universities may be included upon application. Elective studies may include a maximum of 6 ECTS credits of internship improving expertise. The student should discuss the choice of the elective courses with the Programme Coordinator.

### Master's Thesis and Seminar 30 ECTS cr

Thesis topics arise from various application areas, research projects and contacts with different universities. Typically, the thesis contains a theoretical study, experimental part and analysis of the experimental results.

### Minor in Technical Physics 20-26 ECTS cr

Minor in Technical Physics can be studied by students of other Master's degree programmes.

Minimum 20 ECTS credits should be selected.

<i>Minor Studies min. 20 ECTS cr</i>		<i>per.</i>	<i>ECTS cr</i>
BM30A0500 <sup>c</sup>	Applied Optics	2	6
BM30A1500 <sup>c</sup>	Advanced Topics in Material Science	2	6
BM30A1600 <sup>c</sup>	Microelectronics	1	6
BM30A2100	Microelectronics Processing Technology	1-2	2
BM30A2200	Semiconductor and Superconductor Physics	1-2	6

<sup>c</sup>) Choose a min. of two courses.

## **Additional Information**

### **Personal Study Plans**

The personal study plan (PSP) is the student's own plan how s/he is going to complete the Master's degree. The degree structure of the Master's programme determines the frame of the studies. At the Master's level, the student makes the PSP by the end of 1<sup>st</sup> period, and submits it to Study Coordinator for approval. The electronic personal study plan (ePSP, in Finnish eHOPS) is a tool for drawing the plan up. The students of the Faculty of Technology are recommended to complete the PSP in an electronic form by using the ePSP tool at WebOodi.

### **Credit Transfers**

ECTS credits can be transferred from the student's previous university level studies or higher university degrees from Finnish or foreign universities. More information on credit transfer is available from Study Coordinator.

### **Complementary Studies**

Students with a Finnish degree from the University of Applied Sciences or equivalent may have to study complementary studies. The extent of these studies depends on the content of the previous degree. More information is available from Study Coordinator.

### **Maturity Test**

Students must take a maturity test to show how well they know the topic of their Master's thesis. The test evaluates the student's familiarity with the theories and problems of the thesis. The students are asked to contact their supervising professors to agree how the maturity test is taken, that is, as a seminar presentation or as a written test. The maturity test is evaluated on a scale of passed/failed by the supervising professor of the thesis.

### **Further Information**

Programme Coordinator in Technomathematics:  
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**The Courses Offered in English**

	<i>ECTS cr</i>	
BM10A0000	Master's Thesis and Seminar	30
BM20A1300	Complex Analysis	3
BM20A1900	Statistics II	3
BM20A2000	Simulation	4
BM20A2102	Differential Equations	6
BM20A2201	Logic and Discrete Methods	4
BM20A2500	Linear Algebra and Normed Spaces	3
BM20A2600	Integral Transforms	3
BM20A2701	Numerical Methods II	3
BM20A2800	Nonlinear Optimization	4
BM20A2901	Discrete Optimization	5
BM20A3001	Statistical Analysis in Modelling	5
BM20A3101	Fuzzy Sets and Fuzzy Logic	6
BM20A3202	Fuzzy Engineering	6
BM20A3301	Stochastic Theory and Models	3 - 5
BM20A3401	Design of Experiments	4
BM20A3602	Fuzzy Data Analysis	6
BM20A3801	Advanced Mathematical Methods	3 - 6
BM20A3900	Modelling Methodology in Process Engineering	6
BM20A4000	Case Study Seminar	5
BM20A4201	Applied Functional Analysis	4 - 6
BM20A4500	Evolutionary Computation	5
BM20A4800	Project Work in Applied Mathematics	10 - 30
BM20A5000	Principles of Technical Computing and Scientific Publishing	4
BM30A0500	Applied Optics	6
BM30A0601	Optoelectronics	6
BM30A1500	Advanced Topics in Material Science	6
BM30A1600	Microelectronics	6
BM30A1700	Physics of Semiconductor Devices	3 - 6
BM30A2100	Microelectronics Processing Technology	2
BM30A2200	Semiconductor and Superconductor Physics	6
BM30A2300	Project Work in Technical Physics	10 - 30

<b>BM10A0000</b>	<b>MASTER'S THESIS AND SEMINAR</b>	<b>30 ECTS cr</b>
	<b>Master's Thesis and Seminar, Diplomityö ja seminaari</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-4	
<b>Teacher(s)</b>	Professor of the major subject	
<b>Aims</b>	Person in Charge: Professor, Ph.D. Matti Heiliö	
<b>Content</b>	Student has general knowledge about a specific field of engineering and applied science in society and is able to apply scientific knowledge and methods in this area. The student is able to work independently, prepare a research plan and operate in a disciplined way.	
<b>Modes of Study</b>	The student works independently and keeps contact with the supervisor informing about the progress. The thesis work is presented in a seminar with other thesis students and their instructors. The student gives a brief presentation on the results of his/her project. The presentations are discussed and reviewed by asking questions.	
<b>Evaluation</b>	0-5, Master's thesis 100%.	
<b>BM20A1300</b>	<b>COMPLEX ANALYSIS</b>	<b>3 ECTS cr</b>
	<b>Complex Analysis, Kompleksianalyysi</b>	
	<b>The course will be lectured every other year, next during the academic year 2010 - 2011.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1	
<b>Teacher(s)</b>	Senior Assistant, D.Sc. (Tech.) Pasi Luukka	
<b>Aims</b>	In the end of the course student is expected to be able to understand <ul style="list-style-type: none"> <li>- complex numbers and functions, conformal mapping</li> <li>- derivative of a complex function and analytical functions</li> <li>- complex integration, Cauchy's theorem, complex series and Residue theorem</li> <li>- the necessary knowledge of complex analysis needed in technical applications.</li> </ul>	
<b>Content</b>	Complex number arithmetics. 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>Modes of Study</b>	Lectures 28 h, exercises 14 h, 1st period. Exam.	
<b>Evaluation</b>	0-5, examination 100%.	
<b>Study materials</b>	Kreyszig, E.: Advanced Engineering Mathematics, 8th Ed., Part D.	
<b>Prerequisites</b>	Recommended Mathematics A and B.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	

<b>BM20A1900</b>	<b>STATISTICS II</b>	<b>3 ECTS cr</b>
	<b>Statistics II, Tilastomatemiikka II</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 2	
<b>Teacher(s)</b>	Professor, Ph.D. Matti Heiliö	
<b>Aims</b>	The student acquires understanding of basic and some advanced statistical methods, is able to formulate models and apply these methods to various areas in technology, economics and science.	
<b>Content</b>	Statistical inference: hypothesis testing, two sample tests. Nonparametric tests. Basics of analysis of variance, time series analysis and multiple regression models. Introduction to nonlinear regression. Elements decision theory. Introduction to multivariate methods. Principal component analysis. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures 28 h, exercises 14 h, home assignments, 2nd period. Exam.	
<b>Evaluation</b>	0-5, examination 80%, home assignments 20%.	
<b>Study materials</b>	Will be announced at lectures.	
<b>Prerequisites</b>	Recommended BM20A1401 Tilastomatemiikka I.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	
<b>BM20A2000</b>	<b>SIMULATION</b>	<b>4 ECTS cr</b>
	<b>Simulation, Simulointi</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1	
<b>Teacher(s)</b>	Professor, Ph.D. Heikki Haario	
<b>Aims</b>	The course gives an introduction to the concepts of discrete simulation models and methods together with numerical examples. After the course, the student is able numerically simulate basic queuing, server, scheduling and storage size problems.	
<b>Content</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. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures 28 h, exercises 14 h, practical assignment, 1st period. Exam.	
<b>Evaluation</b>	0-5, examination 100%. Practical assignment.	
<b>Prerequisites</b>	Recommended BM20A1401 Tilastomatemiikka I.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BM20A2102</b>	<b>DIFFERENTIAL EQUATIONS</b>	<b>6 ECTS cr</b>
	<b>Differential Equations, Differentiaaliyhtälöt</b>	
	<b>Replaces the course BM20A2101 Differential Equations. The course will be lectured every other year, next during the academic year 2011 - 2012.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 3	
<b>Teacher(s)</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. After the course, the student is able to solve analytically simple equations, and numerically, using Matlab solvers, ordinary and basic partial differential equations.	
<b>Content</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.	

<b>Modes of Study</b>	Numerical solutions with semidiscretization methods. Modelling examples from different engineering fields.
<b>Evaluation</b>	Lectures 28 h, exercises 28 h, practical assignment, 3rd period. Exam.
<b>Prerequisites</b>	0-5, examination 100%. Practical assignment.
<b>Further Information</b>	Mathematics A and B. This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BM20A2201</b>	<b>LOGIC AND DISCRETE METHODS</b>	<b>4 ECTS cr</b>
	<b>Logic and Discrete Methods, Logiikka ja diskreetit menetelmät</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-4	
<b>Teacher(s)</b>	Docent, Ph.D. Jorma 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>Content</b>	The course consists of classical logic and resolution method, some basic things of non-classical logics, inductive, recursion and relational methods for computer science. An algebraic approach to discrete methods is considered. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Self study material, exam.	
<b>Evaluation</b>	0-5, examination 100%.	
<b>Study materials</b>	Grassmann, W.K., Tremblay J-P.: Logic and Discrete Mathematics. A Computer Science Perspective, Prentice Hall, 1996.	
<b>Prerequisites</b>	Basic knowledge in elementary intuitive set theory.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BM20A2500</b>	<b>LINEAR ALGEBRA AND NORMED SPACES</b>	<b>3 ECTS cr</b>
	<b>Linear Algebra and Normed Spaces, Lineaarialgebra ja normiavaruudet</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1	
<b>Teacher(s)</b>	Professor, Ph.D. Matti Heiliö	
<b>Aims</b>	The student knows the concepts of function spaces, norms, metric and convergence, linear operators, orthogonality, eigenvalues, singular values and decomposition. Student understands essentials principles in various methods of applied mathematics and is able to apply these methods in analysis of functions and signals in areas of differential equations, image analysis, numerical methods and optimization.	
<b>Content</b>	Vector spaces and linear operators. Linear subspaces and projection. Norms, metric and convergence. Function spaces. Banach spaces, Lp-spaces. Inner product and orthogonality. Hilbert spaces. Theory of linear operators, eigenvalues and spectral decomposition. Introduction to wavelet analysis. Applications in systems and signal analysis, numerical methods, optimization. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures 21 h, exercises 14 h, 1st period. Exam.	
<b>Evaluation</b>	0-5, examination 100%.	
<b>Study materials</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>	Recommended BM20A1601 Matriisilaskenta.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	



<b>BM20A2600</b>	<b>INTEGRAL TRANSFORMS</b>	<b>3 ECTS cr</b>
	<b>Integral Transforms, Integraalimuunnokset</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 3, Period 4	
<b>Teacher(s)</b>	Senior Assistant, D.Sc. (Tech.) Pasi Luukka	
<b>Aims</b>	In the end of the course student is expected to be able to - apply Laplace transform to solve differential equations and use this knowledge to solve engineering applications - understand Fourier series and Fourier transform and apply them - understand Z-transform and apply it.	
<b>Content</b>	Laplace transform. Inverse Transform. Linearity. Shifting. Transforms of Derivatives and Integrals. Differential equations. Unit Step Function. Second Shifting Theorem. Dirac's delta function, Differentiation and Integration of Transforms. Convolution. Integral Equations. Partial Fractions. Differential Equations. Fourier series, complex Fourier series, Fourier integrals, Fourier cosine and sine transforms, Fourier transform. Z transform, inverse Z transform, discrete-time systems and difference equations, discrete linear systems, engineering applications.	
<b>Modes of Study</b>	Lectures 28 h, exercises 14 h, 4th period. Exam.	
<b>Evaluation</b>	0-5, examination 100%.	
<b>Study materials</b>	Kreyszig, E.: Advanced Engineering Mathematics, Wiley, 1999. James, G.: Advanced Modern Engineering Mathematics, Addison-Wesley, 2003.	
<b>Prerequisites</b>	Recommended Mathematics A and B.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	
<b>BM20A2701</b>	<b>NUMERICAL METHODS II</b>	<b>3 ECTS cr</b>
	<b>Numerical Methods II, Numeeriset menetelmät II</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 4	
<b>Teacher(s)</b>	Professor, Ph.D. Heikki Haario	
<b>Aims</b>	An introduction to numerical methods for differentiation, integration, interpolation and differential equations. Numerical methods for linear systems. After the course the student understands the basic concepts of numerical analysis, and is able to independently use numerical software (Matlab solvers).	
<b>Content</b>	Numerical differentiation and integration. Interpolation methods in 1D and 2D. Numerical matrix calculations with applications. Over- and underdetermined linear systems, singular values of a matrix, principal components. Ill-posed linear problems and regularized solutions.	
<b>Modes of Study</b>	Lectures 21 h, exercises 14 h, 4th period. Exam.	
<b>Evaluation</b>	0-5, examination 100%.	
<b>Study materials</b>	Will be announced at lectures.	
<b>Prerequisites</b>	Mathematics A and B. Recommended BM20A1501 Numeeriset menetelmät I.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BM20A2800</b>	<b>NONLINEAR OPTIMIZATION</b>	<b>4 ECTS cr</b>
	<b>Nonlinear Optimization, Epälineaarinen optimointi</b>	
	<b>The course will be lectured every other year, next during the academic year 2011 - 2012.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 4	
<b>Teacher(s)</b>	Lecturer, Lic.Phil. Sirkku Parviainen	
<b>Aims</b>	After the course the student should	

<b>Content</b>	<ul style="list-style-type: none"> <li>- know how formulate and classify nonlinear optimization models</li> <li>- recognize optimum solutions using optimality criteria</li> <li>- be able to understand the principles of optimization algorithms and solve problems of line search, multivariate unconstrained and constrained optimization</li> <li>- know how to use optimization software.</li> </ul> <p>Formulation of optimization models. Classification of optimization problems. 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. Optimization software tools, examples with Matlab. Suitable also for postgraduate studies.</p>
<b>Modes of Study</b>	Lectures 28 h, exercises 14 h, 4th period. Practical assignment. Exam.
<b>Evaluation</b>	0-5, examination 100%. Practical assignment.
<b>Study materials</b>	Nocedal, J. and Wright, S. J.: Numerical Optimization, Springer, 2006.
<b>Prerequisites</b>	Experience in programming or using mathematical software required. BM20A4301 Johdatus tekniseen laskentaan Mathematics A and B, BM20A1501 Numeeriset menetelmät I.
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b>BM20A2901</b>	<b>DISCRETE OPTIMIZATION</b>	<b>5 ECTS cr</b>
	<b>Discrete Optimization, Diskreetti optimointi</b>	
	<b>The course will be lectured every other year, next during the academic year 2010 - 2011.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 4	
<b>Teacher(s)</b>	Lecturer, Lic.Phil. Sirkku Parviainen	
<b>Aims</b>	After the course the student should <ul style="list-style-type: none"> <li>- understand the nature of discrete and combinatorial optimization problems</li> <li>- know the classes of computational complexity and be able to classify problems and algorithms according to their complexity</li> <li>- be able to solve various discrete optimization problems with exact methods and heuristics.</li> </ul>	
<b>Content</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. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures 28 h, exercises 28 h, 4th period. Practical assignment. Exam.	
<b>Evaluation</b>	0-5, examination 100%. Practical assignment.	
<b>Study materials</b>	Will be announced at lectures.	
<b>Prerequisites</b>	Experience in programming or using mathematical software required. BM20A4301 Johdatus tekniseen laskentaan Recommended BM20A1801 Lineaarinen optimointi.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	

<b>BM20A3001</b>	<b>STATISTICAL ANALYSIS IN MODELLING</b>	<b>5 ECTS cr</b>
	<b>Statistical Analysis in Modelling, Mallien tilastollinen analyysi</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 2	
<b>Teacher(s)</b>	Professor, Ph.D. Heikki Haario	
<b>Aims</b>	Introduction to modern computational methods of estimating reliability of modeling and simulation results. After the course, the student is able to create	

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<b>Content</b>	posterior distributions for parameters estimation problems of nonlinear models by MCMC (Markov chain Monte Carlo) methods. Introduction to the methods of estimating reliability of modelling. Errors and uncertainty in experimental data. Uncertainty in model parameters and prediction results. Bayesian approach for parameter estimation and inverse problems, various Monte Carlo (MCMC) methods for nonlinear models. Suitable also for postgraduate studies.
<b>Modes of Study</b>	Lectures 28 h, exercises 28 h, 2nd period. Exam.
<b>Evaluation</b>	0-5, examination 100%.
<b>Study materials</b>	To be given at the lectures.
<b>Prerequisites</b>	Mathematics A and B, BM20A1401 Tilastomatematiikka I. Recommended BM20A2000 Simulation.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BM20A3101</b>	<b>FUZZY SETS AND FUZZY LOGIC</b>	<b>6 ECTS cr</b>
	<b>Fuzzy Sets and Fuzzy Logic, Sumeat joukot ja sumea logiikka</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-2	
<b>Teacher(s)</b>	Senior Assistant, D.Sc. (Tech.) Pasi Luukka	
<b>Aims</b>	In the end of the course student is expected to be able to <ul style="list-style-type: none"> <li>- understand the basic mathematics of fuzzy systems</li> <li>- understand relations between crisp and fuzzy sets</li> <li>- understand relations between algebras of crisp and fuzzy sets, some function algebras</li> <li>- understand lattices of membership functions and basics of L-sets</li> <li>- understand non-classical logics and basics of mathematical fuzzy logic.</li> </ul>	
<b>Content</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, fuzzy compositional calculus, ordering fuzzy numbers, introduction to many-valued logics, many-valued fuzzy logic, and fuzzy-valued logic. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures 56 h, exercises 28 h, 1st-2nd period. Exam.	
<b>Evaluation</b>	0-5, examination 100%.	
<b>Study materials</b>	Nguyen, H.T., Walker, E.A.: A First Course in Fuzzy Logic, 2nd Ed., Chapman & Hall/CRC, 2000. Klir, G., Yuan, B.: Fuzzy Sets and Fuzzy Logic. Theory and Applications, Prentice Hall, 1995. Fullér, R.: Introduction to Neuro-Fuzzy Systems, Physica-Verlag, 2000. Bergmann, M.: An Introduction to Many-Valued and Fuzzy Logic, Cambridge University Press, 2008.	
<b>Prerequisites</b>	Bachelor level basic math courses.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	

<b>BM20A3202</b>	<b>FUZZY ENGINEERING</b>	<b>6 ECTS cr</b>
	<b>Fuzzy Engineering, Sumea teknologia</b>	
	<b>Replaces the course BM20A3201 Fuzzy Engineering. The course will be lectured every other year, next during the academic year 2011 - 2012.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 3-4	
<b>Teacher(s)</b>	Senior Assistant, D.Sc. (Tech.) Pasi Luukka	
<b>Aims</b>	In the end of the course student is expected to be able to <ul style="list-style-type: none"> <li>- apply fuzzy systems in engineering environment</li> <li>- apply function approximation methods with fuzzy systems</li> <li>- model and solve control problems and apply neuro-fuzzy systems.</li> </ul>	
<b>Content</b>	Fuzzy sets and relations, fuzzy functions and rule-based systems, Mamdani	

<b>Modes of Study</b> <b>Evaluation</b> <b>Study materials</b>  <b>Prerequisites</b> <b>Further Information</b>	fuzzy system and Sugeno-Tagaki fuzzy system, universal approximators, fuzzy modelling, fuzzy control, fuzzy controllers in applications, aggregation operators, fuzzy screening systems, averaging operators and modifier operations. Neuro-Fuzzy systems. Suitable also for postgraduate studies. Lectures 28 h, exercises 14 h, 3rd period. Project work 4th period. Exam. 0-5, examination 100%. Project work. Fullér, R.: Introduction to Neuro-Fuzzy Systems, Physica-Verlag, 2000. Kosko, B.: Fuzzy Engineering, Prentice-Hall, 1996. Passino, K.M., Yurkovich, S.: Fuzzy Control, Addison-Wesley, 1998. Recommended BM20A3101 Fuzzy Sets and Fuzzy Logic. This course has 11-15 places for open university students. More information on the web site for open university instruction.
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<b>BM20A3301</b>	<b>STOCHASTIC THEORY AND MODELS</b>	<b>3 - 5 ECTS</b> <b>cr</b>
<b>Year and Period</b> <b>Teacher(s)</b> <b>Aims</b>  <b>Content</b>  <b>Modes of Study</b>  <b>Evaluation</b> <b>Study materials</b> <b>Prerequisites</b>  <b>Further Information</b>	<b>Stochastic Theory and Models, Stokastiikan teoriaa ja malleja</b> M.Sc. (Tech.) 1, Period 4 Professor, Ph.D. Matti Heiliö Student knows the theory of stochastic models and advanced statistical methods and is able to apply them in analyzing and understanding systems and phenomena containing randomness and uncertainty. 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 methods. Suitable also for postgraduate studies. Supervised self study course. Lectures 10 h, exercises 14h, project assignment, self-study material, 4th period. Exam. 0-5, examination 50%, project assignment 50%. Will be announced at lectures. BM20A1401 Tilastomatematiikka I. Recommended BM20A1900 Statistics II, BM20A2500 Linear Algebra and Normed Spaces. This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BM20A3401</b>	<b>DESIGN OF EXPERIMENTS</b>	<b>4 ECTS cr</b>
<b>Year and Period</b> <b>Teacher(s)</b>  <b>Aims</b>	<b>Design of Experiments, Koesuunnittelu</b>  <b>The course is organized jointly with the Department of Mathematics and Physics and with the Department of Chemical Technology. It covers the design of experiment modules of the courses BJ70A0701 Teollisuus- ja ympäristöanalytiikka I and BJ70AJ110 Design of Experiments and Sampling (postgraduate course).</b> M.Sc. (Tech.) 1-2, Period 4 Professor, Ph.D. Heikki Haario Researcher/Teacher, Docent, D.Sc. (Tech.) Satu-Pia Reinikainen Person in Charge: Professor, Ph.D. Heikki Haario After the course, the student is expected to master the basic skills for effective experimentation, together with regression analysis of data: - understanding of the importance of designed experiments - ability to apply the basic experimental plans, and regression techniques to analyse the results - skills to optimize an engineering process using design of experiments and	

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<b>Content</b>	data analysis. Importance of experimental design, minimization of prediction uncertainty of regression models. Basic factorial designs: 2N, Central Composite designs for regression analysis. Mixture designs. The Taguchi principles. Experimental optimisation of engineering processes. Suitable also for postgraduate studies.
<b>Modes of Study</b>	Lectures 14 h as an intensive course. Exercises 14 h weekly as guided group works both real laboratory experimentation and regression analysis. Project work 14 h.
<b>Evaluation</b>	Examination.
<b>Study materials</b>	0-5, examination 70%, project work 30%. Box, G., Hunter, S., Hunter, W. G.: Statistics for Experimenters, Wiley 2005, 2nd Edition.
<b>Prerequisites</b>	Mathematics A and B, BM20A1401 Tilastomatematiikka I/basic statistics. Basic (Matlab) skills for technical computing with PC.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BM20A3602</b>	<b>FUZZY DATA ANALYSIS</b>	<b>6 ECTS cr</b>
	<b>Fuzzy Data Analysis, Data-analyysiä sumeassa ympäristössä</b>	
	<b>Replaces the course BM20A3601 Fuzzy Data Analysis. The course will be lectured every other year, next during the academic year 2010 - 2011.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 3	
<b>Teacher(s)</b>	Senior Assistant, D.Sc. (Tech.) Pasi Luukka	
<b>Aims</b>	In the end of the course student is expected to be able to - understand theoretical aspects of data analysis - understand the principles of multicriteria decision making and is capable of applying them - model and analyze uncertainty in different problem settings - apply fuzzy principal component analysis, fuzzy clustering and classification methods to data analysis problems - apply fuzzy regression analysis.	
<b>Content</b>	Fuzzy sets and relations. Uncertainty measures. Qualitative and quantitative analysis of fuzzy data. Introduction to possibility theory and generalized measure theory. Principles of individual multiperson, multicriteria and multidecision making, fuzzy interpolation, fuzzy principle component analysis, fuzzy clustering and classification, fuzzy regression analysis. Evaluation of methods. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures 28 h, exercises 28 h, 3rd period. Project work 4th period. Exam.	
<b>Evaluation</b>	0-5, examination 100%. Project work.	
<b>Study materials</b>	Bandemer, H., Näther, W.: Fuzzy Data Analysis, Kluwer Academic Publ., 1992.	
<b>Prerequisites</b>	Recommended BM20A3101 Fuzzy Sets and Fuzzy Logic.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BM20A3801</b>	<b>ADVANCED MATHEMATICAL METHODS</b>	<b>3 - 6 ECTS cr</b>
	<b>Advanced Mathematical Methods, Matemaattisten menetelmien erikoiskurssi</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-4	
<b>Teacher(s)</b>	Professor, Ph.D. Matti Heiliö	
<b>Aims</b>	The student will obtain theoretical and operational skills in some specific area of applied mathematics. He understands the methods and knows how to apply the methods to modeling problems in science and engineering.	

<b>Content</b>	The course will demand reading literature, working on exercises and practical projects. Material will be individually chosen according to the focus of the study module, students' interests and research task. The topic may be for example optimization, numerical methods, PDE:s, stochastics, theory of algorithms, wavelets, filtering, systems analysis, mathematics of finance etc. The course with the same title can be included in the study programme twice when two distinct areas are covered. Suitable also for postgraduate studies.
<b>Modes of Study</b>	Self study material, assignments, report.
<b>Evaluation</b>	0-5, report 100%.
<b>Prerequisites</b>	Recommended BM20A1501 Numeeriset menetelmät I, BM20A1601 Matriisilaskenta.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BM20A3900</b>	<b>MODELLING METHODOLOGY IN PROCESS ENGINEERING</b>	<b>6 ECTS cr</b>
	<b>Modelling Methodology in Process Engineering, Mallinnus prosessitekniiikassa</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Researcher/Teacher, Ph.D. Tuomo Kauranne M. Sc. (Tech.) Ville Manninen Miika Tolonen	
<b>Aims</b>	Person in Charge: Researcher/Teacher, Ph.D. Tuomo Kauranne The student knows the principles of regression analysis and mathematical modeling in process engineering and is able to build simple mathematical models for chemical processes using Matlab and calibrate their parameters with measurement data.	
<b>Content</b>	Types of modelling: empirical and physicochemical models and their uses. 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, parameter estimation and data assimilation. Examples from data analysis, process modelling, pulp and paper technology, chemical engineering, and signal processing among others. Examples and exercises with Matlab.	
<b>Modes of Study</b>	Lectures 21 h, exercises 14 h, 1st period. Lectures 21 h, exercises 14 h, 2nd period. Practical assignment. Exam.	
<b>Evaluation</b>	0-5, examination 70%, practical assignment 30%.	
<b>Study materials</b>	Giordano, Frank R. - Weir, Maurice D. - Fox, William P.: A first course in mathematical modeling, Brooks/Cole, 1997. Borrelli, R., Coleman, C.: Differential Equations: A Modeling Perspective, John Wiley & Sons, 2003. Svobodny, T.: Mathematical Modeling for Industry and Engineering, Prentice Hall, 1998.	
<b>Prerequisites</b>	Mathematics A and B. Recommended BM20A1401 Tilastomatematiikka I, BM20A1501 Numeeriset menetelmät I, BM20A1601 Matriisilaskenta, BM20A2102 Differential Equations.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	

<b>BM20A4000</b>	<b>CASE STUDY SEMINAR</b>	<b>5 ECTS cr</b>
	<b>Case Study Seminar, Sovelletun matematiikan erikoistyöt</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-4	
<b>Teacher(s)</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. The students learn	

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<b>Content</b>	how to prepare and give scientific presentations. 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. For example, 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. The project work typically is an introduction to the diploma work topic of the student. Suitable also for postgraduate studies.
<b>Modes of Study</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.
<b>Evaluation</b>	Pass/fail. To pass the course student must attend 7 weeks and present his/her project work.
<b>Prerequisites</b>	Mathematics A and B. Recommended BM20A1501 Numeeriset menetelmät I, BM20A1601 Matriisilaskenta, BM20A3900 Modelling Methodology in Process Engineering.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>BM20A4201</b>	<b>APPLIED FUNCTIONAL ANALYSIS</b>	<b>4 - 6 ECTS cr</b>
	<b>Applied Functional Analysis, Sovellettu funktionaalianalyysi</b>	
	<b>Replaces the course BM20A4200 Applied Functional Analysis. The course will be lectured every other year, next during the academic year 2010 - 2011.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 2-3	
<b>Teacher(s)</b>	M.Sc. (Tech.) Jouni Sampo	
<b>Aims</b>	To introduce some specific area of applied functional analysis. Topic may change every year. Academic year 2010-2011 subject is "Wavelet and multiscale transforms with applications". After course student should: <ul style="list-style-type: none"> <li>- understand elementary functional analysis and linear algebra behind wavelet bases</li> <li>- understand concept of multiresolution analysis and basic properties of different wavelet bases</li> <li>- be able to implement simple discrete wavelet transform</li> <li>- understand relationship between wavelets and filter banks</li> <li>- be able to apply wavelet transform in compression, de-noising and analysis of singularities.</li> </ul>	
<b>Content</b>	Academic year 2010-2011: Elementaries of orthogonal and bi-orthogonal bases and frames, continuous and discrete wavelet transforms, properties of wavelet basis, multiresolution analysis, filter banks, implementation of wavelet transform in 1-D and 2-D, geometric multiscale transforms, applications (especially compression and denoising of signals and images). Suitable also for postgraduate studies.	
<b>Modes of Study</b>	4 ECTS cr: Lectures 28 h, exercises 28 h, 2nd period. Exam. 6 ECTS cr: Lectures 28 h, exercises 28 h, 2nd period. Exam. Seminars 7 h and project work and seminar presentation, 3rd period.	
<b>Evaluation</b>	0-5, examination 100% (4 ECTS cr). Project work and seminar presentation (6 ECTS cr).	
<b>Study materials</b>	Will be announced at lectures.	
<b>Prerequisites</b>	Recommended BM20A2500 Linear Algebra and Normed Spaces.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	

<b>BM20A4500</b>	<b>EVOLUTIONARY COMPUTATION</b>	<b>5 ECTS cr</b>
	<b>Evolutionary Computation, Evoluutiolaskenta</b>	
	<b>The course will be lectured every other year, next during the academic year 2010 - 2011.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 2	
<b>Teacher(s)</b>	Saku Kukkonen	
<b>Aims</b>	After the course the student is expected to: - understand what evolutionary computation is and what its possibilities / limitations are - know major types of evolutionary algorithms - be able to apply evolutionary computation in order to solve a practical problem.	
<b>Content</b>	Introduction to evolutionary computation and its applications. Structure, components, and characteristics of evolutionary algorithms. Evolutionary problem solving, searching, and optimization. Different evolutionary algorithms, practical problem solving, and multiobjective optimization using evolutionary algorithms. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures 28 h, exercises 14 h, project work and seminars (about 7 h), 2nd period. Exam.	
<b>Evaluation</b>	0-5, examination 100%. Project work.	
<b>Study materials</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. Other material given at lectures.	
<b>Prerequisites</b>	Good programming skill using some programming language is needed. The following courses might be helpful: CT60A0200 Ohjelmoinnin perusteet, CT60A0210 Käytännön ohjelmointi and CT50A2310 Tietorakenteet ja algoritmit.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	
<b>BM20A4800</b>	<b>PROJECT WORK IN APPLIED MATHEMATICS</b>	<b>10 - 30 ECTS cr</b>
	<b>Project Work in Applied Mathematics, Soveltavan matematiikan projektityö</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2	
<b>Teacher(s)</b>	N. N. Person in Charge: Professor, Ph.D. Matti Heiliö	
<b>Aims</b>	The student obtains practical skills and advanced knowledge in a specific application area. The student gains experience in project work, team work skills, self management and work discipline.	
<b>Content</b>	A specific project which is done in one of the research groups of applied mathematics. The project is planned together with the supervisor(s) and consists of computational research work, model building, literature surveys and report writing. The course may contain lectures and seminars. The project may also be planned together with industry and partly carried out in the environment of the company.	
<b>Modes of Study</b>	The amount of work hours in the project will determine the amount of credits, e.g. three months of work would give 15 ECTS cr. Credits will be granted when the final report is delivered. Extra credits can be received if specific examinations are made.	
<b>Evaluation</b>	0-5 or pass/fail, depending on the work performance and project report.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	



<b>BM20A5000</b>	<b>PRINCIPLES OF TECHNICAL COMPUTING AND SCIENTIFIC PUBLISHING</b>	<b>4 ECTS cr</b>
	<b>Principles of Technical Computing and Scientific Publishing, Teknisen laskennan ja julkaisemisen perusteet</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 2, M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Researcher/Teacher, Ph.D. Tuomo Kauranne M. Sc. (Tech.) Matylda Jablonska	
<b>Aims</b>	Person in Charge: Researcher/Teacher, Ph.D. Tuomo Kauranne Students get a good hold of principles of scientific computing applied to engineering problems and gain fluency in using related software environments, including scientific publishing.	
<b>Content</b>	Solving engineering problems with scientific computing. Computational methods and problem-solving environments. Basics of Mathematical software. Programming constructs. Solving engineering problems with Matlab and Octave. Basics of scientific publishing using LaTeX.	
<b>Modes of Study</b>	Lectures 8 h, computer class exercises 16 h, practical assignment, 1st-2nd period.	
<b>Evaluation</b>	0-5, exercises 50%, practical assignment 50%.	
<b>Study materials</b>	Gilat, A.: An Introduction to Matlab with Applications.	
<b>Prerequisites</b>	Basic University Calculus recommended. Recommended Mathematics A and B or corresponding knowledge.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	
<b>BM30A0500</b>	<b>APPLIED OPTICS</b>	<b>6 ECTS cr</b>
	<b>Applied Optics, Sovellettu optiikka</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 2	
<b>Teacher(s)</b>	Researcher/Teacher, Ph.D. Erik Vartiainen	
<b>Aims</b>	The aims of the course are to describe basic optical phenomena and their applications particularly in the field of optical measurement technology and to provide the students with the skills to understand the operation of optical measurement instruments.	
<b>Content</b>	Ocular optics. Optical measurement instruments. Interferometry. Polarisation. Diffraction. Fourier optics. The optical properties of materials.	
<b>Modes of Study</b>	Lectures 42 h, tutorials 28 h, 2nd period. Written examination.	
<b>Evaluation</b>	0-5, examination 100%.	
<b>Study materials</b>	Pertti Silfsten: Sovellettu optiikka.	
<b>Prerequisites</b>	Students are recommended to have completed Physics or Physics L.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	
<b>BM30A0601</b>	<b>OPTOELECTRONICS</b>	<b>6 ECTS cr</b>
	<b>Optoelectronics, Optoelektroniikka</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1	
<b>Teacher(s)</b>	Professor, Ph.D. Tuure Tuuva	
<b>Aims</b>	To understand the basics of optical data communication.	
<b>Content</b>	Optical waveguides, light emitting devices and photodetectors. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures 35 h, exercises 14 h, 1st period. Examination.	
<b>Evaluation</b>	0-5, examination 100%.	
<b>Study materials</b>	Kasap, S. O.: Optoelectronics and Photonics P. Silfsten & E. Vartiainen: Optoelektroniikka,	
<b>Prerequisites</b>	Physics or Physics L.	

<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BM30A1500</b>	<b>ADVANCED TOPICS IN MATERIAL SCIENCE</b>	<b>6 ECTS cr</b>
	<b>Advanced Topics in Material Science, Moderni materiaalitiede</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 2	
<b>Teacher(s)</b>	Visiting lecturers	
<b>Aims</b>	Person in Charge: Professor, Ph.D. Erkki Lähderanta	
<b>Content</b>	The aim of the course is to introduce students to selected topics of advanced physics, especially in the area of nanophysics.	
<b>Modes of Study</b>	Nanophysics, applied superconductivity, ferroelectrics, other advanced topics in material science connected to nanophysics. Suitable also for postgraduate studies.	
<b>Evaluation</b>	Lectures and exercises 24 h, 2nd period.	
<b>Study materials</b>	Pass/Fail. Written assignment 100%.	
<b>Prerequisites</b>	To be given at lectures.	
<b>Further Information</b>	BM30A2200 Semiconductor and Superconductor Physics	
	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BM30A1600</b>	<b>MICROELECTRONICS</b>	<b>6 ECTS cr</b>
	<b>Microelectronics, Mikroelektroniikka</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1	
<b>Teacher(s)</b>	Person in Charge: Professor, Ph.D. Tuure Tuuva	
<b>Aims</b>	To acquaint students with integrated circuit technology and provide them with skills for analog IC design. The students will learn the most important variables and functions related to the components of integrated circuits. Components will be modelled with simulation programs. The assignment of IC design will be carried out with a suitable design program.	
<b>Content</b>	Semiconductor physics for the analysis of the operation of components. The geometry and design rules of IC components. PN junctions, MOS, BJT, and passive components in IC. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures 28 h, tutorials 28 h, 1st period.	
<b>Evaluation</b>	Assignment and its presentation. Written examination.	
<b>Study materials</b>	0-5, examination 100%. Satisfactorily completed assignment required.	
<b>Prerequisites</b>	Roger T. Howe, Charles G. Sodini: Microelectronics An Integrated Approach. Recommended BL40A1710 Digitaalielektroniikka A and BL50A1400 Analogiaelektroniikka.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BM30A1700</b>	<b>PHYSICS OF SEMICONDUCTOR DEVICES</b>	<b>3 - 6 ECTS cr</b>
	<b>Physics of Semiconductor Devices, Puolijohdekomponenttien fysiikka</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-2	
<b>Teacher(s)</b>	Person in Charge: Professor, Ph.D. Tuure Tuuva	
<b>Aims</b>	To provide the student with an in-depth knowledge of semiconductor devices and their operation.	
<b>Content</b>	Structure, operation and physics of semiconductor devices. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Special assignment, seminars 28 h, 1st-2nd period.	
<b>Evaluation</b>	Pass/fail, special assignment 100%.	
<b>Study materials</b>	Sze, Physics of Semiconductor Devices.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BM30A2100</b>	<b>MICROELECTRONICS PROCESSING TECHNOLOGY</b>	<b>2 ECTS cr</b>
	<b>Microelectronics Processing Technology, Mikropiirien valmistustekniikka</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Professor, Ph.D. Tuure Tuuva	
<b>Aims</b>	To provide the student with a knowledge of microelectronics processing technology and components.	
<b>Content</b>	Purification of semiconductor materials. Growth of semiconductor crystals and wafer preparation. Epitaxial layers, diffusion, ion implantation, oxidation, etching and photolithography. Semiconductor manufacturing and development.	
<b>Modes of Study</b>	Special assignment. Simulation studies of semiconductor processing using Silvaco Virtual Wafer Fab simulation program.	
<b>Evaluation</b>	0-5, special assignment 100%.	
<b>Study materials</b>	Plummer, J. D., Deal, M. D., Griffin, P. B., Silicon VLSI Technology: Fundamentals, Practice and Modeling.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>BM30A2200</b>	<b>SEMICONDUCTOR AND SUPERCONDUCTOR PHYSICS</b>	<b>6 ECTS cr</b>
	<b>Semiconductor and Superconductor Physics, Puolijohde- ja suprajohdefysiikka</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Professor, Ph.D. Erkki Lähderanta	
<b>Aims</b>	The course gives the student the skills to understand the basic behaviour of semiconductors and superconductors.	
<b>Content</b>	Classical conductor, free-electron model of metals, energy bands, doped semiconductors, spintronics, basic properties of superconductivity, London equations, thermodynamics of the superconducting transition, the intermediate state, coherence length, current in superconductor, thin films, BCS-theory, type-II superconductors. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures 42 h, exercises 28 h, 1st-2nd period.	
<b>Evaluation</b>	0-5, examination 100%.	
<b>Study materials</b>	Juha Sinkkonen: Puolijohdeteknologian perusteet. A. C. Rose-Innes and E. H. Rhoderick: Introduction to Superconductivity, 2nd edition (Pergamon).	
<b>Prerequisites</b>	A knowledge of the fundamentals of material physics, a knowledge of the electric and physical properties of materials.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>BM30A2300</b>	<b>PROJECT WORK IN TECHNICAL PHYSICS</b>	<b>10 - 30 ECTS cr</b>
	<b>Project Work in Technical Physics, Teknillisen fysiikan projektityö</b>	
	<b>The course is mainly intended for foreign visiting students.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2	
<b>Teacher(s)</b>	N. N. Person in Charge: Professor, Ph.D. Erkki Lähderanta Professor, Ph.D. Tuure Tuuva Researcher/Teacher, Ph.D. Erik Vartiainen	
<b>Aims</b>	The student obtains practical skills and advanced knowledge in a specific application area. The student gains experience in experiments, project work, team work skills, self management and work discipline.	
<b>Content</b>	A specific research work or experiment or project which is done in one of the research groups of technical physics. The experiment is planned together with the supervisor(s) and consists of either experimental work or computational research work with modelling. Additionally is included literature surveys and report writing. The course may contain lectures and seminars. The project may also be planned together with industry and partly carried out in the environment of the company.	
<b>Modes of Study</b>	The amount of work hours in the project will determine the amount of credits, e.g. three months of work would give 15 ECTS cr. Credits will be granted when the final report is delivered. Extra credits can be received if specific examinations are made.	
<b>Evaluation</b>	0-5 or pass/fail, depending on the work performance and project report.	
<b>Study materials</b>	Literature related to the project.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

## 5. Faculty of Technology Management

### 5.1. Master's Degree Programme in Information Technology

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

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

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

#### Professional Scope of the Master's Degree Programme

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

#### Fields of Specialisation

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

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

1. **Students of Intelligent Computing** get a broad idea of the applications and methods of information processing as well as information processing systems and their design. Advanced studies focus on intelligent information processing and its applications. The graduates can work in:

- Design, development, and maintenance of information processing systems and software
- Project planning and management in ICT companies
- Product development and consulting of intelligent computing
- Research and teaching in universities and research institutes

2. **Students of Communications Software** gain knowledge of networking by having both technical as well as social point of view. Studies in the major emphasize current and future network technologies that allow communication and networking between humans and/or machines. The highly practical approach to the software aspects of networking links the theoretical knowledge to the real life applications. By completing these studies the students are capable of working in the following fields:

- Design, implementation, development and maintenance of communication networks and systems
- Design, implementation and development of communications software and services
- Product development, consulting and management tasks in the field of communications
- Research and teaching tasks in universities and research institutes

3. **Students of Software Engineering** will get expertise in software development, its processes, methods and tools. Typical roles for the graduates of this major include software architects, programming experts, software product managers, and systems analysts. Common tasks in the field include
- Design, development, and maintenance of software and information systems
  - Software and systems analysis and design
  - Participation to software development projects in either supplier or customer role
  - Software research and product development
  - Management of software development organizations.

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

### **Intelligent Computing**

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

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

### **Communications Software**

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

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

### **Software Engineering**

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

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

### **Complementary Studies**

Students with a degree from a Finnish University of Applied Sciences or Polytechnics or equivalent will have to study complementary studies (26 ECTS cr) which are not included in the Master's degree. The extent of these studies depends on the content of the previous degree. Please, see page 97. Further information: Study coordinator Susanna Koponen, room 4426, phone +358 40 352 4002, susanna.koponen at lut.fi.

## International Master's Degree Programme in Information Technology

## The Degree Structure of the Programme

## Master of Science 120 ECTS cr

	ECTS cr
General studies	12
Major subject	78
Minor subject	20
Elective studies	10
<i>Total</i>	<i>120</i>

## General studies

<i>Obligatory (12 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BK10A0300	Introduction to M.Sc. Studies	M.Sc. (Tech.) 1	1	1
CT10A9500	Research Methods	M.Sc. (Tech.) 1	1-2	3
FV11A6500	Presenting in English	B.Sc. (Tech.) 2-3 M.Sc. (Tech.) 1-2	1, 2, 3, 4	2
		B.Sc. (Econ. & Bus. Adm.) 2-3 M.Sc. (Econ. & Bus. Adm.) 1-2		
FV11A8900	Academic Writing in English	B.Sc. (Tech.) 3 M.Sc. (Tech.) 1-2 B.Sc. (Econ. & Bus. Adm.) 3 M.Sc. (Econ. & Bus. Adm.) 1-2	1-2, 3-4, 5	4
FV18A9101 <sup>†</sup>	Finnish 1		1, 3	2

<sup>†</sup>) Teknisk svenska 2 ECTS is obligatory for Finnish students who have not attained proficiency in Swedish in their previous degree

## 5.1.1 MAJOR: Intelligent Computing

## Major Subject in Intelligent Computing

<i>Obligatory Studies (56 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT50A5700	Introduction to Computer Graphics	M.Sc. (Tech.) 1	2	5
CT50A6000	Pattern Recognition	M.Sc. (Tech.) 1	3-4	7
CT50A6100 <sup>†</sup>	Machine Vision and Digital Image Analysis	M.Sc. (Tech.) 1-2	1-2	7
CT50A6200 <sup>†</sup>	Computer and Robot Vision	M.Sc. (Tech.) 1-2	1-2	7
CT50A6400	Compiler Construction	M.Sc. (Tech.) 1	3-4	7
CT10A6000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

<sup>†</sup>) Exchangeable

<i>Elective Studies (min. 22 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT10A9601	Research Methods, Laboratory Project	M.Sc. (Tech.) 1	1-4	1-5
CT50A6100	Machine Vision and Digital Image Analysis	M.Sc. (Tech.) 1-2	1-2	7
CT50A6200	Computer and Robot Vision	M.Sc. (Tech.) 1-2	1-2	7
CT30A7001	Concurrent and Parallel Computing	M.Sc. (Tech.) 1-2	3-4	8
BK70A0000	Simulation of a Mechatronic Machine	M.Sc. (Tech.) 1	3-4	6
BM20A1900	Statistics II	M.Sc. (Tech.) 1-2	2	3
BM20A2800	Nonlinear Optimization	M.Sc. (Tech.) 1-2	4	4
BM20A2901	Discrete Optimization	M.Sc. (Tech.) 1-2	4	5
BM20A4201	Applied Functional Analysis	M.Sc. (Tech.) 1-2	2-3	4-6
BM30A0500	Applied Optics	M.Sc. (Tech.) 1	2	6

### 5.1.2 MAJOR: Communications Software

#### Major Subject in Communications Software

<i>Obligatory Studies (53 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT30A5000	Network Programming	M.Sc. (Tech.) 1	1-2	5
CT30A6000	Communications Software, Protocols and Architectures	M.Sc. (Tech.) 1	1-3	8
CT30A8001	User-Centric Service Design	M.Sc. (Tech.) 1	3	5
CT30A8902	Service Oriented Architecture	M.Sc. (Tech.) 2	2	5
CT10A6000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

<i>Elective Studies (min. 25 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT10A9601	Research Methods, Laboratory Project	M.Sc. (Tech.) 1	1-4	1-5
CT10A9700	Summer School on Communications Engineering	M.Sc. (Tech.) 2		2
CT30A6801	Local Area Networks, Special Course	M.Sc. (Tech.) 1-2	1-3	8
CT30A6900	Peer-to-peer Networking	M.Sc. (Tech.) 1-2	3-4	5
CT30A7001	Concurrent and Parallel Computing	M.Sc. (Tech.) 1-2	3-4	8
CT30A8300	Wireless Service Engineering	M.Sc. (Tech.) 1-2	1-2	5
CT30A8800	Secured Communications	M.Sc. (Tech.) 1-2	1-2	6
CT30A9300	Code Camp on Communications Engineering	M.Sc. (Tech.) 1-2		4
CT30A9400	Ad hoc and Sensor Networks	M.Sc. (Tech.) 1-2	1-4	5
CT60A7201	Architecture in Systems and Software Development	M.Sc. (Tech.) 1	3-4	7
CT60A7302	Software Quality, Processes, and Organizations	M.Sc. (Tech.) 2	1-2	7
CT60A7400	Fundamentals of Information Systems	M.Sc. (Tech.) 1	1-2	7
CT60A7500	Object-Oriented Programming Techniques	M.Sc. (Tech.) 1	1-2	5

### 5.1.3 MAJOR: Software Engineering

#### Major Subject in Software Engineering

<i>Obligatory Studies (56 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT60A7201	Architecture in Systems and Software Development	M.Sc. (Tech.) 1	3-4	7
CT60A7302	Software Quality, Processes, and Organizations	M.Sc. (Tech.) 2	1-2	7
CT60A7400	Fundamentals of Information Systems	M.Sc. (Tech.) 1	1-2	7
CT60A7500	Object-Oriented Programming Techniques	M.Sc. (Tech.) 1	1-2	5
CT10A6000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

<i>Elective Studies (min 22 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT10A9601	Research Methods, Laboratory Project	M.Sc. (Tech.) 1	1-4	1-5
CT30A5000	Network Programming	M.Sc. (Tech.) 1	1-2	5
CT30A6000	Communications Software, Protocols and Architectures	M.Sc. (Tech.) 1	1-3	8
CT30A8001	User-Centric Service Design	M.Sc. (Tech.) 1	3	5
CT30A8902	Service Oriented Architecture	M.Sc. (Tech.) 2	2	5
CT30A9300	Code Camp on Communications Engineering	M.Sc. (Tech.) 1-2		4
CT50A5700	Introduction to Computer Graphics	M.Sc. (Tech.) 1	2	5
CT50A6000	Pattern Recognition	M.Sc. (Tech.) 1	3-4	7
CT50A6400	Compiler Construction	M.Sc. (Tech.) 1	3-4	7



### Minor Subject, 20 ECTS credits

The minor subject can be selected freely either from Information Technology or from any other minor subject listed below.

Information Technology:

- major Intelligent Computing: minor either Communications Software or Software Engineering
- major Communications Software: minor either Intelligent Computing or Software Engineering
- major Software Engineering: minor Intelligent Computing or Communications Software

The minor in Information Technology must include at least 20 ECTS credits of the compulsory courses of the selected topic.

Faculty of Technology Management:

- Russia and Transitional Economies: Business Environment
- Business and Technology in Russia
- Business Technology

Faculty of Technology:

- Technomathematics
- Bio-Energy Technology
- Environmental Energy Technology
- Modelling of Energy Systems
- Chemical Engineering
- Advanced Design Methodology
- Packaging Technology
- Manufacturing
- Technical Physics
- Power Electronics and Electrical Drives
- Industrial Embedded Systems

School of Business:

- Business Administration

If choosing one of the minors from other faculties, please check the prerequisites! The course descriptions and description of the minors can be found in this study guide in the section dedicated to each Master's programme. Additional information is provided by the study counselling staff of each Master's programme. Please see chapter 9.

### 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.

The minimum of the degree is 120 ECTS credits. Elective studies are selected such that this 120 ECTS credits are completed.

### Complementary Studies

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

**Complementary Studies**

<i>Obligatory studies (26 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BM20A0500	Matematiikka KoTiB1	B.Sc. (Tech.) 1	3	3
BM20A0700	Matematiikka KoTiB2	B.Sc. (Tech.) 1	3-4	2
BM20A0900	Matematiikka KoTiB3	B.Sc. (Tech.) 1	4	3
BM20A1401	Tilastomatematiikka I	B.Sc. (Tech.) 2	1	3
CT30A2500	TCP/IP -perusteet	B.Sc. (Tech.) 3	1-2	5
CT50A2310	Tietorakenteet ja algoritmit	B.Sc. (Tech.) 2	2	5
CT50A3000	Unix and System Programming	B.Sc. (Tech.) 3	1-2	5

## 5.2. CBU Master's Degree Programme in Information and Communications Technology

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

### The partners in the programme are:

- St. Petersburg State University
- St. Petersburg State Polytechnic University
- Petrozavodsk State University
- Lappeenranta University of Technology
- University of Eastern Finland
- University of Helsinki

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

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

### Levels of collaboration of the CBU ICT Master's Programme

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

### Complementary Studies

Students with a Finnish degree from the University of Applied Sciences or equivalent will have to study complementary studies (26 ECTS cr) which are not included in the Master's degree. The extent of these studies depends on the content of the previous degree. Please, see page 97. Further information: Study coordinator Susanna Koponen, room 4426, phone +358 40 352 4002, susanna.koponen at lut.fi.

### Personal Study Plan

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

## CBU-ICT courses

CBU-ICT courses offered in different partner universities are available on the website <http://cs.ioensuu.fi/CBU/>

## Degree structure of CBU Master's Degree Programme in Information and Communications Technology

### Master of Science 120 ECTS cr

	ECTS cr
General studies	12
Major subject	78
Minor subject	20
Elective studies	10
<i>Total</i>	<i>120</i>

### OBLIGATORY FOR ALL MAJORS 12 ECTS cr

#### General studies

<i>Obligatory (12 ECTS cr)</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BK10A0300 Introduction to M.Sc. Studies	M.Sc. (Tech.) 1	1	1
CT10A9500 Research Methods	M.Sc. (Tech.) 1	1-2	3
FV11A6500 Presenting in English	B.Sc. (Tech.) 2-3 M.Sc. (Tech.) 1-2	1, 2, 3, 4	2
	B.Sc. (Econ. & Bus. Adm.) 2-3 M.Sc. (Econ. & Bus. Adm.) 1-2		
FV11A8900 Academic Writing in English	B.Sc. (Tech.) 3 M.Sc. (Tech.) 1-2 B.Sc. (Econ. & Bus. Adm.) 3 M.Sc. (Econ. & Bus. Adm.) 1-2	1-2, 3-4, 5	4
FV18A9101 <sup>f</sup> Finnish 1		1, 3	2

<sup>f</sup> Teknisk svenska 2 ECTS is obligatory for Finnish students who have not attained proficiency in Swedish in their previous degree

### 5.2.1 MAJOR: Intelligent Computing

#### Major Subject in Intelligent Computing

<i>Obligatory Studies (56 ECTS cr)</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT50A5700 Introduction to Computer Graphics	M.Sc. (Tech.) 1	2	5
CT50A6000 Pattern Recognition	M.Sc. (Tech.) 1	3-4	7
CT50A6100 <sup>1)</sup> Machine Vision and Digital Image Analysis	M.Sc. (Tech.) 1-2	1-2	7
CT50A6200 <sup>1)</sup> Computer and Robot Vision	M.Sc. (Tech.) 1-2	1-2	7
CT50A6400 Compiler Construction	M.Sc. (Tech.) 1	3-4	7
CT10A6000 Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

<sup>1)</sup> Exchangeable

<i>Elective Studies (min 22 ECTS cr)</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT10A9100 ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT30A7001 Concurrent and Parallel Computing	M.Sc. (Tech.) 1-2	3-4	8
CT50A6100 Machine Vision and Digital Image Analysis	M.Sc. (Tech.) 1-2	1-2	7

## 100 Information Technology

CT50A6200	Computer and Robot Vision	2 M.Sc. (Tech.) 1- 1-2	7
BK70A0000	Simulation of a Mechatronic Machine	2 M.Sc. (Tech.) 1 3-4	6
BM20A1900	Statistics II	M.Sc. (Tech.) 1- 2	3
BM20A2800	Nonlinear Optimization	2 M.Sc. (Tech.) 1- 4	4
BM20A2901	Discrete Optimization	2 M.Sc. (Tech.) 1- 4	5
BM20A4201	Applied Functional Analysis	2 M.Sc. (Tech.) 1- 2-3	4-6
BM30A0500	Applied Optics	2 M.Sc. (Tech.) 1 2	6

### 5.2.2 MAJOR: Communications Software

#### Major Subject in Communications Software

<i>Obligatory Studies (53 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT30A5000	Network Programming	M.Sc. (Tech.) 1	1-2	5
CT30A6000	Communications Software, Protocols and Architectures	M.Sc. (Tech.) 1	1-3	8
CT30A8001	User-Centric Service Design	M.Sc. (Tech.) 1	3	5
CT30A8902	Service Oriented Architecture	M.Sc. (Tech.) 2	2	5
CT10A6000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

<i>Elective Studies (min. 25 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT10A9700	Summer School on Communications Engineering	M.Sc. (Tech.) 2		2
CT30A6801	Local Area Networks, Special Course	M.Sc. (Tech.) 1-	1-3	8
CT30A6900	Peer-to-peer Networking	2 M.Sc. (Tech.) 1-	3-4	5
CT30A7001	Concurrent and Parallel Computing	2 M.Sc. (Tech.) 1-	3-4	8
CT30A8300	Wireless Service Engineering	2 M.Sc. (Tech.) 1-	1-2	5
CT30A8800	Secured Communications	2 M.Sc. (Tech.) 1-	1-2	6
CT30A9300	Code Camp on Communications Engineering	2 M.Sc. (Tech.) 1-		4
CT30A9400	Ad hoc and Sensor Networks	2 M.Sc. (Tech.) 1-	1-4	5
CT60A7201	Architecture in Systems and Software Development	2 M.Sc. (Tech.) 1	3-4	7
CT60A7302	Software Quality, Processes, and Organizations	M.Sc. (Tech.) 2	1-2	7
CT60A7400	Fundamentals of Information Systems	M.Sc. (Tech.) 1	1-2	7
CT60A7500	Object-Oriented Programming Techniques	M.Sc. (Tech.) 1	1-2	5

### 5.2.3 MAJOR: Software Engineering

#### Major Subject in Software Engineering

<i>Obligatory Studies (56 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT60A7201	Architecture in Systems and Software Development	M.Sc. (Tech.) 1	3-4	7
CT60A7302	Software Quality, Processes, and Organizations	M.Sc. (Tech.) 2	1-2	7
CT60A7400	Fundamentals of Information Systems	M.Sc. (Tech.) 1	1-2	7
CT60A7500	Object-Oriented Programming Techniques	M.Sc. (Tech.) 1	1-2	5
CT10A6000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

  

<i>Elective Studies (min. 22 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT30A5000	Network Programming	M.Sc. (Tech.) 1	1-2	5
CT30A6000	Communications Software, Protocols and Architectures	M.Sc. (Tech.) 1	1-3	8
CT30A8001	User-Centric Service Design	M.Sc. (Tech.) 1	3	5
CT30A8902	Service Oriented Architecture	M.Sc. (Tech.) 2	2	5
CT30A9300	Code Camp on Communications Engineering	M.Sc. (Tech.) 1-2		4
CT50A5700	Introduction to Computer Graphics	M.Sc. (Tech.) 1	2	5
CT50A6000	Pattern Recognition	M.Sc. (Tech.) 1	3-4	7
CT50A6400	Compiler Construction	M.Sc. (Tech.) 1	3-4	7

#### Master's Thesis 30 ECTS cr

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

#### Minor Subject 20 ECTS cr

Obligatory: CT10A9601 Research Methods, Laboratory Project, 5 credits.

Student chooses 15 credits lectured at the Russian CBU-ICT partner universities, from the CBU Winter and Summer Schools, visiting lectures and intensive courses.

#### Elective Studies 10 ECTS cr

Student chooses 10 credits lectured at the Russian CBU-ICT partner universities, from the CBU Winter and Summer Schools, visiting lectures and intensive courses.

Minimum of the degree is 120 ECTS credits.

For CBU-courses, please see: <http://cs.joensuu.fi/CBU/>

## 5.3. Fenno-Russian Master Degree Programme in Information Technology 2010 – 2011 (FRIT)

FRIT is a double degree programme between LUT and St. Petersburg State Electrotechnical University, ETU. The students will study one year at their home university and then come to LUT for second year to specialize in one of the three offered major subjects. Student is expected to do Master's thesis according to LUT practices. Please, see chapter 11.

Student is also obliged to complete studies at home university and obtain diploma from there.

### Degree structure of Fenno-Russian Master Degree Programme in Information Technology (FRIT)

#### Master of Science 120 ECTS cr

	<i>ECTS cr</i>
General studies	12
Major subject	78
Minor subject	20
Elective studies	10
<i>Total</i>	<i>120</i>

Compensation from ETU's first year studies to LUT degree altogether 50 ECTS credits are included followingly:

General studies 12 ECTS cr

Major subject 8 ECTS cr

Minor subject 20 ECTS cr

Elective studies 10 ECTS cr

#### Major Subject 70 ECTS credits

##### 5.3.1 MAJOR Intelligent Computing

##### Major Subject in Intelligent Computing

<i>Obligatory Studies (56 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT50A5700	Introduction to Computer Graphics	M.Sc. (Tech.) 1	2	5
CT50A6000	Pattern Recognition	M.Sc. (Tech.) 1	3-4	7
CT50A6100 <sup>1)</sup>	Machine Vision and Digital Image Analysis	M.Sc. (Tech.) 1-	1-2	7
		2		
CT50A6200 <sup>1)</sup>	Computer and Robot Vision	M.Sc. (Tech.) 1-	1-2	7
		2		
CT50A6400	Compiler Construction	M.Sc. (Tech.) 1	3-4	7
CT10A6000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

<sup>1)</sup> Exchangeable

<i>Elective Studies (min. 14 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT10A9601	Research Methods, Laboratory Project	M.Sc. (Tech.) 1	1-4	1-5
CT50A6100	Machine Vision and Digital Image Analysis	M.Sc. (Tech.) 1-	1-2	7
		2		
CT50A6200	Computer and Robot Vision	M.Sc. (Tech.) 1-	1-2	7
		2		
CT30A7001	Concurrent and Parallel Computing	M.Sc. (Tech.) 1-	3-4	8
		2		
BK70A0000	Simulation of a Mechatronic Machine	M.Sc. (Tech.) 1	3-4	6
BM20A1900	Statistics II	M.Sc. (Tech.) 1-	2	3

BM20A2800	Nonlinear Optimization	2 M.Sc. (Tech.) 1- 4	4
BM20A2901	Discrete Optimization	2 M.Sc. (Tech.) 1- 4	5
BM20A4201	Applied Functional Analysis	2 M.Sc. (Tech.) 1- 2-3	4-6
BM30A0500	Applied Optics	2 M.Sc. (Tech.) 1 2	6

### 5.3.2 MAJOR Communications Software

#### Major Subject in Communications Software

<i>Obligatory Studies (53 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT30A5000	Network Programming	M.Sc. (Tech.) 1	1-2	5
CT30A6000	Communications Software, Protocols and Architectures	M.Sc. (Tech.) 1	1-3	8
CT30A8001	User-Centric Service Design	M.Sc. (Tech.) 1	3	5
CT30A8902	Service Oriented Architecture	M.Sc. (Tech.) 2	2	5
CT10A6000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30

<i>Elective studies (min. 17 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT10A9601	Research Methods, Laboratory Project	M.Sc. (Tech.) 1	1-4	1-5
CT10A9700	Summer School on Communications Engineering	M.Sc. (Tech.) 2		2
CT30A6801	Local Area Networks, Special Course	M.Sc. (Tech.) 1- 2	1-3	8
CT30A6900	Peer-to-peer Networking	M.Sc. (Tech.) 1- 2	3-4	5
CT30A7001	Concurrent and Parallel Computing	M.Sc. (Tech.) 1- 2	3-4	8
CT30A8300	Wireless Service Engineering	M.Sc. (Tech.) 1- 2	1-2	5
CT30A8800	Secured Communications	M.Sc. (Tech.) 1- 2	1-2	6
CT30A9300	Code Camp on Communications Engineering	M.Sc. (Tech.) 1- 2		4
CT30A9400	Ad hoc and Sensor Networks	M.Sc. (Tech.) 1- 2	1-4	5
CT60A7201	Architecture in Systems and Software Development	M.Sc. (Tech.) 1	3-4	7
CT60A7302	Software Quality, Processes, and Organizations	M.Sc. (Tech.) 2	1-2	7
CT60A7400	Fundamentals of Information Systems	M.Sc. (Tech.) 1	1-2	7
CT60A7500	Object-Oriented Programming Techniques	M.Sc. (Tech.) 1	1-2	5

### 5.3.3 MAJOR Software Engineering

#### Major Subject in Software Engineering

<i>Obligatory Studies (56 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT60A7201	Architecture in Systems and Software Development	M.Sc. (Tech.) 1	3-4	7
CT60A7302	Software Quality, Processes, and Organizations	M.Sc. (Tech.) 2	1-2	7
CT60A7400	Fundamentals of Information Systems	M.Sc. (Tech.) 1	1-2	7
CT60A7500	Object-Oriented Programming Techniques	M.Sc. (Tech.) 1	1-2	5
CT10A6000	Master's Thesis and Seminar	M.Sc. (Tech.) 2	1-4	30



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<i>Elective Studies (min. 14 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CT10A9100	ECSE International Summer School in Novel Computing	M.Sc. (Tech.) 2	int.	1-2
CT10A9601	Research Methods, Laboratory Project	M.Sc. (Tech.) 1	1-4	1-5
CT30A5000	Network Programming	M.Sc. (Tech.) 1	1-2	5
CT30A6000	Communications Software, Protocols and Architectures	M.Sc. (Tech.) 1	1-3	8
CT30A8001	User-Centric Service Design	M.Sc. (Tech.) 1	3	5
CT30A8902	Service Oriented Architecture	M.Sc. (Tech.) 2	2	5
CT30A9300	Code Camp on Communications Engineering	M.Sc. (Tech.) 1-2		4
CT50A5700	Introduction to Computer Graphics	M.Sc. (Tech.) 1	2	5
CT50A6000	Pattern Recognition	M.Sc. (Tech.) 1	3-4	7
CT50A6400	Compiler Construction	M.Sc. (Tech.) 1	3-4	7

## 5.4. Courses Offered in English in Information Technology

		<i>ECTS cr</i>
CT10A0010	Laboratory Work Course in Information Technology	10 - 30
CT10A6000	Master's Thesis and Seminar	30
CT10A9100	ECSE International Summer School in Novel Computing	1 - 2
CT10A9500	Research Methods	3
CT10A9601	Research Methods, Laboratory Project	1 - 5
CT10A9700	Summer School on Communications Engineering	2
CT30A5000	Network Programming	5
CT30A6000	Communications Software, Protocols and Architectures	8
CT30A6801	Local Area Networks, Special Course	8
CT30A6900	Peer-to-peer Networking	5
CT30A7001	Concurrent and Parallel Computing	8
CT30A8001	User-Centric Service Design	5
CT30A8300	Wireless Service Engineering	5
CT30A8800	Secured Communications	6
CT30A8902	Service Oriented Architecture	5
CT30A9300	Code Camp on Communications Engineering	4
CT30A9400	Ad hoc and Sensor Networks	5
CT50A3000	Unix and System Programming	5
CT50A4000	Introduction to Intelligent Computing	5
CT50A5700	Introduction to Computer Graphics	5
CT50A6000	Pattern Recognition	7
CT50A6100	Machine Vision and Digital Image Analysis	7
CT50A6200	Computer and Robot Vision	7
CT50A6400	Compiler Construction	7
CT60A4101	Software Engineering Methods	5
CT60A5000	E-Business Technologies	5
CT60A7201	Architecture in Systems and Software Development	7
CT60A7302	Software Quality, Processes, and Organizations	7
CT60A7400	Fundamentals of Information Systems	7
CT60A7500	Object-Oriented Programming Techniques	5

<b>CT10A0010</b>	<b>LABORATORY WORK COURSE IN INFORMATION TECHNOLOGY</b>	<b>10 - 30 ECTS cr</b>
	<b>Laboratory Work Course in Information Technology</b>	
	<b>The course is only intended for foreign visiting students. The students register for the course by contacting the supervisor.</b>	
<b>Teacher(s)</b>	Person in Charge: Head of the Laboratory.	
<b>Aims</b>	Student has a deeper understanding in Information Technology in a specialized area.	
<b>Content</b>	A specific project which is done in one of the laboratories of the department. The project is planned together with the supervisor and consists mainly of laboratory work, literature work and report writing. The course may contain lectures and seminars.	
<b>Modes of Study</b>	Participation in the work of the research group and the research report.	
<b>Evaluation</b>	0-5 or passed/failed.	
<b>Study materials</b>	Literature related to the project.	
<b>CT10A6000</b>	<b>MASTER'S THESIS AND SEMINAR</b>	<b>30 ECTS cr</b>
	<b>Diplomityö ja seminaari</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-4	
<b>Teacher(s)</b>	Person in Charge: Professor, D.Sc. (Tech.) Ville Kyrki, Professor, D.Sc. (Tech.) Jari Porras and Professor, Ph.D. Kari Smolander	
<b>Aims</b>	A student is able to independent work and scientific writing, related into specific problems in the field of information technology.	
<b>Content</b>	An independent thesis done in the field of information technology, according to the instructions given. In the beginning a student must contact the professor responsible for the major subject of a student: Information Processing, Intelligent Computing (prof. Kyrki), Communications Engineering and Communications Software (prof. Porras) and Software Engineering (prof. Smolander). Independent work according to the agreed plan. The starting and finishing point of the thesis vary. A seminar presentation of the thesis should be given in an agreed, specific time before the assessment of the thesis in a faculty council meeting.	
<b>Modes of Study</b>	Master's Thesis and a seminar presentation, maturity exam.	
<b>Evaluation</b>	0 - 5. Master's thesis 100 %.	
<b>Prerequisites</b>	CT10A9500 Research Methods completed and a minimum of 15 ECTS credits of the major studies completed.	
<b>CT10A9100</b>	<b>ECSE INTERNATIONAL SUMMER SCHOOL IN NOVEL COMPUTING</b>	<b>1 - 2 ECTS cr</b>
	<b>ECSE International Summer School in Novel Computing, Itä-Suomen tietotekniikan tutkijakoulun kesäkoulu</b>	
	<b>Intensive course in summer time.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period int.	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Heikki Kälviäinen	
<b>Aims</b>	The learning outcomes of the course are as follows: A student understands the scientific basics, current research activities and application areas of one of the selected topics of the summer school, and can further apply this knowledge in his/her research work.	
<b>Content</b>	A student knows the practices of an international summer school. Content changes every year. Lectures will be held by visiting international lecturers.	

<b>Modes of Study</b>	Lectures and/or exercises, 40 h, and/or practical assignments. A student must register to the course directly via the web page of the summer school.
<b>Evaluation</b>	Passed/failed. Participation and practical assignments.
<b>Study materials</b>	<a href="http://cs.joensuu.fi/ecse/">http://cs.joensuu.fi/ecse/</a> .

<b>CT10A9500</b>	<b>RESEARCH METHODS</b>	<b>3 ECTS cr</b>
	<b>Research Methods, Tutkimusmenetelmät</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Tech.) Arto Kaarna	
<b>Aims</b>	Student can describe concepts and methods in research. Student understands aspects in scientific reporting. Student can prepare a research plan.	
<b>Content</b>	Research work, philosophy of research. Research process. Designing research, research questions and hypothesis. Qualitative and quantitative research methods. Reporting scientific work.	
<b>Modes of Study</b>	Lectures 14 h, 1st period. Practical assignments, 2nd period. Exam.	
<b>Evaluation</b>	0 - 5. Exam 60 %, practical assignments 40 %.	
<b>Study materials</b>	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.	
<b>Prerequisites</b>	Research reports. B.Sc. studies finished.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>CT10A9601</b>	<b>RESEARCH METHODS, LABORATORY PROJECT</b>	<b>1 - 5 ECTS cr</b>
	<b>Research Methods, Laboratory Project, Tutkimusmenetelmät, laboratoriprojekti</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Jari Porras, Professor, Ph.D. Kari Smolander ja Professor, D.Sc. (Tech.) Ville Kyrki	
<b>Aims</b>	Student is able to execute a well-defined research task in Communications Software, Machine Vision and Pattern Recognition, or Software Engineering Laboratory.	
<b>Content</b>	Research work in the topic defined by the laboratory. When starting the course contact one of the professors according to your major subject: tietojenkäsittelytekniikka, informaatiotekniikka, älykäs laskenta, Information Processing, Intelligent Computing (Prof. Kyrki), tietoliikennetekniikka, tietoliikenneohjelmistot, digitaalinen viestintätekniikka, Communications Engineering, Communications Software (Prof. Jari Porras), and ohjelmistotekniikka, Software Engineering (Prof. Smolander). Reporting and a seminar presentation of the work implemented.	
<b>Modes of Study</b>	Participation in the work of the research group, 1st - 4th period.	
<b>Evaluation</b>	Passed/failed. Research report and seminar presentation.	
<b>Study materials</b>	Literature related to the research topic, agreed with the supervisor of the work.	
<b>Prerequisites</b>	CT10A9500 Research Methods, excellent grades in studies.	

<b>CT10A9700</b>	<b>SUMMER SCHOOL ON COMMUNICATIONS ENGINEERING</b>	<b>2 ECTS cr</b>
	<b>Summer School on Communications Engineering, Tietoliikennetekniikan kesäkoulu</b>	
	Intensive course in summer time.	

<b>Year and Period</b>	M.Sc. (Tech.) 2
<b>Teacher(s)</b>	Person in Charge: Professor, D.Sc. (Tech.) Jari Porras
<b>Aims</b>	Students are expected to understand the meaning of the yearly changing topic of the summer school in the field of communications. Students are able to review the presentations as well as to apply the received knowledge in the implementation of their own application. Students are able to clearly present their ideas both in written and in oral form.
<b>Content</b>	Content changes every year. Basics, current status and research activities of the selected field. Practical working on a code camp. Lectures will be held by visiting lecturers and researchers. Suitable also for postgraduate studies.
<b>Modes of Study</b>	Lectures 18 h, practical assignment 22 h, written report about event.
<b>Evaluation</b>	Passed/failed, practical assignment 100%.
<b>Study materials</b>	<a href="http://www.it.lut.fi/ssotc/">http://www.it.lut.fi/ssotc/</a>
<b>Prerequisites</b>	Basic programming skills. Recommended CT10A9500 Research Methods.
<b>CT30A5000</b>	<b>NETWORK PROGRAMMING</b> <span style="float: right;"><b>5 ECTS cr</b></span>
	<b>Network Programming, Tietoliikenneohjelmointi</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2
<b>Teacher(s)</b>	Adjunct Professor, D.Sc. (Tech.) Jouni Ikonen
<b>Aims</b>	Students understand problematics of networked applications, and are able to read and implement protocols described in standards.
<b>Content</b>	Use of Internet Protocol in communications programming. Server models. Socket interface usage and event-based programming. Synchronous and asynchronous operations, layers, parallelism and security in network programming. Realization of protocols according standards.
<b>Modes of Study</b>	Lectures 14 h, exercises 10 h, 1st period. Exercises 8 h, 2nd period. 6 practical assignments. Final assignment. Assignments can not be combined from multiple years.
<b>Evaluation</b>	0 - 5. Practical assignments 70 %, final assignment 30 %. Exercises.
<b>Study materials</b>	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. CT30A2500 TCP/IP - perusteet. Recommended CT50A3000 Unix and System Programming.
<b>CT30A6000</b>	<b>COMMUNICATIONS SOFTWARE, PROTOCOLS AND ARCHITECTURES</b> <span style="float: right;"><b>8 ECTS cr</b></span>
	<b>Communications Software, Protocols and Architectures, Tietoliikenneohjelmistot ja -protokollat</b>
	<b>Replaces the courses CT30A5800 Communications Software and Architecture and CT30A5900 Communications Software Laboratory Work.</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-3
<b>Teacher(s)</b>	Person in Charge: Professor, D.Sc. (Tech.) Jari Porras
<b>Aims</b>	In this course, students gain basic knowledge about the development of communication protocols and software. After this course, students will understand the methods to describe the internal and external behavior of protocols. Students will be able to write specifications for communication software interfaces, and model and program communications software. Students will know the basic testing and verification methods.
<b>Content</b>	Protocol design, message sequence charts, state machines, Abstract Syntax Notation 1, protocol testing, connectionless and connection oriented software,

<b>Modes of Study</b>	protocol layering architectures, concurrency in communication, communication software programming, implementation of state machines, implementation of codecs, software communication conformance testing. Lectures 28 h , exercises 14 h, 1st period
<b>Evaluation</b>	Lectures 14 h, exercises 14 h, homework, project work part 1, 2nd period, Exercises 14 h, homework, project work part 2, 3rd period.
<b>Study materials</b>	0-5. exam 70%, project 30%. Lecture handouts.
<b>Prerequisites</b>	Popovic, M: Communication protocol engineering. Stalling, W: Data and Computer Communications. Recommended CT30A2001 Tietoliikennetekniikan perusteet , CT50A3000 Unix and System Programming, CT60A4001 Ohjelmistotuotanto.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>CT30A6801</b>	<b>LOCAL AREA NETWORKS, SPECIAL COURSE 8 ECTS cr</b>
	<b>Local Area Networks, Special Course, Lähiverkot -erikoistyyökurssi</b>
	<b>The course will be lectured every second year only. The course will be lectured every other year, next during the academic year 2010 - 2011.</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-3
<b>Teacher(s)</b>	Adjunct Professor, D.Sc. (Tech.) Jouni Ikonen
<b>Aims</b>	Students recognize local area networking technologies and understand how basic network services operate and are able to implement services independently for common software components. Students understand requirements and relationships of network services and common problematics. They can act as member and leader of a large project.
<b>Content</b>	Local area network standards, components, application interfaces and practice. Study of used communication protocols (e.g. IP and some of upper layer protocols). Network services in Linux environment (e.g. DHCP, firewalls and web-server). Course has practical exercises and a large scale project work.
<b>Modes of Study</b>	Lectures 4 h (1. lecture is obligatory), seminar work, seminars 10 h, 1st period. Lectures 4 h, exercises 21 h, 2nd period. Seminars 10 h, exercises 17 h, 3rd period. Laboratory works, seminar works and project work, learning diary 1st, 2nd and 3rd period. Making a seminar on first period is a prerequisite for participating the project work.
<b>Evaluation</b>	0 - 5. Project work 40 %, laboratory- and seminar works 60 %.
<b>Study materials</b>	Stallings, W.: Local and Metropolitan area networks, Prentice-Hall, 1997. Stevens, W.R.: TCP/IP Illustrated, Vol. 1: The Protocols, Addison-Wesley, 1994.
<b>Prerequisites</b>	Stevens, W.R.: UNIX Network Programming, Addison-Wesley, 2004. Recommended CT50A3000 Unix and System Programming, CT30A5000 Network Programming.

<b>CT30A6900</b>	<b>PEER-TO-PEER NETWORKING</b>	<b>5 ECTS cr</b>
	<b>Peer-to-peer Networking, Vertaisverkot</b>	
	<b>The course will be lectured every second year only. The course will be lectured every other year, next during the academic year 2011 - 2012.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Jari Porras	
<b>Aims</b>	Student is expected to understand the peer-to-peer paradigm and its main principles. Student should be able to apply his knowledge of the paradigm to	

<b>Content</b>	various applications areas and should be able to implement applications based on peer-to-peer paradigm. Principles of peer-to-peer networking, Peer-to-peer systems and applications, Overlay networks, Challenges, Security, fairness and trust concerns, Practical P2P development with a programming language. Suitable also for postgraduate studies.
<b>Modes of Study</b>	Lectures 21 h, Exercises 14 h, 3rd period. Project work 4th period. Exam.
<b>Evaluation</b>	0 – 5. Exam, 50% Project work 50 %.
<b>Study materials</b>	Barkai, D. 2001 Peer-To-Peer Computing: Technologies for Sharing and Collaborating on the Net. Intel Press. Steinmetz, R. and Wehrle, K. 2005 Peer-To-Peer Systems and Applications (Lecture Notes in Computer Science). Springer-Verlag See more: <a href="http://mediaserver.it.lut.fi/kurssiwiki/index.php/Peer-to-Peer_Networking">http://mediaserver.it.lut.fi/kurssiwiki/index.php/Peer-to-Peer_Networking</a>
<b>Prerequisites</b>	CT30A5000 Network Programming

<b>CT30A7001</b>	<b>CONCURRENT AND PARALLEL COMPUTING 8 ECTS cr</b>
	<b>Concurrent and Parallel Computing, Rinnakkaislaskennan perusteet</b>
	<b>The course will be lectured every second year only. The course will be lectured every other year, next during the academic year 2010 - 2011.</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 3-4
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Jari Porras
<b>Aims</b>	Students are expected to understand the concept of concurrency and the meaning, concepts as well as applications of parallel and distributed computing. Students also know different parallel architectures and their usage. Students can implement simple parallel programs and can utilize parallel methods on their own work.
<b>Content</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 environment. Suitable also for postgraduate studies.
<b>Modes of Study</b>	Lectures 30 h, exercises 12 h, 3rd period.
<b>Evaluation</b>	Seminars 21 h, exercises 14 h, practical assignments, 4th period. Exam.
<b>Study materials</b>	0 - 5. Exam 50 %, presentation 25 %, practical assignments 25 %. Grama, A. et al.: Introduction to Parallel Computing, Addison-Wesley, 2003. Roscoe, A.W.: The theory and practice of concurrency, Pearson Education, 1998.
<b>Prerequisites</b>	Recommended CT50A2601 Käyttöjärjestelmät, CT50A3000 Unix and System Programming.

<b>CT30A8001</b>	<b>USER-CENTRIC SERVICE DESIGN 5 ECTS cr</b>
	<b>User-Centric Service Design, Käyttäjäkeskeiset tietoliikennepalvelut</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Tech.) Kari Heikkinen
<b>Aims</b>	After the course the student is expected to be able - to understand the terminology, fundamentals and characteristics of User-Centric Service design - to understand its role, main methods and processes and effect on designing communication engineering applications and services taking into account both user and technology requirements - to demonstrate the learning with both written assignments and with designed, implemented and presented practical assignment.
<b>Content</b>	User-Centric Service Design terminology, fundamentals and characteristics. The role, methods, processes and the effect of the UCD in applying it to communication engineering application design, implementation and evaluation. User and Technology requirements based on selected area of interest in

<b>Modes of Study</b> <b>Evaluation</b> <b>Study materials</b> <b>Prerequisites</b> <b>Further Information</b>	communication engineering. Evaluation of UCD designs and prototypes of different fidelities. Flash programming as prototyping technology. Suitable also for postgraduate studies. Lectures 21 h, exercises 14 h, home assignments (4), exam, 3. period. 0 - 5. Home assignments 40%, continuous evaluation 40%, exam 20%. Lecture and Web-material. Recommended CT10A9500 Research Methods. This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>CT30A8300</b>	<b>WIRELESS SERVICE ENGINEERING</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>Year and Period</b> <b>Teacher(s)</b> <b>Aims</b>  <b>Content</b>  <b>Modes of Study</b>  <b>Evaluation</b> <b>Study materials</b> <b>Prerequisites</b> <b>Further Information</b>	<b>Wireless Service Engineering, Langattomien palveluiden tekniikka</b>  <b>The course will be lectured every second year only.</b> <b>The course will be lectured every other year, next during the academic year 2010 - 2011.</b>  M.Sc. (Tech.) 1-2, Period 1-2 Associate Professor, D.Sc. (Tech.) Pekka Jäppinen The student understands the challenges that wireless communication technologies and mobile devices provide to service development. He/she learns methods to create and improve services for wireless environment. 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. Suitable also for postgraduate studies. Lectures 21 h, demonstrations 14 h, exercises 14 h, practical assignment, 1st period. Exercises 14 h and practical assignment, 2nd period. Exam. 0 - 5. Exam 50 %, practical assignments 50 %. Will be announced on lectures. CT30A2600 Langaton tietoliikenne, CT30A5000 Network Programming. This course has 11-15 places for open university students. More information on the web site for open university instruction.
<b>CT30A8800</b>	<b>SECURED COMMUNICATIONS</b> <span style="float: right;"><b>6 ECTS cr</b></span>
<b>Year and Period</b> <b>Teacher(s)</b> <b>Aims</b>  <b>Content</b>  <b>Modes of Study</b>  <b>Evaluation</b> <b>Study materials</b>	<b>Secured Communications, Suojatut tietoyhteydet</b>  <b>The course will be lectured every second year only.</b> <b>The course will be lectured every other year, next during the academic year 2011 - 2012.</b>  M.Sc. (Tech.) 1-2, Period 1-2 Associate Professor, D.Sc. (Tech.) Pekka Jäppinen Student learns how to secure the communication channel between communicating devices. Security risks against communication channel. Creation of secure communication channel. Cryptographic methods: Symmetric and asymmetric encryption algorithms, hash functions, key exchange methods. Authentication methods. Digital signatures. Suitable also for postgraduate studies. Lectures 14 h, exercises 14 h, 1st period. Lectures 8 h, seminars 20 h, practical assignment, 2nd period. Exam. 0 - 5. Exam 40 %, seminars 30 %, practical assignment 30 %. Trappe W., Washington L.C.: Introduction to Cryptography with Coding Theory. Schneier, B.: Applied Cryptography, Wiley, 1996. Kerttula, E.: Tietoverkkojen tietoturva, 2. painos, Edita, 2000.



<b>Prerequisites</b>	Lecture hand-outs. CT30A3500 Tietoturvan perusteet. Recommended CT30A2500 TCP/IP -perusteet, CT30A5000 Network Programming.
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.
<b>CT30A8902</b>	<b>SERVICE ORIENTED ARCHITECTURE</b> <b>5 ECTS cr</b>
	<b>Service Oriented Architecture, Palvelukeskeinen arkkitehtuuri</b>
	<b>Replaces the course CT30A8901 Service Oriented Communications.</b>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 2
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Jari Porras
<b>Aims</b>	Students are expected to understand the meaning of service oriented paradigm and the aspects affecting the efficient utilization of it. Students are able to design and implement service oriented applications.
<b>Content</b>	Service and web oriented architecture terminology, technologies and infrastructures. SOA and web services fundamentals, SOA and WS-* extensions, SOA and service-orientation, Designing and Building SOA.
<b>Modes of Study</b>	Lectures 21h, exercises 14h, practical assignment. Exam.
<b>Evaluation</b>	0-5. Exam 60%, practical assignment 40%.
<b>Study materials</b>	Erl, T.: Service-Oriented Architecture: Concepts, Technology and Design, Prentice-Hall, 2005.
<b>Prerequisites</b>	Recommended CT30A3101 Web-ohjelmointi
<b>CT30A9300</b>	<b>CODE CAMP ON COMMUNICATIONS ENGINEERING</b> <b>4 ECTS cr</b>
	<b>Code Camp on Communications Engineering, Tietoliikennetekniikan code camp</b>
	<b>The course is arranged intensively 1-4 times /year.</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1-2
<b>Teacher(s)</b>	Person in Charge: Professor, D.Sc. (Tech.) Jari Porras
<b>Aims</b>	Code camp is a short term practically oriented course where students work together on their projects based on the selected topic of the course. After the course students are expected to be able - to use the achieved knowledge on the topic in their work - to implement other projects with the technology.
<b>Content</b>	Topic varies each time.
<b>Modes of Study</b>	Lectures and demonstrations, project work, presentation 52h.
<b>Evaluation</b>	0 – 5. project work 60%, reports 30%, presentation 10%.
<b>Study materials</b>	To be announced in beginning of the course based on the selected topic.
<b>Prerequisites</b>	Based on the topic. To be announced with the final course description.
<b>CT30A9400</b>	<b>AD HOC AND SENSOR NETWORKS</b> <b>5 ECTS cr</b>
	<b>Ad hoc and Sensor Networks, Dynaamiset sensoriverkot</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-4
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Jari Porras
<b>Aims</b>	Students are expected to understand the fundamental principles of wireless ad hoc and sensor networking as well as their main challenges and possible solutions.
<b>Content</b>	Wireless ad hoc networks: link layer issues and medium access control, ad hoc routing, wireless sensor networks: architectures, broadcasting, multicasting,

<b>Modes of Study</b>	geocasting, routing and energy efficiency.	
<b>Evaluation</b>	Book based course.	
<b>Study materials</b>	0 – 5. Exam 100%.	
<b>Prerequisites</b>	Cordeiro C. and Agrawal D.: Ad hoc & Sensor Networks, World Scientific Publishing, 2006, OR Murthy C. and Manoj B.: Ad hoc wireless networks, Prentice-Hall, 2004. Recommended: CT30A2600 Langaton tietoliikenne	
<b>CT50A3000</b>	<b>UNIX AND SYSTEM PROGRAMMING</b>	<b>5 ECTS cr</b>
	<b>Unix and System Programming, Unix ja systeemiohjelmointi</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 3, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Joni Kämäräinen	
<b>Aims</b>	Students can write Unix programs using C language and utilise fundamental Unix libraries and system level functions in their programs. Students can write shell scripts. Students can do basic administration of Unix systems.	
<b>Content</b>	Basic structure of Unix system. C programming environment and tools in Unix. Unix shells (Bash), shell programming, shell script programming, regular expressions and basic utilities (e.g. Sed, Awk, etc.) File I/O. Files and directories. Standard I/O library. System data files and information. Process environment. Process control. Process relationships. Signals. Threads and thread control. Daemon processes. Advanced I/O. Interprocess communication and sockets.	
<b>Modes of Study</b>	Lectures 21h, exercises 14h and homeworks, 1st period. Course project, 2nd period. Exam.	
<b>Evaluation</b>	0-5. Exam 100%. Homeworks and course project passed.	
<b>Study materials</b>	Stevens and Rago, 2005: Advanced Programming in the UNIX Environment, 2nd edition, W. Richard Stevens and Stephen A. Rago, 2005. Quigley, 2005: Unix Shells by Example, 4th edition, Ellie Quigley, 2005.	
<b>Prerequisites</b>	CT60A0210 Käytännön ohjelmointi, CT50A2601 Käyttäjärjestelmät or equivalent.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	
<b>CT50A4000</b>	<b>INTRODUCTION TO INTELLIGENT COMPUTING</b>	<b>5 ECTS cr</b>
	<b>Introduction to Intelligent Computing, Johdatus älykkääseen laskentaan</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 2-3, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Joni Kämäräinen	
<b>Aims</b>	Students know the principles of intelligent systems and hardware and software parts required to build intelligent systems. Students know robotic paradigms and navigation methods required of AI robots. Students can use the basic theorems of machine learning and devise procedures for machine learning and computational intelligence. Students know the work flow of computer vision and are able to capture and process digital images. With the help of programming skills the students are able to implement the learned techniques as runnable programs in intelligent systems.	
<b>Content</b>	Basic structure of intelligent systems. Basics of computer vision. Basics of machine learning. Robotic paradigms. Robot navigation. Visual sensing and parts of computer vision systems. 3D vision and basic image processing. Principles of machine learning. Concept learning. Decision tree learning. Data clustering and unsupervised learning. Learning sets of rules and expert systems. Black box methods and genetic algorithms. Bayesian learning.	
<b>Modes of Study</b>	Lectures 21h, exercises 14h and homeworks, 1st period. Lectures 21h, exercises 14h and homeworks, 2nd period. Exam.	
<b>Evaluation</b>	0-5. Exam 100%. Exercises, homeworks passed.	
<b>Study materials</b>	Murphy, 2000: Introduction to AI Robotics, Robin R. Murphy, MIT Press, 2000.	

<b>Prerequisites</b>	Davies, 2005: Machine Vision, E.R. Davies, 3rd edition, Elsevier, 2005.
<b>Further Information</b>	Mitchell, 1997: Machine Learning, Tom Mitchell, McGraw-Hill, 1997. Matematiikka A and B, CT60A0200 Ohjelmoinnin perusteet or equivalent. This course has 6-10 places for open university students. More information on the web site for open university instruction.
<b>CT50A5700</b>	<b>INTRODUCTION TO COMPUTER GRAPHICS 5 ECTS cr</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 2
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Tech.) Arto Kaarna
<b>Aims</b>	Student knows the basic algorithms and methods in 2D/3D computer graphics. Student can apply both a graphics library and a software package in composing 3D scenes.
<b>Content</b>	Examples and applications of computer graphics. Introduction to two-dimensional graphics. Principals of graphics hardware. Raster graphics. Introduction to modelling of three-dimensional objects. Algorithms in three-dimensional graphics. Open GL graphics library.
<b>Modes of Study</b>	Lectures 21 h, exercises 14 h and two practical assignments, 2nd period. Exam.
<b>Evaluation</b>	0 - 5. Exam 100 %. Exercises and practical assignments.
<b>Study materials</b>	Hearn, D., Baker, M.P.: Computer Graphics with OpenGL, Prentice-Hall, 3rd Edition, 2004. Foley, J.D., van Dam, A., Feiner, S.K., Hughes, J.H.: Computer Graphics: Principles and Practice. 2nd edition in C. Addison-Wesley, 1997.
<b>Prerequisites</b>	CT60A0210 Käytännön ohjelmointi.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>CT50A6000</b>	<b>PATTERN RECOGNITION 7 ECTS cr</b>
	<b>Pattern Recognition, Hahmontunnistus</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Ville Kyrki
<b>Aims</b>	A student can analyze a pattern recognition problem, choose a suitable pattern recognition method, and implement a solution. A student can analyze the performance and quality of a pattern recognition system.
<b>Content</b>	Introduction. Bayesian inference and statistical pattern recognition. Discriminants and neural pattern recognition. Decision tree, syntactic and structural approaches. Context-dependent classification. Reinforcement learning. Unsupervised learning. Suitable also for postgraduate studies.
<b>Modes of Study</b>	Lectures 21 h, exercises 14 h, 3rd period. Lectures 21 h, exercises 14 h, 4th period. Practical assignment. Exam.
<b>Evaluation</b>	0-5. Exam 50 %, exercises 50 %.
<b>Study materials</b>	Lecture notes. Duda, R.O., Hart, P.E., Stork, D.G.: Pattern Classification, Wiley, 2001. Theodoridis, S., Koutroumbas, K.: Pattern Recognition, Academic Press, 2003.
<b>Prerequisites</b>	Matematiikka A and B, CT60A0210 Käytännön ohjelmointi, BM20A1401 Tilastomatematiikka I. Recommended BM20A1501 Numeeriset menetelmät I, BM20A1601 Matriisilaskenta, or equivalent knowledge.
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b>CT50A6100</b>	<b>MACHINE VISION AND DIGITAL IMAGE ANALYSIS</b>	<b>7 ECTS cr</b>
	<b>Machine Vision and Digital Image Analysis, Konenäkö ja digitaalinen kuva-analyysi</b>  <b>The course will be lectured every second year only.</b> <b>The course will be lectured every other year, next during the academic year 2011 - 2012.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Heikki Kälviäinen	
<b>Aims</b>	After the course a student is expected to be able to explain the fundamental steps of image processing and analysis, to implement solutions to the steps using Matlab, to introduce and compare machine vision applications, to plan a solution to a given object recognition problem, and to implement the solution using Matlab or other suitable programming language.	
<b>Content</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. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures and seminars 21 h, exercises 12 h, 1st period. Lectures and seminars 21 h, exercises 14 h, practical assignment seminars 4 h, practical assignment, 2nd period. Exam.	
<b>Evaluation</b>	0 - 5. Exam 50 %, exercises 50 %. Seminar presentation, which gives extra points to an exam. Acting as an opponent. Practical assignment.	
<b>Study materials</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 CT50A5700 Introduction to Computer Graphics, CT50A6000 Pattern Recognition, CT50A6200 Computer and Robot Vision.	
<b>CT50A6200</b>	<b>COMPUTER AND ROBOT VISION</b>	<b>7 ECTS cr</b>
	<b>Computer and Robot Vision, Tietokone- ja robottinäkö</b>  <b>The course will be lectured every second year only.</b> <b>The course will be lectured every other year, next during the academic year 2010 - 2011.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Ville Kyrki	
<b>Aims</b>	A student understands the theoretical basis of geometric and dynamic computer vision, and can apply the knowledge to solve practical computer vision problems. A student can explain basic approaches and applications of vision in robotics.	
<b>Content</b>	Vision in Robotics. Imaging models and calibration. Coordinate frames and geometrical primitives. Single and multi-view geometry. Pose estimation. Dynamic vision and tracking. Visual servoing. Structure from motion and SLAM. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures 21 h, exercises 14 h, 1st period. Lectures 21 h, exercises 14 h, 2nd period. Practical assignment. Exam.	
<b>Evaluation</b>	0 - 5. Exam 50 %, exercises 50 %. Practical assignment.	
<b>Study materials</b>	Lecture notes. Trucco, E., Verri, A.: Introductory Techniques for 3-D Computer Vision, Prentice-Hall, 1998.	
<b>Prerequisites</b>	Matematiikka A and B, CT60A0200 Ohjelmoinnin perusteet. Recommended BM20A1401 Tilastomatematiikka I, BM20A1501 Numeeriset menetelmät I, BM20A1601 Matriisilaskenta or equivalent knowledge.	
<b>Further</b>	This course has 6-10 places for open university students. More information on	

<b>Information</b>	the web site for open university instruction.	
<b>CT50A6400</b>	<b>COMPILER CONSTRUCTION</b>	<b>7 ECTS cr</b>
	<b>Compiler Construction, Kääntäjätekniiikat</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Tech.) Arto Kaarna	
<b>Aims</b>	Student understands structures and operations in compilation. Student can implement a compiler using high-level tools.	
<b>Content</b>	Languages and grammars. Regular languages and lexical analysis. Introduction to parsing. Tools for compiler construction. Syntax directed translation, attribute grammars, intermediate representation. Machine independent optimization.	
<b>Modes of Study</b>	Lectures 21 h, exercises 14 h, 3rd period. Lectures 21 h, exercises 14 h and a terminal project, 4th period. Exam.	
<b>Evaluation</b>	0 - 5. Exam 100 %. Exercises and project.	
<b>Study materials</b>	Aho, A.V., Lam, M.S., Sethi, R., Ullman, J.D.: Compilers: Principles, Techniques, and Tools, Second edition, Addison Wesley, 2007.	
<b>Prerequisites</b>	CT50A2000 Tietojenkäsittelyn perusteet I, CT50A2310 Tietorakenteet ja algoritmit.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>CT60A4101</b>	<b>SOFTWARE ENGINEERING METHODS</b>	<b>5 ECTS cr</b>
	<b>Software Engineering Methods, Ohjelmistotuotannon menetelmät</b>	
	<b>Replaces the course CT60A4101 Ohjelmistotuotannon menetelmät. If all of the participants speak Finnish, the course will be lectured in Finnish.</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 3, Period 1-2	
<b>Teacher(s)</b>	Professor, Ph.D. Kari Smolander	
<b>Aims</b>	The student will be able to participate in the analysis and design of software and information systems. The student will understand the problems in modern system and software work and the principles in their planning. The student will be able to use the UML language in planning.	
<b>Content</b>	Features of modern software development, requirements analysis and modeling, UML use cases, class diagrams, dynamic modeling, state diagrams, architecture design, the importance of methods and processes in software and systems development.	
<b>Modes of Study</b>	Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h and practical assignment, 2nd period. Exam.	
<b>Evaluation</b>	0-5. Exam. The course project can raise the grade as informed in the lectures.	
<b>Study materials</b>	Lecture slides, supplementary material, e.g. Booch, G., Rumbaugh, J., Jacobson, I.: The Unified Modeling Language User Guide, Addison-Wesley, 1999. Jacobson, I., Booch, G., Rumbaugh, J.: The Unified Software Development Process, Addison-Wesley, 1999. Fitzgerald, Russo, Stolterman: Information Systems Development - Methods in Action, McGraw-Hill, 2002.	
<b>Prerequisites</b>	Other material announced during lectures. CT60A4001 Ohjelmistotuotanto.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>CT60A5000</b>	<b>E-BUSINESS TECHNOLOGIES</b>	<b>5 ECTS cr</b>
	<b>E-Business Technologies, E-business -teknologiat</b>	
	<b>The course will be lectured every other year, next during the academic year 2011 - 2012.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 3-4	
<b>Teacher(s)</b>	Professor, Ph.D. Kari Smolander	
<b>Aims</b>	The student understands the basics of e-business technologies and implementation and can use the acquired knowledge in further studies of the subject.	
<b>Content</b>	E-business basics, EDI/EDIFACT, interoperability, B2B e-business, e-commerce. Basics of XML, web services, service orientation, and enterprise application integration. E-business technologies and standards such as RosettaNet and ebXML.	
<b>Modes of Study</b>	Lectures and seminars 28h , 3-4 periods. Project assignment, report and presentation. Exam.	
<b>Evaluation</b>	0-5, exam 60%, course project 40%.	
<b>Study materials</b>	To be announced at the lectures.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>CT60A7201</b>	<b>ARCHITECTURE IN SYSTEMS AND SOFTWARE DEVELOPMENT</b>	<b>7 ECTS cr</b>
	<b>Architecture in Systems and Software Development, Arkkitehtuuri järjestelmien ja ohjelmistojen kehityksessä</b>	
	<b>Replaces the course CT60A7200 Architecture in Systems and Software Development. The maximum number of participants is limited to 50 students.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4	
<b>Teacher(s)</b>	Professor, Ph.D. Kari Smolander	
<b>Aims</b>	The student understands the role of architecture in the development of software and information systems and has the basic skills of how to design and describe architecture.	
<b>Content</b>	The role of architecture in development. Software architecture. Systems architecture. Enterprise architecture. Application integration. Architecture design. Architecture documentation. Architectural styles and patterns. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures, lecture exercises and presentations at lectures 21 h, 3rd period. Lectures, lecture exercises and presentations at lectures 21 h, 4th period. Practical assignment and presentation. Exam, including reading of a literature package given at the course.	
<b>Evaluation</b>	0 - 5. Exam 50 %, practical assignment 30 %, presentation 20 %.	
<b>Study materials</b>	Lecture notes based on the following books: Bass, L., Clements, P., Kazman, R.: Software Architecture in Practice, 2nd Ed., Addison-Wesley, 2003. Linthicum, D.S.: Next Generation Application Integration: From Simple Information to Web Services, Addison-Wesley, 2003. Ross, J.W., Weill, P., Robertson, D.: Enterprise Architecture As Strategy: Creating a Foundation for Business Execution, Harvard Business School Press, 2006. Literature package given at the course.	
<b>Prerequisites</b>	CT60A4101 Software Engineering Methods or equivalent.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>CT60A7302</b>	<b>SOFTWARE QUALITY, PROCESSES, AND ORGANIZATIONS</b>	<b>7 ECTS cr</b>
	<p><b>Software Quality, Processes, and Organizations, Ohjelmistojen laatu, prosessit ja organisaatiot</b></p> <p><b>Replaces the course CT60A7301 Software Quality, Processes, and Organizations.</b></p>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-2	
<b>Teacher(s)</b>	Postdoctoral Researcher, D.Sc. (Tech.) Uolevi Nikula	
<b>Aims</b>	After the course student can explain quality, process, and organization related issues in software development and how such issues can be solved based on literature and on personal experiences from the course project. Students can also synthesize the knowledge acquired during the course and develop quality and process documentation for a software company.	
<b>Content</b>	Software development issues. Software development processes, their history, maturity, and state of the practice. Quality in software development, approaches to assure and improve quality. Processes and organizations. Suitable also for postgraduate studies.	
<b>Modes of Study</b>	Lectures 14 h and exercises 14 hours, 1st period. Lectures 14 h and exercises 14 hours, 2nd period.	
<b>Evaluation</b>	Compulsory assignments and team project given in the lectures. Exam. 0 - 5. Exam 50 %, compulsory assignments 50%.	
<b>Study materials</b>	Robillard, Kruchten, and d'Astous: Software Engineering Process with the UPEDU, Addison-Wesley, 2002.	
<b>Prerequisites</b>	CT60A4101 Software Engineering Methods or equivalent.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	
<b>CT60A7400</b>	<b>FUNDAMENTALS OF INFORMATION SYSTEMS 7 ECTS cr</b>	
	<b>Fundamentals of Information Systems</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Tech.) Erja Mustonen-Ollila	
<b>Aims</b>	In order to complete the course the student should be able to: Demonstrate a sound grasp of the history of information systems (IS) in business, including an IS development. Describe the organisational uses of information systems to improve overall quality. Demonstrate the concepts for the specification and design or the re-engineering of organisationally related systems of limited scope using information technology. Explain what is meant by an information system development process, and what performance measurement implies. Show how information technology can be used to design, facilitate, and communicate organisational goals and objectives of information systems. Describe career paths in information systems. Present and discuss the professional and ethical responsibilities of the IS practitioner. Recognise the role and use of IS in technology and in business systems and operations. Identify and describe organisational structure and business processes within these structures. Demonstrate an understanding of the process in systems design and development. Discuss, and describe fundamental concepts of IS theory and IS research methods and their importance to practitioners. Discuss the relationship of IS planning to organisational planning.	
<b>Content</b>	Examination the nature of the information systems discipline and key areas of professional interest and expertise. Introduction of the main topic areas in the study of information systems (IS) from both a theoretical and practical perspective covering also the IS research perspective. To discuss the role of information systems in society. To explain the operations of information systems, and the role of technology, business, and social environment within systems, and how information systems are developed, acquired or outsourced.	

<b>Modes of Study</b>	To explain the use of information systems in business. To discuss and analyse the changing role of the information systems in the achievement of business objectives such as communication, collaboration, performance enhancement etc. Getting familiar with the basic concepts and methods in information systems research. Suitable also for postgraduate studies. Lectures 21 h, exercises 14 h, 1st period. Lectures 21 h, exercises 14 h, 2nd period. Practical assignment. Exam.
<b>Evaluation</b>	0 - 5. Exam 50 %, practical assignment 50 %.
<b>Study materials</b>	Stair, R., and Reynolds, G. (2006) The Fundamentals of Information Systems. 3rd edition. ISBN 13: 978-0-619-21560-6. ISBN 10: 0-619-21560-7. Järvinen, P. (2004) On Research methods. Opinpaja, Tampere. Järvinen, P. (2004) Tutkimustyön metodeista. Opinpaja, Tampere.
<b>Prerequisites</b>	CT60A4001 Ohjelmistotuotanto
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b>CT60A7500</b>	<b>OBJECT-ORIENTED PROGRAMMING TECHNIQUES</b>	<b>5 ECTS cr</b>
<b>Year and Period</b>	<b>Object-Oriented Programming Techniques, Olio-ohjelmoinnin menetelmät</b>	
<b>Teacher(s)</b>	M.Sc. (Tech.) 1, Period 1-2 Professor, Ph.D. Kari Smolander	
<b>Aims</b>	The student understands advanced concepts and techniques of object-oriented programming, especially design patterns, and can apply these techniques in solving practical programming tasks.	
<b>Content</b>	Introduction to Java. Java run-time object model. Composition, inheritance, and interfaces. Reusability. Collections and containers. Reflection. Serialization. Design patterns and their applications. Design rules and principles.	
<b>Modes of Study</b>	Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h, practical assignment, 2nd period. Exam.	
<b>Evaluation</b>	0 - 5. Exam 60 %, exercises and practical assignment 40 %.	
<b>Study materials</b>	Lecture notes. Eckel, B.: Thinking in Java, Prentice Hall. Gamma, E. et al.: Design Patterns, Addison-Wesley. Freeman, Freeman, Sierra & Bates: Head First Design Patterns, O'Reilly (2004 or newer).	
<b>Prerequisites</b>	Olio-ohjelmointi (Object-Oriented Programming) or equivalent.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	



### 5.5. Master's Degree Programme in Industrial Management

#### International Master's Degree Programme - Global Management of Innovation and Technology

The new university level Master's Degree Programme in Industrial Management – Global Management of Innovation and Technology – offers a wide variety of perspectives into the management of innovation and technology in an international environment that is based on the combination of business, engineering and management.

The programme starts annually and lasts two years. The programme course package is worth approximately 90 ECTS credits, and at the end of their studies, students write a Master's thesis counted as an additional 30 ECTS credits. The programme is in total worth 120 ECTS credits, leading to a Master of Science in Technology degree.

#### Aims of the Master's Degree Programme and Learning Outcomes

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

After completing the degree, the graduate can

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

#### Professional Scope of the Master's Degree Programme

International studies combined with engineering and business management skills and a multicultural study environment provide graduates with interesting and challenging career prospects. Global customer-supplier relationships and business networks demand talented young professionals in management of innovations and technologies, industrial marketing, management of sales, supply chain management and technology sourcing. Master of Science graduates with an engineering and management background and a strong ability and will to continue learning after graduation will have many career opportunities at the executive level of management as well as in global technology and business.

Graduates from the Department of Industrial Management have been employed e.g. as export managers, key account managers, logistics managers, controllers, analysts, business application specialists, operative purchasers, technology innovation managers etc. The studies also give graduates a firm basis for doctoral studies in the field of industrial management.

## **Field of Specialisation**

The following field of specialisation is available as a major subject at Lappeenranta University of Technology at the department of Industrial Management: Global Management of Innovation and Technology. Efforts will be made to offer all students the opportunity to prepare their final Master's thesis for practical purposes in companies. In this way, students will have a chance to find solutions to practical problems that companies face. Besides the specific obligatory or elective courses offered in the degree programme, all other courses arranged at the university in English are available for the students, subject to practical limitations such as group size, teaching methods, schedules, etc.

The major subject allows focusing on a range of areas for the Master's thesis phase. Students may prepare their final thesis on topics including industrial marketing and international business, innovation and technology management, product and service development in networked company structures, methods and tools for decision making in product development and technology management, managing ramp-ups and innovative product launches in the market place, supply-demand networks, and service management. As a rule, all lecturing professors at the department are available for supervising theses. The topics may vary depending on the needs of the companies.

## **Complementary Studies**

Students with a degree from a Finnish University of Applied Sciences or Polytechnics or equivalent will have to study complementary studies (25 ECTS cr) which are not included in the Master's degree. The extent of these studies depends on the content of the previous degree. Please, see page 123. Further information: Study coordinator Susanna Koponen, room 4426, phone +358 40 352 4002, susanna.koponen at lut.fi.

## Global Management of Innovation and Technology

### The Degree Structure of the Programme

#### Master of Science 120 ECTS cr

	<i>ECTS cr</i>
General studies	10
Major subject	70
Minor subject	22
Elective studies	18
<i>Total</i>	<i>120</i>

#### General Studies

<i>Obligatory studies (10 ECTS cr)</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CS10A0860 Introduction to Research Methods	M.Sc. (Tech.) 1	2	4
FV11A8900 Academic Writing in English	B.Sc. (Tech.) 3	1-2, 4	
	M.Sc. (Tech.) 1-2	3-4,	
	B.Sc. (Econ. & Bus. Adm.) 3	5	
	M.Sc. (Econ. & Bus. Adm.) 1-2		
FV18A9101 Finnish 1		1, 3	2

#### Major Subject Global Management of Innovation and Technology 70 ECTS cr

##### Major Subject 70 ECTS cr

<i>Obligatory studies (60 ECTS cr)</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CS10A0151 Business Relationships and Networks	M.Sc. (Tech.) 1	3-4	5
CS10A0550 International Business Methods	M.Sc. (Tech.) 1	1-2	7
CS30A1001 Product and Technology Strategy: Advanced Course in Innovation Management	M.Sc. (Tech.) 1	1-3	7
CS30A1051 Methods of Technology Management	M.Sc. (Tech.) 2	3	6
CS34A0500 Technology Commercialization and Corporate Venturing	M.Sc. (Tech.) 2	4 int.	5
CS90A0060 Master's Thesis	M.Sc. (Tech.) 2	1-4	30

<i>Elective studies min. 10 ECTS cr</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CS10A0651 Management of Innovations in Russia	M.Sc. (Tech.) 1	4	5
CS30A1361 Creativity in Innovation Processes	M.Sc. (Tech.) 1	4 int.	5
CS30A1551 System Dynamics and Industrial Management	M.Sc. (Tech.) 1-2	1-2 int.	5
CS30A1670 Service Innovation and Management	M.Sc. (Tech.) 2	1-2	5
CS34A0400 Strategic Entrepreneurship in Age of Uncertainty	M.Sc. (Tech.) 2	1	5

#### Minor Subject Business Technology 22 ECTS cr

##### Minor: Business Technology

<i>Obligatory studies (min 22 ECTS cr)</i>	<i>per.</i>	<i>ECTS cr</i>
CS20A6060 Introduction to Logistics	1	5
CS35A0151 Product Lifecycle Management	4 int.	7
CT60A4101 Software Engineering Methods	1-2	5
CT60A5000 E-Business Technologies	3-4	5

## Elective Studies 18 ECTS cr

Elective studies are needed to attain the full 120 ECTS credits. It is recommended to choose the elective studies among the courses that are listed under major subject. However, elective courses can include any courses offered by LUT if the required prerequisites are completed.

## Complementary Studies

Students with a degree from a Finnish University of Applied Sciences or Polytechnics or equivalent will have to study complementary studies (25 ECTS cr) which are not included in the Master's degree.

### Complementary studies

<i>Obligatory studies (25 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BM20AMatB	Matematiikka B1 - B3	B.Sc. (Tech.) 1	3-4	8
CS10A0101	Markkinoinnin johtaminen	B.Sc. (Tech.) 3	3-4	5
CS10A0201	Markkinointitutkimus	B.Sc. (Tech.) 3	1-2	5
CS10A0260	Managing International Business	B.Sc. (Tech.) 3	2	5
CS90A0000	Johdatus tuotantotalouden opiskeluun	B.Sc. (Tech.) 1	1-2	2

## 5.6. Master's Degree Programme in Industrial Management – Global Management of Innovation and Technology

### Joint Master's Degree LUT – Russian home university

Joint Master's Degree Programme is a double degree programme between LUT and partner universities. The students will study one year at their home university and then come to LUT for second year to specialize in Global Management of Innovation and Technology. Student is expected to do Master's thesis according to LUT practices. Please, see chapter 11.

Student is also obliged to complete studies at home university and obtain diploma from there.

### The Degree Structure

#### Master of Science 120 ECTS cr

	<i>ECTS cr</i>
General studies	10
Major subject	70
Minor subject	20
Elective studies	20
<i>Total</i>	<i>120</i>

Compensation from the partner university's studies to LUT degree (altogether max. 50 ECTS credits) is included followingly:

General studies 10 ECTS credits, minor subject 20 ECTS credits and elective studies 20 ECTS credits.

#### Major Subject Global Management of Innovation and Technology 70 ECTS cr

##### Major Subject 70 ECTS cr

<i>Obligatory studies (60 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CS10A0151	Business Relationships and Networks	M.Sc. (Tech.) 1	3-4	5
CS10A0550	International Business Methods	M.Sc. (Tech.) 1	1-2	7
CS30A1001	Product and Technology Strategy: Advanced Course in Innovation Management	M.Sc. (Tech.) 1	1-3	7
CS30A1051	Methods of Technology Management	M.Sc. (Tech.) 2	3	6
CS34A0500	Technology Commercialization and Corporate Venturing	M.Sc. (Tech.) 2	4 int.	5
CS90A0060	Master's Thesis	M.Sc. (Tech.) 2	1-4	30

<i>Elective studies min. 10 ECTS cr</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
CS10A0651	Management of Innovations in Russia	M.Sc. (Tech.) 1	4	5
CS30A1361	Creativity in Innovation Processes	M.Sc. (Tech.) 1	4 int.	5
CS30A1551	System Dynamics and Industrial Management	M.Sc. (Tech.) 1-2	1-2 int.	5
CS30A1670	Service Innovation and Management	M.Sc. (Tech.) 2	1-2	5
CS34A0400	Strategic Entrepreneurship in Age of Uncertainty	M.Sc. (Tech.) 2	1	5

## 5.7. Courses in English in Industrial Management

		<i>ECTS cr</i>
CS10A0151	Business Relationships and Networks	5
CS10A0260	Managing International Business	5
CS10A0550	International Business Methods	7
CS10A0600	Doing Business in Transitional Economies	7
CS10A0651	Management of Innovations in Russia	5
CS10A0751	Enterprises and Competition in Russia	6
CS10A0800	The Basics of Doing Business in Russia	5
CS10A0852	European Union – Competitiveness and Enlargement	5
CS10A0860	Introduction to Research Methods	4
CS10A0890	Business Ethics	5
CS20A6000	Supply Chain Management	6
CS20A6050	Decision-Making in Supply Chain	5
CS20A6060	Introduction to Logistics	5
CS30A1001	Product and Technology Strategy: Advanced Course in Innovation Management	7
CS30A1051	Methods of Technology Management	6
CS30A1361	Creativity in Innovation Processes	5
CS30A1500	Transportation Systems	5
CS30A1551	System Dynamics and Industrial Management	5
CS30A1651	Process and Product Innovations	10
CS30A1660	Open Innovation	5
CS30A1670	Service Innovation and Management	5
CS30A6000	Technology Management	3
CS30A6050	Cost and Profitability Estimation	3
CS30A6100	Technology Management	6
CS30A7000	Technology Management in Japan	3
CS34A0400	Strategic Entrepreneurship in Age of Uncertainty	5
CS34A0500	Technology Commercialization and Corporate Venturing	5
CS35A0151	Product Lifecycle Management	7
CS35A6000	Information & Knowledge Management in Innovative Enterprises	6
CS90A0060	Master's Thesis	30
CT60A4101	Software Engineering Methods	5
CT60A5000	E-Business Technologies	5

<b>CS10A0151</b>	<b>BUSINESS RELATIONSHIPS AND NETWORKS 5 ECTS cr</b>
	<p><b>Liiketoimintasuhteet ja -verkostot</b></p> <p><b>Replaces the course CS10A0150 Liiketoimintasuhteet ja -verkostot.</b></p>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Risto Salminen Docent, D.Sc. (Econ. & Bus. Adm.) Henrikki Tikkanen Post-Doctoral Researcher, D.Sc. (Tech.) Anne Jalkala Part-time Untenured Teacher, D.Sc. (Tech.) Juha Haimala Assistant, M.Sc. (Tech.) Harri Ryyänen Doctoral Student, M.Sc. (Tech.) Olli Pekkarinen Doctoral Student, M.Sc. (Tech.) Joonas Keränen Visiting lecturers.
<b>Aims</b>	Person in Charge: Professor, D.Sc. (Tech.) Risto Salminen Student <ul style="list-style-type: none"> <li>• understands the premises of relationship and network theories in industrial marketing</li> <li>• knows the principles and key concepts of relationship marketing</li> <li>• is able to analyze different phases of a customer relationship and manage and utilize a company's customer portfolio as a strategic resource</li> <li>• understands the characteristics and challenges in project marketing and solution business.</li> </ul>
<b>Content</b>	<ul style="list-style-type: none"> <li>• relationship and network theory in industrial marketing</li> <li>• theoretical premises and characteristics of industrial marketing</li> <li>• underlying theories and key concepts of relationship marketing</li> <li>• different phases of customer relationships and customer portfolio management</li> <li>• network theory and value networks</li> <li>• principles and characteristics of project marketing and solution business</li> <li>• practical illustrations related to managing business relationships.</li> </ul>
<b>Modes of Study</b>	Lectures 28 h, seminars 4 h, 3rd-4th period. The web-based learning environment platform Blackboard is used in this course.
<b>Evaluation</b>	0-5, exam. 65%, learning diary and seminar presentation 35%.
<b>Study materials</b>	Ford, David - Berthon, Pierre et al.: The Business Marketing Course - Managing in Complex Networks. John Wiley & Sons, Ltd., IMP Group, 2002, chapters 2, 3, 6, 7, 8, 9. Cova, Bernard - Ghauri, Pervez - Salle, Robert: Project Marketing - Beyond Competitive Bidding. John Wiley & Sons Ltd, 2002, chapters 1 - 9.
<b>Prerequisites</b>	CS10A0001 Markkinoinnin peruskurssi and CS10A0101 Markkinoinnin johtaminen completed before the examination. Recommended: CS35A0050 Teollisuusyrityksen arvoverkot.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>CS10A0260</b>	<b>MANAGING INTERNATIONAL BUSINESS 5 ECTS cr</b>
	<b>Managing International Business</b>
<b>Year and Period</b>	B.Sc. (Tech.) 3, Period 2
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Risto Salminen Professor, D.Sc. (Tech.) Juha Väättänen
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• recognizes the different entry modes and is able to describe the advantages and disadvantages between the different operation methods</li> <li>• is able to describe the most well known internationalization theories and evaluate the international operations of enterprises based on these theories</li> <li>• recognizes the characteristics of international relationships and understands</li> </ul>

<b>Content</b>	the key practices of global account management <ul style="list-style-type: none"> <li>• knows the principles of building a global marketing strategy and the factors affecting it.</li> <li>• entry modes in international business</li> <li>• internationalization theories</li> <li>• multinational Enterprises in global business</li> <li>• marketing strategies</li> <li>• international relationships and business networks.</li> </ul>
<b>Modes of Study</b>	Lectures 21 h, period 2, exam and written report
<b>Evaluation</b>	0 - 5
<b>Study materials</b>	Hollensen, S., 2004, Global Marketing: A Decision-oriented approach, Harlow : FT Prentice Hall.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>CS10A0550</b>	<b>INTERNATIONAL BUSINESS METHODS</b>	<b>7 ECTS cr</b>
<b>Year and Period</b>	International Business Methods, Kansainvälisen liiketoiminnan menetelmät	
<b>Teacher(s)</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Aims</b>	Professor, Ph.D. Tauno Tiusanen	
<b>Content</b>	Student <ul style="list-style-type: none"> <li>• is able to distinguish and evaluate the advantages and disadvantages of different entry modes</li> <li>• is able to evaluate risks and opportunities in the global markets and justify the choice of entry method for different markets.</li> </ul>	
<b>Modes of Study</b>	<ul style="list-style-type: none"> <li>• various trade theories and the usefulness of them in practice</li> <li>• main features of international trading and business relations since the Second World War</li> <li>• markets and methods to evaluate them</li> <li>• modes of international operations; special attention will be paid to exporting</li> <li>• contractual arrangements and foreign direct investment (FDI)</li> <li>• theoretical approaches which explain international factor mobility</li> <li>• different currency regimes</li> <li>• trade agreements between nations</li> <li>• risks in international business</li> <li>• international financial markets</li> <li>• cultural factors in international business.</li> </ul>	
<b>Evaluation</b>	Lectures 42 h 1. period, exercises 14 h 1. period and 14 h 2. period. Web-based learning environment platform Blackboard is used in this course.	
<b>Study materials</b>	0-5, examination 50 %, exercises 25 %, research report 25 %. Lecture handouts.	
<b>Prerequisites</b>	Bradley, Frank: International marketing strategy. London 2002. Luostarinen, Reijo - Welch, Lawrence: International Business Operations. Helsinki 1990.	
<b>Further Information</b>	CS10A0260 Managing International Business This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>CS10A0600</b>	<b>DOING BUSINESS IN TRANSITIONAL ECONOMIES</b>	<b>7 ECTS cr</b>
<b>Year and Period</b>	Doing Business in Transitional Economies, Liiketoiminta siirtymätalouksissa	
<b>Teacher(s)</b>	M.Sc. (Tech.) 1, Period 3-4	
<b>Aims</b>	Professor, Ph.D. Tauno Tiusanen	
<b>Content</b>	Student <ul style="list-style-type: none"> <li>• knows the special economic and business features and development of the emerging markets</li> </ul>	



<b>Content</b>	<ul style="list-style-type: none"> <li>• can evaluate and analyze the risks and opportunities for investment, and choose the right modes of operations in TEs.</li> <li>• country profiles of European transitional economies (TEs)</li> <li>• the communist legacy in TEs</li> <li>• macro-economic framework of the transitional process</li> <li>• post-communist region in the global economy</li> <li>• risks and opportunities in the TE markets</li> <li>• investment climate and foreign direct investment in the TEs</li> <li>• EU's enlargement process.</li> </ul>
<b>Modes of Study</b>	Lectures 42 h 3. period, exercises 14 h 3. period and 14 h 4. period. Web-based learning environment platform Blackboard is used in this course.
<b>Evaluation</b>	0-5, examination 50 %, exercises 25 %, research report 25 %.
<b>Study materials</b>	Lecture handouts. Tiusanen, Tauno: Foreign Investors in Transitional Economies: Cases in manufacturing and Services, Northern Dimension Research Centre, Publication n:o 27, Lappeenranta University of Technology 2006. Tiusanen Tauno, Karhu Anna: Twenty Years of Post-Communist Transition in Europe, Northern Dimension Research Centre, Publication n:o 56, Lappeenranta University of Technology 2009. Tiusanen Tauno: Business Climate in Transitional Economies, Northern Dimension Research Centre, Publication n:o 48, Lappeenranta University of Technology 2008. Tiusanen Tauno: Development of rouble exchange rate in Russia, Northern Dimension Research Centre, Publication n:o 45, Lappeenranta University of Technology 2007. Tiusanen, Tauno: Romania and Bulgaria - Two New EU Members, Northern Dimension Research Centre, Publication n:o 44, Lappeenranta University of Technology 2007. Tiusanen Tauno, Karhu Anna: Twenty Years of Post-Communist Transition in Europe, Northern Dimension Research Centre, Publication n:o 56, Lappeenranta University of Technology 2009.
<b>Prerequisites</b>	CS10A0550 International Business Methods.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>CS10A0651</b>	<b>MANAGEMENT OF INNOVATIONS IN RUSSIA 5 ECTS cr</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 4
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Juha Väättänen Professor, D.Sc. (Tech.) Marko Torkkeli Doctoral Student, M.Sc. Daria Podmetina Doctoral Student, M.Sc. (Econ. & Bus. Adm.) Irina Savitskaya Person in Charge: Professor, D.Sc. (Tech.) Juha Väättänen Student
<b>Aims</b>	<ul style="list-style-type: none"> <li>• knows how to apply theories of national/regional innovation systems</li> <li>• knows how to analyze the interaction between main players of the innovation system (universities and research organizations, enterprises, government and industries)</li> <li>• knows how innovation process is managed in Russia</li> <li>• knows how global environment and international collaboration influence the innovation management process</li> <li>• knows how study the innovativeness of the enterprises</li> <li>• knows aspects of open innovations.</li> </ul>
<b>Content</b>	• National Innovation System (NIS) in Russia. Models, main players, role of government, innovation policy, role of universities and research institutions,

<p><b>Modes of Study Evaluation</b></p> <p><b>Study materials</b></p>	<p>regional diversity of innovations (regional innovation system RIS), science parks and innovation centers</p> <ul style="list-style-type: none"> <li>• innovative industries in Russia, high-tech and low-tech industries</li> <li>• international cooperation and innovations. Role of FDIs, spillovers, exports</li> <li>• innovations as the source of competitive advantage</li> <li>• key issues of technology and innovation management in Russia</li> <li>• aspects of open innovations, Internal R&amp;D, technology transfer and business model innovations.</li> </ul> <p>Suitable also for postgraduate studies.</p> <p>Lectures 14 h, Research report and presentation</p> <p>0-5</p> <p>OECD (2005). Fostering Public-Private Partnership for innovation in Russia. OECD. ISBN 92-64-00965-5.</p> <p>Gianella, C. and Tompson W. (2007). "Stimulating Innovation in Russia: The Role of Institutions and Policies", OECD Economics Department Working Papers, No. 539, OECD Publishing.</p> <p>Gurkov, I. (2004) Business Innovation in Russian Industry, Post-Communist Economies, Vol. 16, No. 4, pp. 423-438</p> <p>Torkkeli, M., Vaatanen, J , Podmetina, D., Yla-Kojola, A-M.,. (2009) Knowledge absorption in an emerging economy – the role of foreign investments and trade flows in Russia, International Journal of Business Excellence, Vol. 2, No.3/4 pp. 269 – 284</p> <p>Desai, R.M., Goldberg, I, Enhancing Russia's competitiveness and innovative capacity, The World Bank</p> <p>Additional material will be announced at the lectures.</p>
<p><b>Prerequisites</b></p>	<p>CS10A0800 The Basics of Doing Business in Russia, not required from foreign exchange students. Sufficient prior business studies required. Due to the teaching methods, the amount of participants may be limited. In this case the priority would be given to the students of Industrial Management.</p>

<p><b>CS10A0751</b></p>	<p><b><i>ENTERPRISES AND COMPETITION IN RUSSIA 6 ECTS cr</i></b></p>
<p><b>Year and Period</b></p> <p><b>Teacher(s)</b></p> <p><b>Aims</b></p>	<p><b>Enterprises and Competition in Russia, Yritykset ja kilpailu Venäjällä</b></p> <p><b>Replaces the course CS10A0750 Enterprises and Competition in Russia.</b></p> <p>M.Sc. (Tech.) 1, Period 3</p> <p>Professor, D.Sc. (Tech.) Juha Väättänen</p> <p>Student</p> <ul style="list-style-type: none"> <li>• is able to explain the theory of transition from centrally planned economy (CPE) to market economy</li> <li>• is able to assess competitiveness of industrial sectors and enterprises</li> <li>• is able to evaluate the impact of foreign direct investment on the development of transitional economy</li> <li>• is able to explain the methods of increasing competitiveness and productivity on national, industrial and enterprise level.</li> </ul>
<p><b>Content</b></p>	<ul style="list-style-type: none"> <li>• privatization process and deregulation of the economy</li> <li>• Russian enterprise structures and emergence of new enterprises</li> <li>• natural resources and consumer markets</li> <li>• Russia's competitiveness and foreign direct investment development</li> <li>• role of government in transition process.</li> </ul>
<p><b>Modes of Study Evaluation</b></p> <p><b>Study materials</b></p>	<p>Lectures 28 h, presentations, seminar work, 3rd period.</p> <p>0-5, examination.</p> <p>The World Bank. Transition, the First Ten Years - Analysis and Lessons for Eastern Europe and the Former Soviet Union. 2002.</p> <p>Raj, D. and Goldberg, I. 2007. Enhancing Russia's Competitiveness and Innovative Capacity. The World Bank. Washington DC. 185 p.</p> <p>Additional material will be announced on lectures.</p>
<p><b>Prerequisites</b></p>	<p>CS10A0800 The Basics of Doing Business in Russia, not required from foreign exchange students. Sufficient prior business studies required. Due to the teach-</p>

	ing methods, the amount of participants may be limited. In this case the priority would be given to the students of Industrial Management.
<b>CS10A0800</b>	<b><i>THE BASICS OF DOING BUSINESS IN RUSSIA 5 ECTS cr</i></b>
	<b>The Basics of Doing Business in Russia, Venäjän kaupan perusteet</b>
<b>Year and Period</b>	B.Sc. (Tech.) 3, Period 2
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Juha Väättänen
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• is able to define the special characteristics of Russian business environment</li> <li>• is able to explain the transition process from communism to market economy</li> <li>• is able to distinguish Russian markets and society from the world economy</li> <li>• is able to produce reliable information about Russia, its economy, society and investment opportunities</li> </ul>
<b>Content</b>	<ul style="list-style-type: none"> <li>• is able to recognize Russia's competitive advantages and disadvantages.</li> <li>• transition of Russian society and business environment</li> <li>• living standard analysis</li> <li>• industrial sectors and foreign direct investments</li> <li>• Russia's competitiveness</li> <li>• economic and political integration with the world economy</li> </ul>
<b>Modes of Study</b>	Lectures 28 h, presentation, seminar work, 2nd period.
<b>Evaluation</b>	0-5, examination.
<b>Study materials</b>	Tiusanen, T.: Russia and Foreign Direct Investment. Northern Dimension Research Centre, Publication n:o 52, Lappeenranta University of Technology 2008. Tiusanen, T.: Russia in the Global Economy. Northern Dimension Research Centre, Publication n:o 49, Lappeenranta University of Technology 2008. Lecture materials.
<b>Prerequisites</b>	Additional material will be announced on lectures. Sufficient prior business studies required. Due to the teaching methods, the amount of participants may be limited. In this case the priority would be given to the students of Industrial Management.
<b>CS10A0852</b>	<b><i>EUROPEAN UNION – COMPETITIVENESS AND 5 ECTS cr ENLARGEMENT</i></b>
	<b>European Union – Competitiveness and Enlargement</b>
	<b>Replaces the course CS10A0851 Transitional Countries Integration with the European Union.</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 4
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Juha Väättänen
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• is able to assess the competitiveness of EU in global economy</li> <li>• is able to explain the process of European Union enlargement and it's influence on the competitiveness of EU</li> <li>• is able to identify the factors affecting competitiveness and analyze the state and development of a country according to these measures.</li> </ul>
<b>Content</b>	<ul style="list-style-type: none"> <li>• European Union global competitiveness</li> <li>• enlargement process and profiles of new EU members</li> <li>• trade and investment flows</li> <li>• country competitiveness research methodologies.</li> </ul>
<b>Modes of Study</b>	Lectures 25 h, presentations, seminar work, 4th period.
<b>Evaluation</b>	0-5, examination.
<b>Study materials</b>	UNCTAD, World Investment Report 2010, United Nations 2010. World Economic Forum, Global Competitiveness Report 2010-2011, WEF 2010. Tiusanen, T., Karhu, A.: Twenty Years of Post-Communist Transition in Eu-

<b>Prerequisites</b>	rope. Northern Dimension Research Centre, Publication n:o 56, Lappeenranta University of Technology 2009. Additional material will be announced on lectures. Sufficient prior business studies required. Due to the teaching methods, the amount of participants may be limited. In this case the priority would be given to the students of Industrial Management.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>CS10A0860</b>	<b>INTRODUCTION TO RESEARCH METHODS</b>	<b>4 ECTS cr</b>
	<b>Introduction to Research Methods</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Juha Väättänen	
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• is able to read and access empirical research literature</li> <li>• is able to understand different research philosophies and approaches</li> <li>• is able to formulate the research topic for Master Thesis</li> <li>• is able to understand how to collect and analyze different type of data</li> <li>• is able to estimate and interpret the results of the research</li> <li>• is able to write the Master Thesis research proposal.</li> </ul>	
<b>Content</b>	<ul style="list-style-type: none"> <li>• nature of business and management research</li> <li>• research topic</li> <li>• different research philosophies and approaches</li> <li>• research design</li> <li>• selecting samples, using secondary data</li> <li>• collecting primary data (observations, interviews, questionnaires)</li> <li>• analyzing qualitative data</li> <li>• analyzing quantitative data.</li> </ul>	
<b>Modes of Study</b>	Lectures 14 h, research proposal and presentation	
<b>Evaluation</b>	0-5	
<b>Study materials</b>	R.B. Burns: Introduction to Research Methods, Sage Publications, 2000. (selected chapters) R. Marschan-Piekkari & C. Welch (eds.): Handbook of Qualitative Research for International Business, Edward Elgar, 2004 (selected chapters). Additional material will be announced on lectures.	
<b>Prerequisites</b>	Course participation is limited to students of Global Innovation and Technology Management M.Sc. program.	

<b>CS10A0890</b>	<b>BUSINESS ETHICS</b>	<b>5 ECTS cr</b>
	<b>Vastuullinen liiketoiminta</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3-4	
<b>Teacher(s)</b>	Professor, Lic.Sc. (Econ. & Bus. Adm.) Seppo Pitkänen	
<b>Aims</b>	Person in Charge: Professor, Lic.Sc. (Econ. & Bus. Adm.) Seppo Pitkänen Student <ul style="list-style-type: none"> <li>• understands the globalization-related challenges for business</li> <li>• knows the principles of corporate governance</li> <li>• understands the essentials of stakeholder theory and its influence to business</li> <li>• is able to manage company operations taking into account the key principles of business ethics.</li> </ul>	
<b>Content</b>	<ul style="list-style-type: none"> <li>• challenges for business due to globalization</li> <li>• stakeholder theory and its influence to firm's customer-, employee-, supplier- and society relationships</li> <li>• principles of corporate governance</li> <li>• ethical issues in marketing.</li> </ul>	
<b>Modes of Study</b>	Lectures 28 h, written report, 3-4. period.	
<b>Evaluation</b>	0-5, exam 50 %, written report 50 %.	
<b>Study materials</b>	To be announced in the beginning of the course.	

<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>CS20A6000</b>	<b>SUPPLY CHAIN MANAGEMENT</b>	<b>6 ECTS cr</b>
	<b>Supply Chain Management, Toimitusketjun hallinta</b>	
	<b>Only for the students of the Master's degree programme "New Packaging Solutions".</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period int.	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Janne Huiskonen Assistant, N. N.	
<b>Aims</b>	Relevant supply chain concepts. Basic principles and methods for planning and control of material flows in supply chains. Understanding of inter-company effects and needs for coordination and collaboration. Key performance indicators of supply chain management.	
<b>Content</b>	The role and tasks of supply chain management (SCM) in a firm. Principles and basic methods of planning and control of material flows in supply chain. Supply chain dynamics and coordination. Structural design of supply chains. Inter-company relationships and collaboration. Performance measurement.	
<b>Modes of Study</b>	Lectures, exercises and case assignments 28 h as intensive teaching in April to June. exercises and case assignments. Written examination. Accepted assignments.	
<b>Evaluation</b>	0-5. Examination and assignments.	
<b>Study materials</b>	Literature will be announced later.	
<b>CS20A6050</b>	<b>DECISION-MAKING IN SUPPLY CHAIN</b>	<b>5 ECTS cr</b>
	<b>Decision-Making in Supply Chain , Päätöksenteko toimitusketjussa</b>	
	<b>Only for the students of the Master's degree programme "New Packaging Solutions".</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period int.	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Tech.) Petri Niemi	
<b>Aims</b>	Ability to manage strategic supply chain decision-making processes and support them with quantitative supply chain analysis techniques.	
<b>Content</b>	Quantitative supply chain analysis techniques utilization in strategic supply chain decision-making process. Strategic supply chain decision-making as a process. Presentations for decision-making support.	
<b>Modes of Study</b>	Lectures and group work guidance 26 h as intensive teaching in April to June. Accepted case assignments.	
<b>Evaluation</b>	0-5. Case assignments oral presentations and written reports 100%.	
<b>Study materials</b>	Literature will be announced later.	
<b>Prerequisites</b>	CS20A6000 Supply Chain Management.	
<b>CS20A6060</b>	<b>INTRODUCTION TO LOGISTICS</b>	<b>5 ECTS cr</b>
	<b>Introduction to Logistics, Johdatus logistiikkaan</b>	
	<b>Course can not be used in same degree as CS20A0000 Toimitusketjut ja logistiikka</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 1, Period 1	
<b>Teacher(s)</b>	Post-Doctoral Researcher, D.Sc. (Tech.) Juha Saranen	
<b>Aims</b>	Student knows the role of logistics, importance in industry, key concepts, different activities of logistics and current trends.	
<b>Content</b>	Logistics and supply chains, capacity planning, global logistics, logistics strategy, integration and forecasting, transportation and facility location, inventory	

<b>Modes of Study</b>	management and warehousing, performance measurement and risk.
<b>Evaluation</b>	Period 1, lectures 21 h, examination
<b>Study materials</b>	Scale 0-5, exam 100 % Waters, D.: Supply Chain Management: An Introduction to Logistics, Palgrave Macmillan, 2009. Additional journal articles.
<b>CS30A1001</b>	<b>PRODUCT AND TECHNOLOGY STRATEGY: 7 ECTS cr ADVANCED COURSE IN INNOVATION MAN- AGEMENT</b>
	<b>Product and Technology Strategy: Advanced Course in Innovation Management, Tuote- ja teknologiastrategia: Innovaatiojohtamisen jatkokurssi</b>
	<b>Replaces the course CS30A1000 Tuote- ja teknologiastrategia: innovaatiojohtamisen jatkokurssi.</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1-3
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Tuomo Kässi Assistant, N. N.
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• can analyze technology strategy of a company</li> <li>• can apply different tools and frameworks of technology strategy for comparisons, categorizations, and judgment</li> <li>• can make conclusions, develop and plan alternative progress routes for managing technology, innovations and product portfolios</li> <li>• can produce, propose, and manage the build-up of product families, product systems and product platforms in tangible products and services</li> <li>• can build up company networks and develop solutions for the issues relating to them.</li> </ul>
<b>Content</b>	Core material: Integrating technology and strategy. Managing innovation. The process of innovation management. Different theories of R&D. Assessment of different management strategic schools from the viewpoint of technology management. Dynamic capability. Innovation systems. Learning from markets and alliances. A company's internal venture operations. Managing and creating innovative organisations. Additional material: Product systems. Modulation and standardisation. Product platforms. Suitable also for postgraduate studies.
<b>Modes of Study</b>	Special material: Connecting business know-how to technology management. Lectures 18 h, exercises 8 h, 1st period. Lectures 15 h, exercises 8 h, 1st period. Seminars 12 h, 3rd period.
<b>Evaluation</b>	0-5, exam 60%, seminar work 40%. Possibility to get extra points for exercises.
<b>Study materials</b>	Lecture and exercise material. Tidd, Joe & Bessant, John & Pavitt, Keith: Managing Innovation: Integrating Technological, Market and Organizational Change. John Wiley & Sons, England, 2001 or newer.
<b>Prerequisites</b>	Recommended CS30A0951 Innovaatio- ja teknologiajohtamisen peruskurssi, CS30A1151 Strateginen johtaminen yrityksessä, CS30A0301 Yrityssuunnittelu.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>CS30A1051</b>	<b>METHODS OF TECHNOLOGY MANAGEMENT 6 ECTS cr</b>
	<p><b>Methods of Technology Management, Teknologian johtamisen menetelmät</b></p> <p><b>Replaces the course CS30A1050 Teknologian johtamisen menetelmät.</b></p>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 3
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Tech.) Kalle Elfvengren Assistant, N. N. Person in Charge: Professor, D.Sc. (Tech.) Markku Tuominen
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• will understand technology management methods</li> <li>• can apply different technology management methods to practical problems</li> <li>• can analyse the results for better decisions.</li> </ul>
<b>Content</b>	Customer need assessment tools, quality function deployment, technology roadmapping, delphi-analysis, scenario analysis, NPDP project selection. Suitable also for postgraduate studies.
<b>Modes of Study</b>	- lectures and small group presentations 8 hours - laboratory exercises at group support system laboratory 10 hours
<b>Evaluation</b>	0-5, examination 30%, article summaries 30 %, laboratory exercises 40 %
<b>Study materials</b>	Articles, lecture notes and other announced literature.
<b>Prerequisites</b>	Recommended: CS30A0951 Innovaatio- ja teknologiajohtamisen peruskurssi, CS30A1001 Product and Technology Strategy: Advanced Course in Innovation Management
<b>CS30A1361</b>	<b>CREATIVITY IN INNOVATION PROCESSES 5 ECTS cr</b>
	<p><b>Creativity in Innovation Processes, Luovuus innovaatioprosesseissa</b></p> <p><b>Max. 30 students admitted. Replaces the course CS30A1360 Luovuus innovaatioprosesseissa.</b></p>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 4 int.
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Vesa Harnaakorpi Guest Lecturer, D.Sc. (Econ. & Bus. Adm.) Tapani Fransi Researcher, M.Sc. Anne Pässilä
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• understands creativity and its components in innovation</li> <li>• recognizes people as creative actors</li> <li>• is able to understand collective creativity and creativity systems</li> <li>• can combine artistic and engineer creativity</li> <li>• understands principles of multi-actor innovation and creativity processes</li> <li>• develops following skills of his/hers: creative personality, creative thinking skills and methods, creative will and motivation, as well as skills to act as innovation promoter in open innovation processes.</li> </ul>
<b>Content</b>	Must know: students will be able to use practical creativity methods and methods enhancing group dynamics. Further on, they will be able to avoid association obstacles and lock-ins in creative processes. Should know: enhancing intellectual cross-fertilization in innovation sessions.
<b>Modes of Study</b>	Lectures 24 h (obligatory), assignment, exam.
<b>Evaluation</b>	0-5, exam 50%, assignment 50%.
<b>Study materials</b>	To be informed later.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>CS30A1500</b>	<b>TRANSPORTATION SYSTEMS</b>	<b>5 ECTS cr</b>
	<b>Transportation Systems, Kuljetusjärjestelmät</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 4 int.	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Olli-Pekka Hilmola	
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• understands the application of different transportation modes in transportation logistics area, particularly in Eurasia</li> <li>• knows the most suitable international routes and their performance</li> <li>• knows organizational and technology development in transportation logistics, and their application and relationship on the overall performance</li> <li>• has a knowledge from environmental issues of transportation logistics – especially from the use of railways, intermodality, and containers</li> <li>• understands the environmental emissions caused by transportation systems, and the usage of dry ports for the reduction of these emissions.</li> </ul>	
<b>Content</b>	Among lectures, course contains case exercises (which will combine the issues of different transportation modes together), and by participating in all of these, student will have some amount of basic points for exam.	
<b>Modes of Study</b>	Lectures 14 h and cases 12 h as intensive teaching in the 4th period.	
<b>Evaluation</b>	0-5, examination (70 %) ja accepted case exercises (30 %).	
<b>Study materials</b>	<ol style="list-style-type: none"> <li>1. Häkkinen, Lotta (2005). Operations Integration and Value Creation in Horizontal Cross-Border Acquisitions. Turku School of Economics and Business Administration, A-6 (Doctoral Diss.). Available at URL: <a href="http://www.tukkk.fi/julkaisut/vk/Ae6_2005.pdf">http://www.tukkk.fi/julkaisut/vk/Ae6_2005.pdf</a></li> <li>2. Roso, Violeta (2009). The Dry Port Concept. Chalmers University of Technology, Doctoral Dissertation. ISBN 978-91-7385-338-5. Available at URL: <a href="http://publications.lib.chalmers.se/cpl/record/index.xhtml?pubid=101601">http://publications.lib.chalmers.se/cpl/record/index.xhtml?pubid=101601</a></li> <li>3. Hilmola, Olli-Pekka, Ulla Tapaninen, Erik Terk &amp; Ville-Veikko Savolainen (2007). Container Transit in Finland and Estonia – Current Status, Future Demand and Implications on Infrastructure Investments in Transportation Chain. Publications from the Centre for Maritime Studies, University of Turku, A44. Available at URL: <a href="http://www.okt-infra.fi/file/lid199/files/attachment/OKT_Infra_Cont_Report.pdf">http://www.okt-infra.fi/file/lid199/files/attachment/OKT_Infra_Cont_Report.pdf</a></li> <li>4. Terk, Erik, Ulla Tapaninen, Olli-Pekka Hilmola &amp; Tonis Hunt (2007). Oil Transit in Estonia and Finland – Current Status, Future Demand, and Implications on Infrastructure Investments in Transportation Chain. Publications of Estonian Maritime Academy, No. 4, 2007. Available at URL: <a href="http://www.okt-infra.fi/file/lid206/files/attachment/OKT_Infra_Oil_Report_a.pdf">http://www.okt-infra.fi/file/lid206/files/attachment/OKT_Infra_Oil_Report_a.pdf</a></li> <li>5. Ivanova, Oksana, Tero Toikka &amp; Olli-Pekka Hilmola (2006). Eurasian Container Transportation Market: Current Status and Future Development Trends with Consideration of Different Transportation Modes. Lappeenranta University of Technology, Department of Industrial Engineering and Management. Research Report 179. Available at URL: <a href="http://kouvola.lut.fi/file/lid980/files/attachment/Research_Report_179_Nora.pdf">http://kouvola.lut.fi/file/lid980/files/attachment/Research_Report_179_Nora.pdf</a></li> <li>6. Additional material provided by the lecturer (notes, articles and case exercises).</li> </ol>	
<b>Prerequisites</b>	Recommended to have taken some logistical courses before, e.g. from topics of supply chain management and production control.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	



<b>CS30A1551</b>	<b>SYSTEM DYNAMICS AND INDUSTRIAL MANAGEMENT</b> <b>5 ECTS cr</b>
	<b>System Dynamics and Industrial Management, Systemeidynamiikka tuotantotaloudessa</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-2 int.
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Olli-Pekka Hilmola
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• is able to construct different systems from the main research topics of industrial management, and identifies the dynamic interconnected nature (time dependent) of the performance of these systems</li> <li>• is able to use system dynamics simulation for quantifying the behavior of different systems by using simulation elements and levels</li> <li>• identifies the situations, where system dynamics based quantitative modelling is applicable, and possibly using these skills in thesis phase (M.Sc. and Dr.).</li> </ul>
<b>Content</b>	In this course system dynamics is used in the modelling of logistics systems (distribution and supply chains) and product development processes. Objective of the course is to give an understanding for a student how to analyze systems through relationships of different modeling elements (delay, feedback/feed forward, flow and stock), which often create complex interactions. Implications of system behavior on company level as well as country level issues of decision making in logistics as well as innovation management are discussed. During the course we also use and analyze practical problem solving tasks, using simulation models from the previous research. Suitable also for postgraduate studies.
<b>Modes of Study</b>	Lectures 12 h, and exercises as well as final seminar 14 h. 1.-2. period in intensive form.
<b>Evaluation</b>	0-5, exam (50 %) and seminar work (50 %).
<b>Study materials</b>	1. John D. Sterman (2000). Business Dynamics - Systems Thinking and Modeling for a Complex World, McGraw-Hill/Irwin. 2. Senge, Peter (1994). The Fifth Discipline. Currency Doubleday. 3. Article collection provided by the lecturer.
<b>Prerequisites</b>	Recommended: At least introductory courses taken from logistics/supply chain management as well as technology/innovation management.
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.
<b>CS30A1651</b>	<b>PROCESS AND PRODUCT INNOVATIONS</b> <b>10 ECTS cr</b>
	<b>Process and Product Innovations , Prosessi- ja tuoteinnovaatiot</b>
	<b>Mainly for Finnish and international students from the departments of Chemical Technology, Mechanical Engineering, Electrical Engineering and Industrial Management. The number of participants is limited and students will be interviewed.</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-4
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Tuomo Kässi Associate Professor, D.Sc. (Tech.) Ville Ojanen Associate Professor, D.Sc. (Tech.) Kimmo Kerkkänen Person in Charge: Professor, D.Sc. (Tech.) Ilkka Turunen
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• becomes familiar with the generation of innovations and new technology, the typical methods, problems and their solutions</li> <li>• learns project and teamwork in interdisciplinary, international environment</li> <li>• gets acquainted with product and process development</li> </ul>

<b>Content</b>	<ul style="list-style-type: none"> <li>• trains and deepens many skills learned in other connections.</li> </ul> <p>Methods of product and process development. Interdisciplinary R &amp; D activities as project and teamwork. Development of new technology, patenting. Suitable also for postgraduate studies.</p>
<b>Modes of Study</b>	<p>Informational lectures, 6 h/period. Project meetings, 6 h/period.</p>
<b>Evaluation</b>	<p>Independent project and teamwork in groups of 4-8 students. 0-5, project work 100%.</p>
<b>Further Information</b>	<p>This course has 1-5 places for open university students. More information on the web site for open university instruction.</p>

<b>CS30A1660</b>	<b>OPEN INNOVATION</b>	<b>5 ECTS cr</b>
	<b>Open Innovation</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 3	
<b>Teacher(s)</b>	Researcher, M.Sc. (Tech.) Antero Kutvonen Visiting lecturers Person in Charge: Professor, D.Sc. (Tech.) Marko Torkkeli	
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• can explain the concept of open innovation through both theory and examples (to e.g. a company executive)</li> <li>• identifies open innovation activities in real life companies and explain the motives for engaging in them and the mechanisms through which they create value for the company</li> <li>• can distinguish between modes of inbound and outbound open innovation</li> <li>• can analyze the relation between a company's strategic choices and application of open innovation</li> <li>• attains a basic familiarity with the scientific literature on the theme and the ability to view open innovation in the context of other innovation management theories.</li> </ul>	
<b>Content</b>	<p>Must know: The fundamental definitions and concept of open innovation. Modes of inbound open innovation, i.e. external acquisition of knowledge, and outbound open innovation, i.e. external exploitation of knowledge. Difference between closed and open innovation in managing technology. Identifying open innovation activities in real life firms. Monetary and strategic motives for engaging in open innovation.</p> <p>Should know: Process models of inbound and outbound open innovation. The role and importance of the individual process phases. The relation between corporate strategy, technology strategy and open innovation activities. Most common examples of firms used to explain open innovation. Varying topics from state-of-the-art open innovation research, depending on guest lecturer.</p> <p>Nice to know: Development of the open innovation concept on the basis of prior innovation management theories. Knowledge of the main scientific literature surrounding open innovation. Theoretical determinants of open innovation.</p>	
<b>Modes of Study</b>	Lectures and guest speakers 28h as intensive teaching. Small group assignments during lectures. Group exams (or substituting them with summaries of scientific articles) on each intensive day.	
<b>Evaluation</b>	Graded on a scale of 0 - 5. Continuous evaluation based on small group exams (80%) and participation in lectures (20%). Possibility to substitute group exams with literary work (summaries of scientific articles) in case of absence.	
<b>Study materials</b>	Chesbrough, Vanhaverbeke and West (eds.): Open Innovation: Researching a New Paradigm. 2006. Oxford: Oxford University Press. Available freely online. Theoretical determinants of open innovation, LUT Research report. 2010. Scientific journal articles.	
<b>Prerequisites</b>	Lecture handouts. Recommended: CS30A1001 Product and Technology Strategy: Advanced Course in Innovation Management, CS34A0500 Technology Commercialization and Corporate Venturing	

<b>CS30A1670</b>	<b>SERVICE INNOVATION AND MANAGEMENT</b>	<b>5 ECTS cr</b>
	<b>Service Innovation and Management</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-2	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Tech.) Ville Ojanen	
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• can recognize and categorize the variety of services and service firms in modern industrial environment as well as understand their influence in management of industrial innovations</li> <li>• can identify the characteristics of services and evaluate the similarities, differences and links between services and physical products</li> <li>• can define the dimensions of service innovations</li> <li>• can explain the processes of new service development</li> <li>• can summarize the main managerial challenges in service innovation management</li> <li>• can select and apply the suitable frameworks, tools and methods, to overcome some typical real-world challenges in service innovation management</li> <li>• can explain the significance, main principles and roles of value networks in service delivery and development.</li> </ul>	
<b>Content</b>	Typologies of service firms. Characteristics of services. Product-service systems in manufacturing industry. Knowledge-intensive business services. New service development process: sources of service ideas, development of service strategies and culture, service design. Dimensions of service innovations. Productization of services. Supporting methods for service innovation management. Managerial challenges in service innovation management. Utilization of frameworks, methods and tools in service innovation management. Roles of different types of firms in service systems and networks. Value creation through services. Customer-centric service development.	
<b>Modes of Study</b>	Lectures, 12 h 1. period, lectures and exercises 4 h 2 period, seminars 12 h 2 period	
<b>Evaluation</b>	Written reports and seminars 100 %	
<b>Study materials</b>	Lecture notes. Other material, books and articles announced in the beginning of the course.	
<b>Prerequisites</b>	Recommended: B.Sc on Industrial Engineering and Management, or equivalent knowledge	
<b>CS30A6000</b>	<b>TECHNOLOGY MANAGEMENT</b>	<b>3 ECTS cr</b>
	<b>Technology Management, Teknologiajohtamisen perusteet</b>	
	<b>Only for the students of the Master's degree programme "New Packaging Solutions".</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period int.	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Tech.) Ville Ojanen	
<b>Content</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>Modes of Study</b>	Lectures and exercises 18 h as intensive teaching in April to June. Written examination and case study reports.	
<b>Evaluation</b>	0-5, examination 70 %, written and oral case/research article reports 30 %.	
<b>Study materials</b>	Lecture notes. F. Betz: Managing Technological Innovation: Competitive Advantage from Change, 2nd edition (2003). Baker, Michael & Hart, Susan (1998): Product strategy and management.	

	Prentice Hall. Articles and Case Studies Other literature announced later.	
<b>CS30A6050</b>	<b>COST AND PROFITABILITY ESTIMATION</b>	<b>3 ECTS cr</b>
	<b>Cost and Profitability Estimation, Kustannusten ja kannattavuuden arviointi</b>	
	<b>For LUT International Master's Degree programme.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Timo Kärrri Assistant, M.Sc. (Tech.) Miia Pirttilä	
<b>Content</b>	Must know: Cost terms. Cost-volume-profit analysis. Time value of money. Cash flow and its components. Estimation methods for operating and capital costs. Profitability appraisal methods. Cost of capital. Risk estimation. Cost/Schedule control of project.	
<b>Modes of Study</b>	Lectures 14 h, exercises 14 h, 2. period.	
<b>Evaluation</b>	0-5, tasks and final report.	
<b>Study materials</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>CS30A6100</b>	<b>TECHNOLOGY MANAGEMENT</b>	<b>6 ECTS cr</b>
	<b>Technology Management</b>	
	<b>Only for the students of the Master's Degree Program (CBU) in Business and Administration. Course will be lectured in the autumn semester 2008 at GSOM.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Marko Torkkeli Professor N.N., GSOM	
<b>Aims</b>	Person in Charge: Professor, D.Sc. (Tech.) Marko Torkkeli Europe is waking up to the challenge of technology and innovation. We see EU commitment to spend 3% of GDP on R&D, but who is thinking about how to spend? Who is thinking about technology management? Does the corporate board have the means to manage this spend? Should some percentage of the R&D be spent on improving technology and innovation management? This is where this course makes a contribution. It brings together the latest practice, research findings and thinking, presented in a way that addresses top management requirements. The goal is to secure the economic future of the firm, in the context of a sustainable industry and society. Using the ideas and methods, the board can assess and improve its own ability to deal with the challenge of technology and innovation.	
<b>Content</b>	The course examines the significant issues related to managing technology from both strategic and tactical perspectives. It is designed to meet the needs of students who must understand the use of technology as a powerful tool of competitive advantage and growth. Open innovation, technology management and evaluation methods, and strategic innovation management issues are covered during the course.	
<b>Modes of Study</b>	Lectures 42 h, 1-2 period. Exam.	
<b>Evaluation</b>	Exam	
<b>Study materials</b>	George S. Day, Paul J. H. Schoemaker (Eds.): Wharton on Managing Emerging Technologies, John Wiley & Sons, 2000 European Institute for Technology and Innovation and European Institute for Technology Management: Bringing Technology and Innovation into the Boardroom, 2003	

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Rita Gunther McGrath, Ian MacMillan: The Entrepreneurial Mindset, Harvard Business School Press, 2000  
Other assigned literature to be announced later.

### **CS30A7000**      **TECHNOLOGY MANAGEMENT IN JAPAN**      **3 ECTS cr**

<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1 int.
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Ichimura Takaya
<b>Aims</b>	Student <ul style="list-style-type: none"><li>• will be provided by the background information needed to understand how the Japanese system of technology management operates</li><li>• will be informed about the characteristics of Japanese management</li><li>• will be informed about the contribution of technology management to the development of Japanese industry</li><li>• will also be given an outline of the Japanese production system and its basis on Japanese culture.</li></ul>
<b>Content</b>	<ol style="list-style-type: none"><li>1. Technology management as an innovation process</li><li>2. Management technology and the effectiveness</li><li>3. The cultural and historical background of Japan</li><li>4. Industrial development of Japan and their causes</li><li>5. The approach to establish a technology management system</li><li>6. Cases of Technology Management System in Japan<ol style="list-style-type: none"><li>6.1 Toyota production system</li><li>6.2 Product development and improvement system</li><li>6.3 Work design for quality of working life(QWL)</li><li>6.4 Quality management system in Japan</li><li>6.5 The process and tools of problem solving</li><li>6.6 Environmental management system</li></ol></li><li>7. Technology management in the global world</li></ol>
<b>Modes of Study</b>	16 hours of lectures and class discussions in English.
<b>Evaluation</b>	0-5, active participation in classes and a written assignment.
<b>Study materials</b>	Written material will be distributed during lectures.
<b>Prerequisites</b>	Basic knowledge of production management.
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.

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

	<b>Strategic Entrepreneurship in Age of Uncertainty, Strateginen yrittäjyys ja epävarmuuden hallinta</b>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Marko Torkkeli
<b>Aims</b>	Student <ul style="list-style-type: none"><li>• can effectively convert assumptions to knowledge</li><li>• can understand the power of entrepreneurial mindset and strategic entrepreneurship</li><li>• can cope with uncertainty in new business creation</li></ul>
<b>Content</b>	Entrepreneurial thinking, uncertainty management, strategic entrepreneurship. "Managing in a knowledge-based economy", "Managing by Core Competences", "Knowledge intensive firms", "Uncertainty and Change management". The latest buzz words or another passing managerial fad? Old wine in new bottles? Or perhaps, just perhaps, a fundamental means of survival and success for modern day corporations? Given the amount of effort that has been devoted to the topic by both academics and practitioners, it appears worth our while to take a deep and dispassionate look at the role of entrepreneurial thinking in sustained competitive advantage.
<b>Modes of Study</b>	Lectures 28 h, 1. period. Exam

<b>Evaluation</b>	0-5
<b>Study materials</b>	Lectures. McGrath Rita and MacMillan Ian, (2000). The Entrepreneurial Mindset. Harvard Business School Pr.
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.
<b>CS34A0500</b>	<b>TECHNOLOGY COMMERCIALIZATION AND CORPORATE VENTURING</b> <b>5 ECTS cr</b>
	<b>Technology Commercialization and Corporate Venturing, Teknologian kaupallistaminen</b>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 4 int.
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Marko Torkkeli Visiting lecturers
<b>Aims</b>	Student understands the characteristics of technology commercialization and high growth technology ventures.
<b>Content</b>	This course examines issues related technology commercialization, corporate venturing, and ways to profitably exploit business opportunities. Business models. Suitable also for postgraduate studies.
<b>Modes of Study</b>	Lectures 28 h, 4. period. Exam
<b>Evaluation</b>	0-5
<b>Study materials</b>	Lectures and course pack. Block Zenas and MacMillan Ian (1985) Corporate Venturing: Creating New Businesses Within the Firm. Harvard Business School Pr. McGrath Rita and MacMillan Ian, (2005). MarketBusters: 40 Strategic Moves That Drive Exceptional Business Growth. Harvard Business School Pr.
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.
<b>CS35A0151</b>	<b>PRODUCT LIFECYCLE MANAGEMENT</b> <b>7 ECTS cr</b>
	<b>Product Lifecycle Management, Tuotetiedon hallinta</b>
	<b>Replaces the course CS35A0150 Tuotetiedon hallinta.</b>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 4 int.
<b>Teacher(s)</b>	Lecturer, M.Sc. (Tech.) Jorma Papinniemi Assistant, M.Sc. (Tech.) Kyllikki Taipale-Erävala Visiting lecturers
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• can define and explain the concepts of product data management and product life cycle management</li> <li>• can recognize the company's product processes and understands their interaction with the company's overall operations</li> <li>• can compare PLM-/PDM systems' characteristics, technical features and managerial functions and is able to see their role in product development and business.</li> </ul>
<b>Content</b>	Different views on the product processes of an enterprise. Lifecycle models of products and project business. Managing the use and changes of product related information at different stages of the product lifecycle. PLM systems and their functionalities: managing generic products, individual products, items and documents. Integrating a PLM system with other enterprise systems. PLM project and system implementation. Demos of PLM systems.
<b>Modes of Study</b>	Lectures 21 h, seminars 14 h, 4th period as intensive studies (lecture days will be announced separately) Project work, 4th period.
<b>Evaluation</b>	0-5, exam 65%, project report and seminar participation 35%.

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<b>Study materials</b>	Journal articles. Sääksvuori-Immonen: Product Lifecycle Management, Springer 2008. Forza-Salvador: Product Information Management for Mass Customization, Palgrave Macmillan, 2007. (partly)
<b>Prerequisites</b>	CS30A0951 Innovaatio- ja teknologiajohtamisen peruskurssi
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>CS35A6000</b>	<b><i>INFORMATION &amp; KNOWLEDGE MANAGEMENT IN INNOVATIVE ENTERPRISES</i></b> <b>6 ECTS cr</b>
	<b>Information &amp; Knowledge Management in Innovative Enterprises , Tietojohtaminen uudistuvassa yrityksessä</b>
	<b>Only for the students of the Master's degree programme "New Packaging Solutions".</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 4 int.
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Hannu Kärkkäinen Lecturer, M.Sc. (Tech.) Jorma Papinniemi
<b>Aims</b>	To clarify how various systematic approaches, tools and methods of information & knowledge management can be utilized as well in product innovation as in business process re-engineering to improve the innovativeness and competitiveness of enterprises.
<b>Content</b>	Must know: Challenges, needed skills and systematic approaches for the development of new innovations. Process innovation and the role of IT. Management of process information and knowledge. Design of business processes. Automation of B2B processes. Should know: How people perceive, gather, select, organize and create information and knowledge for the development of novel types of innovations. Modeling tools in BPR. Process-aware information systems ERP,CRM,SCM,PLM).
<b>Modes of Study</b>	Lectures 32 hrs as intensive teaching from April to June. Written seminar report and its presentation and opponent report.
<b>Evaluation</b>	0 - 5, seminar report 70 %, presentation 10 %, opponent report 20 %.
<b>Study materials</b>	Selection of articles. Becker, Jörg et. al. editors: Process Management. A Guide for the Design of Business Processes. Springer-Verlag 2003.
<b>CS90A0060</b>	<b><i>MASTER'S THESIS</i></b> <b>30 ECTS cr</b>
	<b>Diplomityö</b>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1-4
<b>Teacher(s)</b>	Professors of major subjects
<b>Aims</b>	In their Master's thesis, students demonstrate their knowledge of a topic of scientific and societal importance in a specific professional area. The student must demonstrate the ability to carry out the project independently and following a plan. The thesis must be organised coherently, the presentation academic and the language revised.
<b>Content</b>	The Master's thesis is the final project of the degree of Master of Science (Technology). Usually it involves a development project commissioned by a company and takes about six months. The work entails working on a development project related to industrial management, preparing a report in the form of a thesis, and presenting the work in a seminar.
<b>Modes of Study</b>	Development project and related report, presentation of the work in a seminar, maturity test (usually on the contents of the thesis).
<b>Evaluation</b>	Scale 0-5, Master's thesis 100%.
<b>Prerequisites</b>	B.Sc. (Tech.) degree (not required of students admitted directly into a Master's programme), complementary studies (for students admitted directly into a Master's programme), major studies min. 15 ECTS credits.

<b>CT60A4101</b>	<b>SOFTWARE ENGINEERING METHODS</b>	<b>5 ECTS cr</b>
	<b>Software Engineering Methods, Ohjelmistotuotannon menetelmät</b>	
	<b>Replaces the course CT60A4101 Ohjelmistotuotannon menetelmät. If all of the participants speak Finnish, the course will be lectured in Finnish.</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 3, Period 1-2	
<b>Teacher(s)</b>	Professor, Ph.D. Kari Smolander	
<b>Aims</b>	The student will be able to participate in the analysis and design of software and information systems. The student will understand the problems in modern system and software work and the principles in their planning. The student will be able to use the UML language in planning.	
<b>Content</b>	Features of modern software development, requirements analysis and modeling, UML use cases, class diagrams, dynamic modeling, state diagrams, architecture design, the importance of methods and processes in software and systems development.	
<b>Modes of Study</b>	Lectures 14 h, exercises 14 h, 1st period.	
<b>Evaluation</b>	Lectures 14 h, exercises 14 h and practical assignment, 2nd period. Exam. 0-5. Exam. The course project can raise the grade as informed in the lectures.	
<b>Study materials</b>	Lecture slides, supplementary material, e.g. Booch, G., Rumbaugh, J., Jacobson, I.: The Unified Modeling Language User Guide, Addison-Wesley, 1999. Jacobson, I., Booch, G., Rumbaugh, J.: The Unified Software Development Process, Addison-Wesley, 1999. Fitzgerald, Russo, Stolterman: Information Systems Development - Methods in Action, McGraw-Hill, 2002.	
<b>Prerequisites</b>	Other material announced during lectures. CT60A4001 Ohjelmistotuotanto.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>CT60A5000</b>	<b>E-BUSINESS TECHNOLOGIES</b>	<b>5 ECTS cr</b>
	<b>E-Business Technologies, E-business -teknologiat</b>	
	<b>The course will be lectured every other year, next during the academic year 2011 - 2012.</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 3-4	
<b>Teacher(s)</b>	Professor, Ph.D. Kari Smolander	
<b>Aims</b>	The student understands the basics of e-business technologies and implementation and can use the acquired knowledge in further studies of the subject.	
<b>Content</b>	E-business basics, EDI/EDIFACT, interoperability, B2B e-business, e-commerce. Basics of XML, web services, service orientation, and enterprise application integration. E-business technologies and standards such as RosettaNet and ebXML.	
<b>Modes of Study</b>	Lectures and seminars 28h , 3-4 periods. Project assignment, report and presentation. Exam.	
<b>Evaluation</b>	0-5, exam 60%, course project 40%.	
<b>Study materials</b>	To be announced at the lectures.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	



## 6. School of Business

### 6.1. Master's Degree Program (CBU) in Business and Administration International Technology and Innovation Management (MITIM)

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

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

**NOTE:** LUT MITIM students study 1<sup>st</sup> year of their studies at LUT and 2<sup>nd</sup> year of their studies at GSOM. LUT MITIM students follow the degree structure mentioned below during the 1<sup>st</sup> year of their studies (courses marked M.Sc. (Econ. & Bus. Adm.) 1 or 1/2). During the 2<sup>nd</sup> year of studies LUT MITIM students participate to courses offered by GSOM to fulfill their curriculum.

GSOM MITIM students study 1<sup>st</sup> year of their studies at GSOM and 2<sup>nd</sup> year of their studies at LUT. GSOM MITIM students follow the degree structure of GSOM during the 1<sup>st</sup> year of their studies. During the 2<sup>nd</sup> year of studies GSOM MITIM students participate to courses offered by LUT (courses marked M.Sc. (Econ. & Bus. Adm.) 2 or 1/2) to fulfill their curriculum.

#### Master of Science in Economics and Business Administration

##### The Degree Structure

General Studies	6	ECTS cr
Major Subject	66	ECTS cr
Minor Subject	33	ECTS cr
Elective Studies	15	ECTS cr
<i>Credits</i>	<i>120 (min.)</i>	<i>ECTS cr</i>

##### Major Subject (66 ECTS cr)

##### International Technology and Innovation Management (66 ECTS cr)

<i>All courses are obligatory</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
AC40A0452 International Marketing of High Technology Products and Innovations	M.Sc. (Econ. & Bus. Adm.) 1/2	1	6
AC60A0050 Knowledge Management as a Theory and Practice	M.Sc. (Econ. & Bus. Adm.) 2	2011-2012	6
AC60A0150 Strategic Management of Growth	M.Sc. (Econ. & Bus. Adm.) 1	3	6
AC60A0200 Supply and Innovation Management	M.Sc. (Econ. & Bus. Adm.) 2	2011-2012	6
AC60A0550 Consulting Project at LUT	M.Sc. (Econ. & Bus. Adm.) 1/2	3-4	6
AC60A0600 Technology and Innovation Management	M.Sc. (Econ. & Bus. Adm.) 1/2	2	6
AC60A9000 Research Seminar for Master's Thesis	M.Sc. (Econ. & Bus. Adm.) 1/2	1-4	30

**Minor Subject (33 ECTS cr)****Business Administration in CBU (33 ECTS cr)**

<i>All courses are obligatory</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
AB30A0800 Managerial Finance	M.Sc. (Econ. & Bus. Adm.)	1 3	6
AC40A0651 International Business Strategies	M.Sc. (Econ. & Bus. Adm.)	1 3-4	6
AC60A0650 Organization and Strategy Work in Global Context	M.Sc. (Econ. & Bus. Adm.)	1 3	6
AC60A0700 Introduction to Modern Economics	M.Sc. (Econ. & Bus. Adm.)	1 4	6
AC60A0750 International Marketing Management	M.Sc. (Econ. & Bus. Adm.)	1 1	6
MITIM- Internship HAR1	M.Sc. (Econ. & Bus. Adm.)	2	3

**General Studies (6 ECTS cr)**

	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
AC60A0450 Quantitative Methods for Business Research	M.Sc. (Econ. & Bus. Adm.)	1 1-2	3
Business Processes Management and Information Technologies (GSOM)	M.Sc. (Econ. & Bus. Adm.)	1/2	3

**Elective Studies (15 ECTS cr)**

Min. 15 ECTS credits should be selected from GSOM or LUT School of Business. Two elective courses during the 1<sup>st</sup> year and one or more elective courses during the 2<sup>nd</sup> year of studies should be selected.

<i>Electives from LUT School of Business</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
AB30A0250 Theory of Corporate Finance	M.Sc. (Econ. & Bus. Adm.)	1/2 4	7
AB30A0301 International Finance and Emerging Markets	M.Sc. (Econ. & Bus. Adm.)	1/2 2	6
AB30A0550 International Financial Management	M.Sc. (Econ. & Bus. Adm.)	1/2 3	6
AB30A0600 Empirical Research in Accounting and Finance	M.Sc. (Econ. & Bus. Adm.)	1/2 3-4	7
AC40A0101 Cross-Cultural Marketing Strategies	M.Sc. (Econ. & Bus. Adm.)	1/2 2	6
AC40A0150 Integrated Marketing Communication	M.Sc. (Econ. & Bus. Adm.)	1/2 4	5
AC40A0202 Internationalization of the Firm and Global Marketing	M.Sc. (Econ. & Bus. Adm.)	1/2 2	6
AC40A0850 Contemporary Issues in International Marketing	M.Sc. (Econ. & Bus. Adm.)	1/2 int.	6
AC60A0350 Multivariate and Econometric Analysis Methods	M.Sc. (Econ. & Bus. Adm.)	1/2 3-4	6
AC60A0400 International Accounting and Analysis	M.Sc. (Econ. & Bus. Adm.)	1/2 1-2	6

## Additional Information

### Master's Thesis

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

### Language Studies

Students will have to take complementary language studies of a minimum of 6 ECTS credits of one language (other than English). These studies are not included in the Master's degree, but are an addition to it.

### Contact Information

Program Director:

Vice Rector, Professor, Ph. D. Minna Martikainen ([minna.martikainen@lut.fi](mailto:minna.martikainen@lut.fi))

Academic Coordinator:

Professor, Ph. D. Liisa-Maija Sainio ([liisa-maija.sainio@lut.fi](mailto:liisa-maija.sainio@lut.fi))

International Officer:

Essi Reponen (room 7385.1, [essi.reponen@lut.fi](mailto:essi.reponen@lut.fi))

Program web pages: <http://www.lut.fi/kati/lb/>

## The Courses Offered in English

		<i>ECTS cr</i>
AB30A0250	Theory of Corporate Finance	7
AB30A0301	International Finance and Emerging Markets	6
AB30A0550	International Financial Management	6
AB30A0600	Empirical Research in Accounting and Finance	7
AB30A0800	Managerial Finance	6
AC40A0101	Cross-Cultural Marketing Strategies	6
AC40A0150	Integrated Marketing Communication	5
AC40A0202	Internationalization of the Firm and Global Marketing	6
AC40A0452	International Marketing of High Technology Products and Innovations	6
AC40A0651	International Business Strategies	6
AC40A0850	Contemporary Issues in International Marketing	6
AC60A0050	Knowledge Management as a Theory and Practice	6
AC60A0150	Strategic Management of Growth	6
AC60A0200	Supply and Innovation Management	6
AC60A0350	Multivariate and Econometric Analysis Methods	6
AC60A0400	International Accounting and Analysis	6
AC60A0450	Quantitative Methods for Business Research	3
AC60A0550	Consulting Project at LUT	6
AC60A0600	Technology and Innovation Management	6
AC60A0650	Organization and Strategy Work in Global Context	6
AC60A0700	Introduction to Modern Economics	6
AC60A0750	International Marketing Management	6
AC60A9000	Research Seminar for Master's Thesis	30
MITIM-HAR1	Internship	3

<b>AB30A0250</b>	<b>THEORY OF CORPORATE FINANCE</b>	<b>7 ECTS cr</b>
	<b>Theory of Corporate Finance</b>	
	<b>The language of teaching is English</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1/2, Period 4	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Econ. & Bus. Adm.) Sheraz Ahmed	
<b>Aims</b>	At the end of this course the student is expected to be able to:	
	<ul style="list-style-type: none"> <li>- know the functions of a corporation related to finance</li> <li>- demonstrate advanced level skills in describing corporate finance theories</li> <li>- interpret the empirical analyses in the corporate finance literature in the light of theory</li> <li>- understand the link between the theoretical and practical aspects of corporate finance</li> <li>- deepen knowledge within certain specific areas of corporate finance with the help of research articles</li> <li>- develop new research agendas within the field of corporate finance</li> </ul>	
<b>Content</b>	Specific issues of corporate finance include dividends, valuation, mergers and acquisitions, listings, IPOs, ownership structures, corporate governance, asymmetric information and international finance.	
<b>Modes of Study</b>	Lectures/seminar 21 h, 4th period. Term paper and presentation (written on an agreed topic presented in the seminar). Exam. Blackboard/Noppa in use.	
<b>Evaluation</b>	Graded 0–5 on the basis of an exam (80%) and a term paper (20%), evaluation 0-100 points.	
<b>Study materials</b>	<ol style="list-style-type: none"> <li>1. Ross, S.A., Westerfield, R.W. – Jaffe, J.: Corporate Finance, 7th edition, selected parts</li> <li>2. Copeland, T., Weston, J.F. - Shastri, K.: Financial Theory and Corporate Policy, 2003, only selected parts.</li> <li>3. Handouts in class and all additional material required by the lecturer.</li> </ol>	
<b>Prerequisites</b>	Compulsory B.Sc. courses in Finance (except Bachelor's thesis)	
<b>AB30A0301</b>	<b>INTERNATIONAL FINANCE AND EMERGING MARKETS</b>	<b>6 ECTS cr</b>
	<b>International Finance and Emerging Markets</b>	
	<b>The language of teaching is English.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1/2, Period 2	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Econ. & Bus. Adm.) Kashif Saleem Guest lecturers	
<b>Aims</b>	At the end of the course the student is expected to know:	
	<ul style="list-style-type: none"> <li>- how the theory of international trade and finance is formed</li> <li>- the basic relations in international asset pricing</li> <li>- the specifics in Russian financial markets: stock, bond, money and derivative markets.</li> <li>- the specifics in corporate governance, privatization and corporate finance in Russia.</li> <li>- the latest issues in empirical financial research on the Russian market.</li> <li>- the special characteristics of other emerging markets: BRIC countries, Frontier emerging markets, the Emerging Europe and the Middle East.</li> <li>- what are the different sources of risks involved in emerging markets</li> <li>- different episodes of financial crisis</li> </ul>	
<b>Content</b>	Foundations of international finance theory, foreign exchange rates, interest rates, international financial markets, asset pricing, portfolio management. Emerging financial markets, especially Russia: recent development, main characteristics and future directions.	

<b>Modes of Study</b>	Lectures 30 h. Written term paper. Exam. Blackboard in use.
<b>Evaluation</b>	Grade 0-5 on the basis of the exam (80%) and term paper (20%), evaluation 0-100 points.
<b>Study materials</b>	1. Eiteman, Stonehill, and Moffett: "Multinational Business Finance". Pearson International, 2007, 11th edition. Selected parts. 2. Papaioannou and Tsetsekos (1997): "Emerging Market Portfolios. Diversification and Hedging Strategies". Selected parts. 3. Handouts in class and all additional material required by the lecturer.
<b>Prerequisites</b>	Compulsory B.Sc. courses in Finance (except Bachelor's thesis)

<b>AB30A0550</b>	<b>INTERNATIONAL FINANCIAL MANAGEMENT 6 ECTS cr</b>
	<b>International Financial Management</b>
	<b>The language of teaching is English.</b>
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1/2, Period 3
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Econ. & Bus. Adm.) Sheraz Ahmed
<b>Aims</b>	At the end of this course a student is expected to be able to: - understand the structure and functions of MNCs - analyze cross-border financing and investment decisions - evaluate the different legal environments, tax considerations and country risks involved in the financial management of MNCs - assess the impacts of exchange rates on the profitability, growth and valuation of MNCs - know the valuation and risk management strategies used by multinational corporations - measure cross-border diversification benefits in order to undertake effective risk management strategies
<b>Content</b>	The course covers four different areas in international financial management: 1) currencies exchange rates and asset pricing, 2) multinational financial decision making, 3) cross-border valuation and financing diversification and 4) institutions, risk management and investors' behavior.
<b>Modes of Study</b>	Lectures 24 h, term paper (written individually or in groups of up to three members on a topic agreed on mutually), exam. Blackboard/Noppa in use.
<b>Evaluation</b>	Grade 0–5 on the basis of the exam (80%) and term paper (20%), evaluation 0-100 points.
<b>Study materials</b>	1. Madura and Fox: International Financial Management, 8th edition, or later version 2. Handouts in class and all additional material required by the lecturer
<b>Prerequisites</b>	Compulsory B.Sc. courses in Finance (except Bachelor's thesis)

<b>AB30A0600</b>	<b>EMPIRICAL RESEARCH IN ACCOUNTING AND 7 ECTS cr FINANCE</b>
	<b>Empirical Research in Accounting and Finance</b>
	<b>The language of teaching is English.</b>
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1/2, Period 3-4
<b>Teacher(s)</b>	Docent, D.Sc. (Econ. & Bus. Adm.) Jussi Nikkinen Person in Charge: Professor, D.Sc. (Econ. & Bus. Adm.) Minna Martikainen
<b>Aims</b>	The course has the following objectives: - First, the course provides an overview of recent relevant research issues in accounting and finance, thereby extending and deepening students' knowledge in the area of accounting and finance. - Second, the course is intended to prepare students for empirical research in accounting and finance.

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<b>Content</b>	- Upon the completion of the course, the student will have developed the ability to plan an empirical research project in accounting and finance. Relevant research issues related to financial reporting, corporate governance, agency relationships, managerial incentive plans, market efficiency, information content of asset prices, accounting, capital markets and financial institutions, international financial markets.
<b>Modes of Study</b>	Lectures/seminar 21 h. Over the course of the term there will be two to three assignments, such as an article analysis. The aim of these assignments is to help students to understand the principles of deductive empirical research. The main course requirement is to write a term paper on the area of accounting or finance, containing at minimum a detailed, well-developed research proposal. Blackboard in use.
<b>Evaluation</b>	Grade 0–5 on the basis of the term paper, evaluation 0-100 points.
<b>Study materials</b>	There is no textbook. Issues covered in class will be based on research papers and articles.
<b>Prerequisites</b>	Compulsory B.Sc. courses in Accounting or in Finance (except Bachelor's thesis). AC40A0010 Tilastollisen analyysin perusteet (Basic Course in Statistical Analysis Method) and AB40A0100 Monimuuttujamenetelmät (Multivariate Analysis Methods or Ka6710100 Quantitative Research Methods I)

<b>AB30A0800</b>	<b>MANAGERIAL FINANCE</b>	<b>6 ECTS cr</b>
	<b>Managerial Finance</b>	
	<b>The language of teaching is English.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 3	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Econ. & Bus. Adm.) Kashif Saleem	
<b>Aims</b>	At the end of the course, the student is expected to know: <ul style="list-style-type: none"> <li>- how corporate finance and business strategies are linked to each other</li> <li>- the process and players involved in raising a firm's capital</li> <li>- the methods of valuing real assets</li> <li>- how to make investment decisions based on the riskiness of projects</li> <li>- how corporate taxes impact on asset valuation and financial decisions</li> <li>- how optimal capital structure is linked to corporate strategies of firms</li> <li>- how managerial incentives affect financial decisions</li> <li>- the importance of risk management in corporate financial decisions</li> </ul>	
<b>Content</b>	Introduction to financial instruments, debt financing, equity financing, discounting and valuation, asset allocation, corporate taxes and capital structure, bankruptcy, managerial incentives, asymmetric information, mergers and acquisitions and risk management.	
<b>Modes of Study</b>	Lectures 30 h. Written term paper. Exam.	
<b>Evaluation</b>	Grade: 0–5 on the basis of the exam (80%) and term paper (20%), evaluation 0-100 points.	
<b>Study materials</b>	<ol style="list-style-type: none"> <li>1. David Hiller, Mark Grinblatt and Sheridan Titman: Financial markets and corporate strategy – European edition 2007 (Text book)</li> <li>2. Brealey Myers: Principles of corporate finance, seventh edition ( additional readings)</li> <li>3. Handouts in class and all additional material required by the lecturer</li> </ol>	
<b>Prerequisites</b>	Compulsory B.Sc. courses in Finance (except Bachelor's thesis)	

<b>AC40A0101</b>	<b>CROSS-CULTURAL MARKETING STRATEGIES 6 ECTS cr</b>
	<b>Cross-Cultural Marketing Strategies</b>
	<b>The number of attending students may have to be limited if the number of students exceeds 70. If necessary, priority is given to students and exchange students of the LUT School of Business.</b>
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1/2, Period 2
<b>Teacher(s)</b>	Doctoral Student, M.Sc. (Econ. & Bus. Adm.) Hanna Salojärvi
<b>Aims</b>	The goal of the course is to give an understanding of how the cultural environment affects international marketing operations, and advance students' global mindset by giving conceptual tools to increase their intercultural competence. After completing the course the students can: <ul style="list-style-type: none"> <li>- define and categorize culture</li> <li>- recognize the limits of the global marketing approach from the cultural perspective</li> <li>- understand the effects of the cultural environment on international marketing strategies</li> <li>- remember Hofstede's cultural dimensions</li> <li>- utilize cultural concepts in marketing strategy formulation</li> <li>- analyze cultural differences with different dimensions and categorizations of culture from the marketing perspective.</li> </ul>
<b>Content</b>	Must know: Definitions of culture, the Hofstede and GLOBE cultural dimensions, using cultural concepts to analyze a foreign market from the marketing perspective, the effects of the culture on a product, communication, pricing and distribution strategies. Should know: The limits of globalization from the cultural perspective, standardization vs. adaptation in international marketing, the country-of-origin effect. Nice to know: Country cases of cultural differences (term paper reports).
<b>Modes of Study</b>	21 hours of lectures with integrated exercises, assignments, written exam, 2nd period
<b>Evaluation</b>	Grade 0-5, evaluation 0-100 points: <ul style="list-style-type: none"> <li>- written exam 60 points</li> <li>- term paper 40 points</li> </ul> Both assignments must be passed to obtain the final grade. Optional bonus points from case report and attending the term paper session (+10 points).
<b>Study materials</b>	1. Broweys & Price: Understanding Cross-Cultural Management, Prentice Hall 2008. 2. Usunier: Marketing Across Cultures, Prentice Hall 2000. 3. Lecture slides. 4. Additional material distributed in class.
<b>Prerequisites</b>	AC40A0000 Kansainvälisen markkinoinnin perusteet
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>AC40A0150</b>	<b>INTEGRATED MARKETING COMMUNICATION 5 ECTS cr</b>
	<b>Integrated Marketing Communication</b>
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1/2, Period 4
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio
<b>Aims</b>	After completing the course the student will understand how integrated marketing communication (IMC) is planned and implemented in an organization. The learning outcomes of the course are the following: <ul style="list-style-type: none"> <li>- to define and explain the concept and process of integrated marketing</li> </ul>



<b>Content</b>	<p>communication</p> <ul style="list-style-type: none"> <li>- to recognize the role of MC in marketing strategy</li> <li>- to apply consumer behavior concepts to MC analysis</li> <li>- to define the characteristics of different MC tools and evaluate their usability in different situations</li> <li>- to be able to design, implement and manage marketing communication strategy as part of the marketing process</li> <li>- to be able to analyze the message and logic of an advertising campaign</li> <li>- to enhance a market-oriented mindset by understanding how customer value is communicated through IMC</li> </ul> <p>Must know: The role of MC in the marketing strategy of a firm. The concept of integrated marketing communication, MC process models. High vs. low involvement in consumer behavior and the impact on marketing communication strategy. The characteristics of basic MC tools with a focus on mass media communication. Marketing communications strategy process, message and media strategy. Should know: Legal and ethical issues in advertising. The creative process and execution of a promotion campaign. Brands in MC. Additional knowledge: Strong vs. weak theory of advertising. The services in campaign planning. The advertiser-agency relationship. The Finnish media scene.</p>
<b>Modes of Study</b>	<p>28 hours of lectures with interactive mini-exercises, 4th period. 14 hours of exercises with groupwork presentations, 4th period. Individual ad analysis of a chosen advertising campaign. Written final exam.</p>
<b>Evaluation</b>	<p>Final grade 0-5. Evaluation 0-100 points: written exam 50 points ad analysis 30 points groupwork 20 points.</p>
<b>Study materials</b>	<p>All assignments must be passed to obtain the final grade Course book: Percy, Rossiter &amp; Elliott: Strategic Advertising Management, Oxford University Press, 2001. Lecture slides. Additional material distributed in class.</p>
<b>Prerequisites</b>	<p>AC40A0000 Kansainvälisen markkinoinnin perusteet (or basic course in marketing)</p>
<b>Further Information</b>	<p>This course has 1-5 places for open university students. More information on the web site for open university instruction.</p>

<b>AC40A0202</b>	<b>INTERNATIONALIZATION OF THE FIRM AND GLOBAL MARKETING</b>	<b>6 ECTS cr</b>
<b>Year and Period</b>	<p><b>Internationalization of the Firm and Global Marketing</b></p> <p><b>Replaces AC40A0201 Internationalization of the Firm.</b></p>	
<b>Teacher(s)</b>	<p>M.Sc. (Econ. &amp; Bus. Adm.) 1/2, Period 2 Professor, D.Sc. (Econ. &amp; Bus. Adm.) Sami Saarenketo</p>	
<b>Aims</b>	<p>After completing the course the student will understand the processes of firm internationalization and global marketing. The learning outcomes of the course are the following:</p> <ul style="list-style-type: none"> <li>- to understand the characteristics of the international market environment and be familiar with essential theories of firm internationalization.</li> <li>- to be able to analyze, select and evaluate the appropriate conceptual frameworks for approaching the key management decisions connected with the internationalization of the firm and global marketing: Whether to internationalize, deciding which markets to enter, deciding how to enter the</li> </ul>	

<b>Content</b>	<p>foreign market, designing the global marketing programme.</p> <ul style="list-style-type: none"> <li>- to be able to work in teams.</li> <li>- to be able to create and deliver a group presentation focusing on the mentioned internationalization decisions in a given Finnish company.</li> <li>- to cultivate a global mindset by understanding globalization as a multidimensional phenomenon.</li> </ul> <p>Must know: Chain of strategic decisions related to internationalization of the firm and global marketing, internationalization motives and barriers, internationalization theories (Uppsala model, Network approach, Born Global), the international market selection process, factors influencing the entry mode choice, characteristics of various entry modes (export modes, intermediate entry modes, hierarchical modes), designing a global marketing programme.</p> <p>Should know: Concept of value chain in internationalization, comparison of SMEs and LSEs in internationalization and global marketing, environmental analysis in deciding which market to enter (political, economic, sociocultural, and technological environment)</p> <p>Additional knowledge: Principles of transaction cost analysis.</p>
<b>Modes of Study</b>	<p>21 hours of lectures with interactive mini-case studies, 2nd period. 14 hours of exercises including case study and group assignment (written report and class presentations), 2nd period. Written final exam.</p>
<b>Evaluation</b>	<p>Final grade 0-5. Evaluation 0-100 points: written exam 70 points group assignment 30 points case work passed/failed.</p>
<b>Study materials</b>	<p>All assignments must be passed to obtain the final grade.</p> <ol style="list-style-type: none"> <li>1. Hollensen, S. (2007) Global Marketing – A decision-oriented approach (older editions apply as well), Prentice Hall.</li> <li>2. Welch, L. Benito, G., and Petersen, B. (2008) Foreign operation methods: Theory, analysis, strategy, Edward Elgar Publishing.</li> <li>3. Additional reading and material assigned in class.</li> </ol>
<b>Prerequisites</b>	<p>Basic knowledge of international marketing.</p>

<b>AC40A0452</b>	<b>INTERNATIONAL MARKETING OF HIGH TECHNOLOGY PRODUCTS AND INNOVATIONS</b>	<b>6 ECTS cr</b>
<b>Year and Period</b>	<p><b>International Marketing of High Technology Products and Innovations</b></p> <p><b>Replaces AC40A0451 High Technology Marketing. The number of students attending the course may have to be limited. In registration, priority is given to LUT School of Business Master's students. All instruction will be in English.</b></p>	
<b>Teacher(s)</b>	<p>M.Sc. (Econ. &amp; Bus. Adm.)1/ 2, Period 1 Professor, D.Sc. (Tech.) Sanna-Katriina Asikainen</p>	
<b>Aims</b>	<p>The course aims to provide a deep understanding of the functions of marketing regarding challenges and opportunities of high technology products and markets, assist the participants to understand the virtues and limitations of traditional marketing thinking and tools in emergent, high technology markets, and provide students with an innovation oriented mindset.</p> <p>After completing the course, students will be able to:</p> <ul style="list-style-type: none"> <li>- understand and interpret the special characteristics of a high technology marketing environment</li> <li>- evaluate innovations and interpret their role in marketing decision making</li> <li>- evaluate different marketing tools and strategies in the context of high technology markets and innovations</li> <li>- analyze product/innovation level entry strategies</li> <li>- analyze and criticize firms' marketing decisions in the context of high</li> </ul>	

<b>Content</b>	<p>technology markets.                  Updated insights regarding challenges and opportunities in high technology markets, the concepts of technology and "high-tech", innovations and new products in high-tech markets, industry structure, industry changes and marketing implications, marketing research in high-tech markets, partnering, entry timing, marketing strategies in high technology markets, organizing marketing activities in high-tech markets.                  Must know: (1) contingency model of high technology marketing, (2) special characteristics of technology intensive markets, (3) how to apply marketing tools in high technology companies.                  Should know: Industry evolution, innovation typologies, first mover advantages, technology maps, technology paradox in pricing, launch strategies, innovation adoption and diffusion, partnering.</p>
<b>Modes of Study</b>	<p>The course will be offered as a blend of lectures, guest lectures, and discussions of selected topics and practical problems.                  21 h of interactive lectures in the 1st period.                  Term paper.                  Exam.</p>
<b>Evaluation</b>	<p>Final grade 0-5. Evaluation 0-100 points:                  Term paper 40 points                  Written exam 40 points                  Business case report (voluntary) – 20 points                  The term paper and exam have to be passed (at least 20 points from each) to obtain the final grade.</p>
<b>Study materials</b>	<p>1. Mohr, Jakki, Sanjit Sengupta, and Stanley Slater (2010) Marketing of High-Technology Products and Innovations. Third Edition. Pearson Prentice Hall.                  2. Assigned reading.</p>
<b>Prerequisites</b>	<p>AC40A0900 Strategic Global Marketing Management, AC40A0202 Internationalization of the Firm and Global Marketing, AC60A0600 Technology and Innovation Management</p>

<b>AC40A0651</b>	<b>INTERNATIONAL BUSINESS STRATEGIES</b>	<b>6 ECTS cr</b>
	<p><b>International Business Strategies</b></p> <p><b>The number of students attending the course may have to be limited based on a pre-exam if the number of students exceeds 80. In registration, priority is given to LUT School of Business Master's students and foreign exchange students with earlier knowledge of international business. During the academic year 2011-2012 this course will be lectured in 1st - 2nd period.</b></p>	
<b>Year and Period</b>	<p>M.Sc. (Econ. &amp; Bus. Adm.) 1, Period 3-4</p>	
<b>Teacher(s)</b>	<p>Professor, D.Sc. (Econ. &amp; Bus. Adm.) Olli Kuivalainen, Post-Doctoral Researcher, D.Sc. (Econ. &amp; Bus. Adm.) Anssi Tarkiainen</p>	
<b>Aims</b>	<p>Aims:</p> <ul style="list-style-type: none"> <li>- The aim of the course is to familiarize students with strategic planning for international business in general and the management and execution of international business strategies within the context of multinational corporations in particular.</li> <li>- To help the students to develop an understanding of various international or global strategies and their advantages and disadvantages. The assignment aims to expose the students to actual management challenges in an international context.</li> </ul> <p>After completing the course the students should:</p> <ul style="list-style-type: none"> <li>- possess an understanding of international business in practice: e.g. how to analyse an international marketing environment and plan and develop, implement, coordinate and control different international/global business strategies;</li> </ul>	

	<ul style="list-style-type: none"> <li>- have an in-depth knowledge and understanding of various international business strategies, and international business planning and implementation of international business strategy through the preparation of a group research project applied to a firm in a simulation;</li> <li>- be able to identify the main theories which explain the existence of multinational corporations;</li> <li>- have an understanding of how to compete with integrity in global business;</li> <li>- have the required skills for participating in discussions on topics of international business interest, and to stimulate and answer questions from a knowledgeable audience;</li> <li>- be able to deal with new information critically and systematically and be able to use it to develop and evaluate ideas and projects related to international business;</li> <li>- be able to apply knowledge gained from the course in addition to that provided by additional reading, analysis and discussion, to the events, activities and/or strategies of an actual firm or organization; and</li> <li>- be able to apply intercultural competence and be able work in cross-cultural teams.</li> </ul>
<b>Content</b>	<p>The skills and application of critical inquiry into your reading, discussions, and situations and experiences that you encounter with regard to international business, both inside and outside the classroom setting.</p> <p>Must know: The international business planning process and its content especially related to international marketing. International and global business strategies. Strategic tools for analyzing the internal and external environment, for example resource and product positions. Organization of resources, capabilities and knowledge within a multinational corporation. Implementation methods of an international business strategy.</p> <p>Should know: International finance, international HRM, international production and sourcing strategies, corporate social responsibility.</p> <p>Additional knowledge: OLI paradigm, institutional theory, international technology strategy, real-life firm strategy examples (provided by a guest lecturer).</p>
<b>Modes of Study</b>	<p>18 h of interactive lectures, 1st period. 10 h of interactive lectures, 2nd period.</p> <p>Group assignment/project work based on simulation exercises in international groups (incorporating online simulation and written group assignments: a strategic plan and a reflective report)</p> <p>Mid-term tutorial (each group independently with tutors)</p> <p>Written exam.</p>
<b>Evaluation</b>	<p>Final grade 0-5. Evaluation 0-100 points: Active class participation Assignment(s): oral and written project work in groups, 70 points Exam, 30 points</p>
<b>Study materials</b>	<p>All assignments (including the exam) must be passed.</p> <p>Lasserre, P: (2007). Global Strategic Management. Peng, M.W. (2006). Global Strategy (or a newer 2nd edition). Assigned reading (collection of articles). Guide manual for the simulation.</p>
<b>Prerequisites</b>	<p>Slides from the lectures.</p> <p>AC40A0900 Strategic Global Marketing Management, AC60A0600 Technology and Innovation Management, AC40A0202 Internationalization of the Firm and Global Marketing</p>

<b>AC40A0850</b>	<b>CONTEMPORARY ISSUES IN INTERNATIONAL 6 ECTS cr MARKETING</b>
	<b>Contemporary Issues in International Marketing</b>
	<b>The course can be offered in various ways. Thus, two different evaluation schemes apply (see above).</b>
<b>Year and Period Teacher(s)</b>	M.Sc. (Econ. & Bus. Adm.) 1/2 N. N.
<b>Aims</b>	Person in Charge: Professor, D.Sc. (Econ. & Bus. Adm.) Sami Saarenketo On completion of the course students should: <ul style="list-style-type: none"> <li>- be familiar with the contemporary concepts and issues ("hot topics") in international marketing.</li> <li>- be able to outline the current challenges in international marketing and develop skills for proposing solutions to these.</li> <li>- be able to discuss and debate on contemporary issues in international marketing.</li> <li>- be able to apply chosen contemporary marketing tools.</li> <li>- be able to work co-operatively in a cross-cultural team setting.</li> </ul>
<b>Content</b>	The specific content of this course will vary depending on the visiting international professor. However, the course covers chosen current theories, concepts and issues affecting international marketing today.
<b>Modes of Study</b>	The format of the course is either a combination of lectures and student assignments (Mode A) or consulting projects (Mode B). We will be using the following teaching methods depending on the course mode: <ul style="list-style-type: none"> <li>- International visiting professors as lecturers</li> <li>- Student assignments</li> <li>- Cases</li> <li>- Exam (not in Mode B)</li> </ul>
<b>Evaluation</b>	Grade 0-5. Mode A Total 100 points: <ul style="list-style-type: none"> <li>- Student assignments 20 points</li> <li>- Exam 80 points</li> </ul> Mode B Total 100 points: <ul style="list-style-type: none"> <li>- Completed consulting project consisting of both written and verbal assignments 100 points</li> </ul>
<b>Study materials</b>	Material to be assigned in class.
<b>Prerequisites</b>	Basic knowledge of international marketing
<b>AC60A0050</b>	<b>KNOWLEDGE MANAGEMENT AS A THEORY 6 ECTS cr AND PRACTICE</b>
	<b>Knowledge Management as a Theory and Practice</b>
	<b>The course will be lectured next time during the academic year 2011-2012. Please note that the course content may be changed later.</b>
<b>Year and Period Teacher(s)</b>	M.Sc. (Econ. & Bus. Adm.) 2 Professor, D.Sc. (Econ. & Bus. Adm.) Kirsimarja Blomqvist Professor, D.Sc. (Econ. & Bus. Adm.) Aino Pöyhönen Assistant Professor, Dr. Tatiana Andreeva Person in Charge: Tatiana Andreeva
<b>Aims</b>	In modern times, both managers and management theorists are increasingly challenged by the changing circumstances and contexts where the competitive advantage of firms greatly depends on their ability to create and use knowledge.

	<p>The aim of the course is to provide students with the understanding of knowledge as an organizational phenomenon and source of competitive advantages for contemporary organizations and to introduce them to key issues of managing knowledge in an organization. The course covers current conceptual frameworks in the field of knowledge management, including notions of knowledge, knowledge economy, the knowledge organization and the knowledge worker, and problems of knowledge creation, sharing and measurement (intellectual capital). Discussing these issues, the course aims to answer the key question: how the company should be organized and managed to be competitive in this knowledge-intensive era.</p> <p>Part I. Introduction to knowledge management (10 h).</p> <p>Topic 1. Introduction. Basic definitions and concepts (4 h). The role of knowledge in organizations and society. Knowledge economy, knowledge society, knowledge organizations. Data, information, knowledge and wisdom. Tacit and explicit knowledge. Personal and organizational, internal and external knowledge. Various attributes of knowledge. Controversies and myths about knowledge management.</p> <p>Topic 2. Knowledge management as a scientific discipline (6 h) (visiting lecturers). Evolution of KM as a scientific discipline. Theoretical roots and generations of KM. Paradigms and perspectives of KM. Emerging future topics in KM. Knowledge-based view of the firm, its underlying assumptions and implications for management. The role of knowledge and knowledge-based interaction in a firm's competitiveness.</p> <p>Part II. Managing knowledge in organizations: key challenges (24 h).</p> <p>Topic 3. Key knowledge-related processes: key concepts and key problems (8 h). Knowledge creation: stages and tools. SECI model. Improvization as a process of knowledge creation. Knowledge sharing: key barriers and solutions. Knowledge hoarding and motivation for knowledge sharing. Organizational learning and a learning organization. External knowledge acquisition and absorptive capacity.</p> <p>Topic 4. The human factor in KM (6 h). Knowledge workers: a new type of employee or just a prestigious title? Specific issues of managing knowledge workers: attraction, motivation, development, retention. Managing knowledge teams. Communities of practice.</p> <p>Topic 5. Organizational infrastructure for KM (6 h). Creating a knowledge organization: key tasks. New requirements for organizational leaders. Influence of the organizational structure, communications and culture on knowledge processes. Best practices and failures around the world. Knowledge management and strategy.</p> <p>Topic 6. Cross-cultural issues in KM (4 h). Cultural influences on key knowledge-related processes. Revising the SECI model from a cross-cultural point of view. KM in MNCs.</p> <p>Part III. Finale. Current KM problems in organizations and future research questions (10 h) (visiting lecturers). Student group project presentations of knowledge management practices in different companies: problem analysis and development of recommendations. Future research questions and course review.</p>
<b>Content</b>	
<b>Modes of Study</b>	<p>Lectures 36 h. Student project 50 h. Student project presentations 8 h. Independent work (reading course material) 60 h. Exam 3 h.</p>
<b>Evaluation</b>	<p>Students' work for the course will be assessed on 2 key aspects: group research paper and knowledge of the course topics (exam). The group project will be dedicated to the analysis of knowledge management practices in a particular company. Details of the group project assignment will be provided at the beginning of the course. The exam is a written test. It is based on all course issues and material. The final assessment is composed as follows:</p>

<b>Study materials</b>	<ul style="list-style-type: none"> <li>• Final exam – 60%</li> <li>• Student group project – 40%</li> </ul> <p>Compulsory reading:</p> <ul style="list-style-type: none"> <li>• A selection of up-to-date articles will be provided at the beginning of the course.</li> </ul> <p>Basic textbooks (these books are recommended solely as additional basic reading).</p> <ul style="list-style-type: none"> <li>• Davenport, T. and Prusak, L. Working Knowledge: How Corporations Manage What They Know. Boston: Harvard Business School Press. 1998.</li> <li>• Nonaka, I. and Takeuchi, H. The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation. Oxford: Oxford University Press. 1995.</li> </ul>
<b>Prerequisites</b>	None.

<b>AC60A0150</b>	<b>STRATEGIC MANAGEMENT OF GROWTH</b>	<b>6 ECTS cr</b>
	<b>Strategic Management of Growth</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 3	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Timo Pihkala Person in Charge: Professor, D.Sc. (Econ. & Bus. Adm.) Timo Pihkala	
<b>Aims</b>	The objective of the course is to provide students with up-to-date insights into business growth strategies and their implications on management and on research. The course deals with the concept of strategy, the models of business growth, the relationship between growth and strategy, the barriers to growth, traditional routes of growth, external growth models and business growth analysis.	
<b>Content</b>	Objectives of firms. The connection between business growth and strategy. Dimension and directions of growth and development. External growth.	
<b>Modes of Study</b>	Lectures and assignments 20 h. Exam.	
<b>Evaluation</b>	Final grade 0-5. Evaluation 0-100 points. Assignment 50%, exam 50%.	
<b>Study materials</b>	Articles, lecture notes and material announced during lectures.	
<b>Prerequisites</b>	Introduction to Management	

<b>AC60A0200</b>	<b>SUPPLY AND INNOVATION MANAGEMENT</b>	<b>6 ECTS cr</b>
	<b>Supply and Innovation Management</b>	
	<b>The course will be lectured next time during the academic year 2011-2012. Please note that the course content may be changed later.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Veli-Matti Virolainen Professor, D.Sc. (Tech.) Jukka Hallikas Dr. Konstantin V. Krotov (GSOM)	
<b>Aims</b>	The objective of the course is to address the methods and frameworks for analyzing changing business models as a part of enterprise-wide supply and value networks. The aim is to deepen the understanding about the strategic role of supply management. It is designed to meet the requirements for using purchasing and supply management as a source of competitive advantage in organizations.	
<b>Content</b>	The course examines the structure and role of innovation management in complex supply/demand business systems. The course covers the following topics: inter-firm learning and change management, the principles of systems thinking, methods for assessing customer value, mapping of business processes and value streams, systematic innovation of business models, the role of technology in supply networks, and risk management of supply/demand processes. Purchasing and supply strategy as a part of a business strategy and issues of external resource management are covered during the course.	
<b>Modes of Study</b>	28 h of lectures and exercises in the 3-4 periods.	

<b>Evaluation</b>	Exam 0-5. Approved exercise reports.	
<b>Study materials</b>	1. Hughes, J., Ralf, M., and Michels, B.: Transform Your Supply Chain. International Thomson Business Press, 240 p., 1998. 2. Cox, A.: Business Success. Earlsgate Press, 325 p., 1997. 3. Journal articles. Assigned reading (will be announced later).	
<b>AC60A0350</b>	<b>MULTIVARIATE AND ECONOMETRIC ANALYSIS METHODS</b>	<b>6 ECTS cr</b>
	<b>Multivariate and Econometric Analysis Methods</b>	
	<b>Course is suitable for postgraduate studies. The number of attending students may have to be limited if the number of students exceeds 30. In registration priority is given to MITIM-students and postgraduate students.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1/2, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Kaisu Puumalainen, Post-Doctoral Researcher, D.Sc. (Econ. & Bus. Adm.) Heli Virta	
<b>Aims</b>	The course will familiarize students with basic multivariate and econometric methods of analysis. Empirical cross-sectional, time series and panel data from various fields of economics and business is used, and the students should be able to conduct both descriptive, predictive and explanatory research, and present the results of the analyses.	
<b>Content</b>	Multiple linear regression analysis, factor analysis, cluster analysis, general linear models. Special issues in regression modeling: dummy variables, non-linear models, simultaneous equations, probit/logit-models, limited dependent variables, instrumental variables. SAS software will be used.	
<b>Modes of Study</b>	Lectures 21 h, exercises 21 h, 3rd-4th period. Seminars 8 h, 4th period.	
<b>Evaluation</b>	Written seminar report and presentation. Final grade 0-5. Evaluation 0-100 points. Written seminar report max 75 points, presentation max 25 points. 50% of the maximum points are required for passing.	
<b>Study materials</b>	Hair, Joseph Jr. et al.: Multivariate data analysis. Prentice Hall, 1998. Hill, R. Carter – Griffiths, William E. – Judge, George G.: Undergraduate Econometrics, 2nd edition. 2001.	
<b>Prerequisites</b>	Basic courses in statistics and economics.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	
<b>AC60A0400</b>	<b>INTERNATIONAL ACCOUNTING AND ANALYSIS</b>	<b>6 ECTS cr</b>
	<b>International Accounting and Analysis</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1/2, Period 1-2	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Econ. & Bus. Adm.) Sheraz Ahmed Doctoral Student, M.Sc. (Econ. & Bus. Adm.) Sanna Hämäläinen	
<b>Aims</b>	At the end of the course a student is expected to be able to: <ul style="list-style-type: none"> <li>- compare and analyze the accounting and reporting practices around the world</li> <li>- understand the international aspects of accounting standards</li> <li>- assess the quality of accounting information</li> <li>- interpret the financial information</li> <li>- use the financial statements to assess the current and future performance of a firm</li> <li>- determine the valuation using the information reported in the financial statements</li> </ul>	
<b>Content</b>	The course is focused on international differences in accounting practices,	



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	harmonization of accounting standards, financial statement analysis, assessment of accounting quality, valuation and link between accounting and finance.
<b>Modes of Study</b>	Lectures 28 h. Term paper, exam. Blackboard in use.
<b>Evaluation</b>	Grade 0-5, evaluation 0-100 points on the basis of exam (80%) and term paper (20%).
<b>Study materials</b>	1. Nobes and Parker: Comparative International Accounting, 2006 2. Penman: Financial Statement Analysis and Security Valuation, 2007
<b>Prerequisites</b>	Some basic courses in accounting and finance are recommended.

<b>AC60A0450</b>	<b>QUANTITATIVE METHODS FOR BUSINESS RESEARCH</b>	<b>3 ECTS cr</b>
	<b>Quantitative Methods for Business Research</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Kaisu Puumalainen	
<b>Aims</b>	The objective of the course is to give the students an understanding of the quantitative research process and methodology. The course provides the students with skills in practical research design, analysis and reporting issues. After the course the students should be able to:	
<b>Content</b>	<ul style="list-style-type: none"> <li>- understand the role of quantitative empirical research</li> <li>- write a research proposal</li> <li>- use databases to search for existing publications and empirical data</li> <li>- critically evaluate the research design and results of quantitative studies</li> <li>- design an empirical study</li> <li>- evaluate validity and reliability</li> <li>- understand the applicability of the most typical quantitative analysis methods</li> <li>- use SAS software for simple statistical analyses.</li> </ul> <p>1) What is scientific research? Basic issues of the philosophy of science, research process, requirements for a Master's thesis.</p> <p>2) Using databases: finding research publications, introduction of secondary data sources.</p> <p>3) Research design: sampling, collecting secondary data, designing surveys (soliciting responses, analyzing non-response bias, survey data collection methods, questionnaire design, pre-testing, typical problems with survey data), reliability and validity, observational and experimental research designs.</p> <p>4) Analysis methods (descriptive, crosstabs, correlation, t-test, ANOVA, linear regression) and SAS software.</p> <p>5) Reporting: Research proposal, literature review, reporting the methodology, presenting the results.</p>	
<b>Modes of Study</b>	Participation in lectures, 18 hours. Evaluation of a research proposal and a Master's thesis. Data collection and analysis exercises, 6 hours.	
<b>Evaluation</b>	Written exam based on the lectures and course material. Final grade 0-5. Evaluation 0-100 points. Evaluation of research proposal and Master's thesis passed vs. failed. Report on data collection and analysis exercise max. 25 points. Written exam max. 75 points.	
<b>Study materials</b>	50% of the maximum score is required for passing. Cooper, D.R. & Schindler, P.S. (2001) Business Research Methods. New York: McGraw-Hill. Chapters 1-18, 20	
<b>Prerequisites</b>	None	
<b>AC60A0550</b>	<b>CONSULTING PROJECT AT LUT</b>	<b>6 ECTS cr</b>
	<b>Consulting Project at LUT</b>	
	<b>The maximum amount of participants is 25. Preference is given to MITIM students and after that to Master's Students of LUT School of Business. In the possible selection of students, attention will be given to getting a versatile group from different areas of specializations.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1-2, Period 3-4	
<b>Teacher(s)</b>	Adjunct Professor Timo Santalainen Professor, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio	
<b>Aims</b>	Consulting Project at LUT is focused on strategy consulting with a very hands-	

	<p>on approach to learning: students take the role of strategy consultants to solve a case organization's concrete problem. The course and its ways of working are designed to help participants to explore strategic issues of selected companies/organizations from three perspectives: academic research and concepts (A), business practice (B), and consulting (C). Taking the role of strategy consultants participants are expected to develop value-generating ideas for their respective case organizations.</p> <p>Expected learning outcomes of the course are threefold:</p> <ul style="list-style-type: none"> <li>-to deepen participants' knowledge and insights in strategy and business management</li> <li>-to learn the roles and working modes of strategy consultants</li> <li>-to utilize all previous knowledge to develop viable recommendations for strategic action for the case-organizations</li> <li>-to increase innovative mindset by seeking creative solutions to concrete managerial problems</li> </ul> <p>The course is also aimed at development business "softskills" such as teamwork, leadership, project management, presentation and other communication skills.</p> <p>Must know:</p> <p>Evolving motivations and approaches in strategic management and thinking within the context of (hyper)competitive multinational business arenas.</p> <p>Conceptual tools for strategic situational analysis.</p> <p>The logic of developing customer-centric and resource-based strategies as well as value-capturing business models.</p> <p>Alternative roles, styles and practices of strategy consulting.</p> <p>Should know:</p> <p>Alternative modes and tools of "strategizing" in case- as well as in real business situations.</p> <p>Project management skills.</p> <p>Information collection and problem solving skills.</p> <p>Effective presentation skills.</p> <p>Modes of Study</p> <p>Prework: Reflective essay</p> <p>16 hours of lectures (Kick-off workshop, attendance compulsory)</p> <p>16 hours of seminars, including final presentations of the projects to the evaluation committee</p> <p>Independent project work in teams</p> <p>Written final report, presentation of the project work</p> <p>Evaluation</p> <p>Grade 0-5, evaluation 0-100 points. Max 100 points from project work.</p> <p>Grading of projects:</p> <ul style="list-style-type: none"> <li>30 % case company</li> <li>20 % academic advisors</li> <li>50 % evaluation committee</li> </ul> <p>Study materials</p> <p>Santalainen, Timo (2006) Strategic Thinking, Talentum</p> <p>Other material depending on the project work.</p>
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<b>AC60A0600</b>	<b>TECHNOLOGY AND INNOVATION MANAGEMENT</b>	<b>6 ECTS cr</b>
<p><b>Year and Period</b></p> <p><b>Teacher(s)</b></p> <p><b>Aims</b></p>	<p><b>Technology and Innovation Management</b></p> <p>M.Sc. (Econ. &amp; Bus. Adm.) 1/2, Period 2</p> <p>Professor, D.Sc. (Econ. &amp; Bus. Adm.) Liisa-Maija Sainio, Professor, Ph.D. Karl-Erik Michelsen</p> <p>After completing the course, the students know how a firm manages its R&amp;D and creates core technologies which are bases for innovation strategy. How the R&amp;D is organized in-house and how it is connected to the regional, national and trans-national innovation systems. The learning outcomes are the following:</p> <ul style="list-style-type: none"> <li>• To recognize different types of innovations</li> <li>• To understand how technology changes and what are the instruments of</li> </ul>	

<p><b>Content</b></p>	<p>change.</p> <ul style="list-style-type: none"> <li>• To understand how global firms manage both technological and business innovations.</li> <li>• To understand the culture of an innovative company.</li> </ul> <p>The course explores the concept of innovation from various points of view: What are innovations, how they are made and how they affect company's strategy and performance. In modern large scale corporations innovations are necessary instruments for growth and competitive edge. Yet, innovation process must be managed and maintained and this requires strategic thinking, vision and courage. This course explores how core technologies are created and how they are developed further to serve the needs of company business strategy. Global companies use transparent innovation process in order to facilitate to serve the customers. This course also explores how users affect innovations and what is the role of customer in innovation process. Finally, innovations are not made in isolation, but rather in a context that is affected by regional, national and trans-national innovation systems.</p> <p>Must know:</p> <p>What is an innovation and how innovations are made          Innovation typologies: e.g. incremental vs. radical/discontinuous/disruptive innovations.          Technological and business innovations.          How technology change and what are the causes of change.          The role of R&amp;D and innovations in established firms          The role of R&amp;D in new start-up firms          Role of innovations in business strategy          Process of new product development          Commercialization of new innovations          Technology adoption life cycle</p> <p>Should know:</p> <p>Value creation through technology partnerships and networks          Innovations and business models          The role of customers and users in R&amp;D process.          Innovation, technology and growth.</p>
<p><b>Modes of Study Evaluation</b></p>	<p>21 hours of lectures + 8 hours of seminar work          Final grade 0-5. Evaluation 0-100 points, written exam 60 points, term paper 40 points. All assignments must be passed to get the final grade.</p>
<p><b>Study materials</b></p>	<p>Tidd, J. &amp; Bessant, J. (2009), <i>Managing innovation: Integrating technological, market and organizational change</i>, 4<sup>th</sup> edition, John Wiley &amp; Sons, Ltd.</p>

<p><b>AC60A0650</b></p>	<p><b>ORGANIZATION AND STRATEGY WORK IN GLOBAL CONTEXT</b> <span style="float: right;"><b>6 ECTS cr</b></span></p>
<p><b>Year and Period</b>  <b>Teacher(s)</b>  <b>Aims</b>  <b>Content</b></p>	<p><b>Organization and Strategy Work in Global Context</b></p> <p>M.Sc. (Econ. &amp; Bus. Adm.) 1, Period 3          Professor, D.Sc. (Econ. &amp; Bus. Adm.) Iiro Jussila          Docent, D.Sc. (Econ. &amp; Bus. Adm.) Janne Tienari</p> <p>After taking the course, students will have acquired a research-based and practically grounded understanding of a global organization and of how strategy work is carried out in firms that operate across national borders. Students will also be able to form a substantiated view of strategy work in a global context, and to critically scrutinize notions of strategy and strategic management.</p> <p>The course introduces what some call the modern perspective to organization and strategy, which is followed by a critical perspective that some label postmodernism. The course pays particular attention to questions related to balancing global strategizing and local adaptation and translation. Case examples on strategy work in multinational firms are presented. Thematic sessions include (1) different perspectives into organizations and strategy work, (2) a modern perspective into global organizations, (3) a modern</p>

	perspective into strategy work in global organizations, (4) the field of strategic management today, (5) strategy as practice and work, (6) strategy tools and management consultants, (7) strategy work in growth: mergers and acquisitions, (8) strategy work in decline: rationalization and shutdowns, (9) strategic foresight and scenarios, (10) students' presentations and preparation for the exam, (11) course exam.
<b>Modes of Study</b>	Intensive three day course, including thematic sessions 10 x 3h (+ exam). Requires active participation in all sessions. Group work (oral presentation and written report). Reaction papers on different themes (written reports).
<b>Evaluation</b>	Exam (completed in the last course session). Final grade 0–5. Evaluation 0–100 points. Group work (40% of course grade). Reaction papers on different themes (20% of course grade). Exam (40% of course grade), completed in the last course session.
<b>Study materials</b>	Handouts and literature assigned during the course.

<b>AC60A0700</b>	<b>INTRODUCTION TO MODERN ECONOMICS</b>	<b>6 ECTS cr</b>
	<b>Introduction to Modern Economics</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 4	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Kalevi Kyläheiko Associate Professor, Ph.D. Jorma Sappinen Adjunct Professor Lauri Frank	
<b>Aims</b>	Person in Charge: Associate Professor, Ph.D. Jorma Sappinen By the end of the course, the student will be able to describe the principles of a modern market economy. The student will be able to explain the basic concepts of microeconomics and macroeconomics and can apply models of the consumer, firm, markets and economy in simple situations. Furthermore, the student will be able to draw conclusions about the efficiency of the function of the market, and will understand when and how a public sector intervention may improve efficiency. The student will also be able to analyze the role and consequences of monetary and fiscal policy. In addition, the student will understand the special role of knowledge in modern economy, and will be able to explain how bits of knowledge affect productivity both at the micro and macro levels. Moreover, the student will be able to apply basic models of modern strategy research (transaction cost economics, the resource-based and dynamic capability views) when explaining how to achieve and sustain a competitive advantage.	
<b>Content</b>	Principles of microeconomics and macroeconomics. Demand, supply and market equilibrium, production and markets for the factors of production, economics of the public sector. Economic growth, unemployment, inflation, economic fluctuations, monetary and fiscal policy. The formulation of technology, pricing and networking strategies as tools to profit from innovation. Knowledge related positive externalities from the point of view of firms and macro economy. Economics-based theories of strategy research.	
<b>Modes of Study</b>	Lectures 18 h, May 2011.	
<b>Evaluation</b>	Final grade 0-5, evaluation 0-100 points. Written exam (60%) and home assignments (40%)	
<b>Study materials</b>	Mankiw, N. Gregory: Principles of Economics, chapters will be announced later. Articles required by the teachers.	

<b>AC60A0750</b>	<b>INTERNATIONAL MARKETING MANAGEMENT</b>	<b>6 ECTS cr</b>
	<b>International Marketing Management</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 1	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio	
<b>Aims</b>	After completing the course, the students know what the goals and elements	

<b>Content</b>	<p>are of international marketing strategy and how international marketing is planned and managed in an organization. The learning outcomes are the following:</p> <ul style="list-style-type: none"> <li>- To analyze the logic of customer value creation in an international context</li> <li>- To define marketing as a discipline</li> <li>- To analyze the decision-making process related to internationalization</li> <li>- To compare different options of international marketing strategies</li> <li>- To promote a market-oriented mindset by viewing marketing as a strategic orientation of a firm</li> </ul> <p>Must know: Theoretical foundations of marketing: market orientation and relationship marketing. Defining competitive advantage in an international context. An international marketing environment. Standardization vs. adaptation in international marketing. The process of internationalization. Managing the value chain in an international context: market entry choices, downstream vs. upstream internationalization. Elements of an international marketing strategy.</p> <p>Should know: Customer relationship management and marketing information systems. International branding decisions.</p> <p>Additional knowledge: International market research. Corporate social responsibility in an international context.</p>
<b>Modes of Study</b>	21 hours of lectures and 14 hours of exercises, 1st period.
<b>Evaluation</b>	Article summaries, groupwork presentations. Final grade 0-5. Evaluation 0-100 points, written exam 40 points, groupwork 40 points, article summaries 20 points. All assignments must be passed to get the final grade.
<b>Study materials</b>	Albaum & Duerr (2008): International marketing and export management, Prentice Hall. Selected articles.

<b>AC60A9000</b>	<b>RESEARCH SEMINAR FOR MASTER'S THESIS 30 ECTS cr</b>
	<b>Research Seminar for Master's Thesis</b>
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1-2, Period 1-4
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio Professor, D.Sc. (Tech.) Sanna-Katriina Asikainen
<b>Aims</b>	<p>Upon completion of the course, students should be able to carry out a research project independently and to report on the research in written format according to scientific practices. Students will be able to delimit and to define the purpose and the topic of the research. They know the theory and research methods relevant to their main subject. Students are able to justify and explain the conclusions of the research both in an oral presentation and in written format. Students can assess, evaluate and analyze theses written by other students and defend their own research plan in the seminar. Students will be able to collect, analyze and choose relevant literature based on critical evaluation. They will demonstrate the ability to compare, analyze and to combine information based on literature and empirical material.</p> <p>LUT MITIM students participate in this seminar's first year sessions at LUT, and second year sessions in GSOM, whereas GSOM MITIM students act vice versa.</p>
<b>Content</b>	<p>Must know: Defining a research topic with a research gap. Writing a research proposal. Acquiring the basic skills for conducting qualitative research. Writing a literature review. Creating a theoretical framework.</p>

<b>Modes of Study</b>	Synthesizing theories for the research topic. Academic writing. Applying adequate methodological tools for the topic. Should know: Evaluation criteria. The correct referencing technique. Formatting and structure of the thesis.
<b>Evaluation</b>	The research seminar consists of 8 hours of introductory lectures and several seminar sessions, where the students present their research proposal and different phases of their research. The last research seminar is a so-called pre-defense seminar and maturity test. The analysis of the research topic needs to be accepted by the supervising professor. Presence in all research seminar sessions is compulsory, and all phases of the research process (research proposal, literature review, research plan, final thesis manuscript) have to be documented at an approved level. The Master's thesis and final examination have to be accepted. The Master's thesis is graded 0 – 5 (improbatur – laudatur) Maturity test: pass - fail.

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<b><i>MITIM-HAR1</i></b>	<b><i>INTERNSHIP</i></b>	<b><i>3 ECTS cr</i></b>
<b>Year and Period</b>	<b>Internship</b>	
	M.Sc. (Econ. & Bus. Adm.) 2	

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## 6.2. Master's Degree in International Marketing Management

The International Master's Degree in International Marketing Management integrates marketing, international business and technology management disciplines in order to call for the needs of global firms operating in turbulent environments facing growing challenges in their marketing management. Our degree focuses especially on the management of global knowledge-intensive innovation activities from marketing perspective, and is thus tailored for future marketing managers operating in highly turbulent international environments. In the programme we see international marketing management as a centrepiece and a combinatory element of the many operations a firm must conduct and coordinate in the globalized world. The program aims to combine the most important areas of strategic marketing, international business and technology management. This particular integration of knowledge bases is in high demand in companies and organizations. Thus, such specialized expertise of our graduates opens doors to ample opportunities of employment in organizations based on the combination of their international marketing management, or scientific knowledge as well as their knowledge in technology management, including job titles like Export Manager, Area Manager, Subsidiary Manager, Project Manager in International Marketing, Strategy and Business Development Consultant.

International exchange studies (min. 12 ECTS cr if not included in Bachelor degree) should be included in electives of General Major Studies. International exchange semester is recommended during M. Sc. (Econ. & Bus) 1 Spring semester.

### The Degree Structure

General Major Studies	36	ECTS cr
Specialization Major Studies	53-54	ECTS cr
Minor Subject	24-25	ECTS cr
Language	6	ECTS cr
Credits	120 (min.)	ECTS cr

### General Studies in Marketing, International Business and Technology Management

#### Marketing 12 ECTS cr

<i>Obligatory</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
AC40A0900 Strategic Global Marketing Management	M.Sc. (Econ. & Bus. Adm.)	1 1	6

And one of the following:

<i>Electives</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
AC40A0502 Customer Relationship Management	M.Sc. (Econ. & Bus. Adm.)	1 4	6
AC40A0850 Contemporary Issues in International Marketing	M.Sc. (Econ. & Bus. Adm.)	1	6

#### International Business 12 ECTS cr

<i>Obligatory</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
AC40A0202 Internationalization of the Firm and Global Marketing	M.Sc. (Econ. & Bus. Adm.)	1 2	6

And one of the following:

<i>Electives</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
AB30A0800 Managerial Finance	M.Sc. (Econ. & Bus. Adm.)	1 3	6
AC60A0400 International Accounting and Analysis	M.Sc. (Econ. & Bus. Adm.)	1 1-2	6
AC60A0650 Organization and Strategy Work in Global Context	M.Sc. (Econ. & Bus. Adm.)	1 3	6



**Technology Management 12 ECTS cr**

<i>Obligatory</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
AC60A0550 Consulting Project at LUT	M.Sc. (Econ. & Bus. Adm.) 1- 3-4	2	6
AC60A0600 Technology and Innovation Management	M.Sc. (Econ. & Bus. Adm.) 1 2		6

**Specialization Studies in Marketing, International Business and Technology Management 53-54 ECTS cr**

<i>Obligatory</i>	<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
AB40A0100 <sup>1)</sup> Monimuuttujamenetelmät		1-2	5
AC40A0651 International Business Strategies	M.Sc. (Econ. & Bus. Adm.) 2	3-4	6
AC40A0452 International Marketing of High Technology Products and Innovations	M.Sc. (Econ. & Bus. Adm.) 2	1	6
AC40A0551 International Entrepreneurship	M.Sc. (Econ. & Bus. Adm.) 2	1-2	6
AC60A0350 <sup>1)</sup> Multivariate and Econometric Analysis Methods	M.Sc. (Econ. & Bus. Adm.) 1- 3-4	2	6
AC30A0000 <sup>1)</sup> Kvalitatiiviset tutkimusmenetelmät	M.Sc. (Econ. & Bus. Adm.) 1	2	5
AC40A9500 Master's Thesis (International Marketing Management)	M.Sc. (Econ. & Bus. Adm.) 2	3-4	30

<sup>1)</sup> Exchangeable

**Recommended minor studies in Business and Technology in Russia  
Business and Technology in Russia 20/25 op**

<i>Alternative Studies, select at least 20/25 ECTS cr</i>	<i>per.</i>	<i>ECTS cr</i>
AB30A0301 International Finance and Emerging Markets	2	6
AC40A0800 Corporate Strategy for Emerging Markets	3	6
BJ40A0300 Management of Technical Information in Export of Processing Equipment to Russian Federation	4	5
BH60A2800 Energy and Environmental Challenges in Russia	3	5
CS10A0751 Enterprises and Competition in Russia	3	6
CS10A0800 The Basics of Doing Business in Russia	2	5
FV14A1200 <sup>1)</sup> Venäjä 1	1-2, 3-4	3
FV14A1400 <sup>1)</sup> Venäjä 2	1-2, 3-4	3
FV14A1801 <sup>1)</sup> Venäjän sijamuodot	3-4	3
FV14A4200 <sup>1)</sup> Nykyvenäjän kieltä ja maantuntemusta	1-2	3

<sup>1)</sup> Exchangeable

<sup>2)</sup> Only one Russian language course can be included to the minor. Language courses are alternative to each other and should be selected according to the student's language skills.

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**The Courses Offered in English**

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		<i>ECTS cr</i>
AB30A0800	Managerial Finance	6
AC40A0202	Internationalization of the Firm and Global Marketing	6
AC40A0452	International Marketing of High Technology Products and Innovations	6
AC40A0502	Customer Relationship Management	6
AC40A0551	International Entrepreneurship	6
AC40A0651	International Business Strategies	6
AC40A0850	Contemporary Issues in International Marketing	6
AC40A0900	Strategic Global Marketing Management	6
AC40A9500	Master's Thesis (International Marketing Management)	30
AC60A0350	Multivariate and Econometric Analysis Methods	6
AC60A0400	International Accounting and Analysis	6
AC60A0550	Consulting Project at LUT	6
AC60A0600	Technology and Innovation Management	6
AC60A0650	Organization and Strategy Work in Global Context	6

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<b>AB30A0800</b>	<b>MANAGERIAL FINANCE</b>	<b>6 ECTS cr</b>
	<b>Managerial Finance</b>	
	<b>The language of teaching is English.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 3	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Econ. & Bus. Adm.) Kashif Saleem	
<b>Aims</b>	At the end of the course, the student is expected to know:	
	<ul style="list-style-type: none"> <li>- how corporate finance and business strategies are linked to each other</li> <li>- the process and players involved in raising a firm's capital</li> <li>- the methods of valuing real assets</li> <li>- how to make investment decisions based on the riskiness of projects</li> <li>- how corporate taxes impact on asset valuation and financial decisions</li> <li>- how optimal capital structure is linked to corporate strategies of firms</li> <li>- how managerial incentives affect financial decisions</li> <li>- the importance of risk management in corporate financial decisions</li> </ul>	
<b>Content</b>	Introduction to financial instruments, debt financing, equity financing, discounting and valuation, asset allocation, corporate taxes and capital structure, bankruptcy, managerial incentives, asymmetric information, mergers and acquisitions and risk management.	
<b>Modes of Study</b>	Lectures 30 h. Written term paper. Exam.	
<b>Evaluation</b>	Grade: 0–5 on the basis of the exam (80%) and term paper (20%), evaluation 0-100 points.	
<b>Study materials</b>	<ol style="list-style-type: none"> <li>1. David Hiller, Mark Grinblatt and Sheridan Titman: Financial markets and corporate strategy – European edition 2007 (Text book)</li> <li>2. Brealey Myers: Principles of corporate finance, seventh edition ( additional readings)</li> <li>3. Handouts in class and all additional material required by the lecturer</li> </ol>	
<b>Prerequisites</b>	Compulsory B.Sc. courses in Finance (except Bachelor's thesis)	
<b>AC40A0202</b>	<b>INTERNATIONALIZATION OF THE FIRM AND GLOBAL MARKETING</b>	<b>6 ECTS cr</b>
	<b>Internationalization of the Firm and Global Marketing</b>	
	<b>Replaces AC40A0201 Internationalization of the Firm.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 2	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Sami Saarenketo	
<b>Aims</b>	After completing the course the student will understand the processes of firm internationalization and global marketing. The learning outcomes of the course are the following:	
	<ul style="list-style-type: none"> <li>- to understand the characteristics of the international market environment and be familiar with essential theories of firm internationalization.</li> <li>- to be able to analyze, select and evaluate the appropriate conceptual frameworks for approaching the key management decisions connected with the internationalization of the firm and global marketing: Whether to internationalize, deciding which markets to enter, deciding how to enter the foreign market, designing the global marketing programme.</li> <li>- to be able to work in teams.</li> <li>- to be able to create and deliver a group presentation focusing on the mentioned internationalization decisions in a given Finnish company.</li> <li>- to cultivate a global mindset by understanding globalization as a multidimensional phenomenon.</li> </ul>	
<b>Content</b>	Must know: Chain of strategic decisions related to internationalization of the firm and global marketing, internationalization motives and barriers, internationalization theories (Uppsala	

	<p>model, Network approach, Born Global), the international market selection process, factors influencing the entry mode choice, characteristics of various entry modes (export modes, intermediate entry modes, hierarchical modes), designing a global marketing programme.</p> <p>Should know: Concept of value chain in internationalization, comparison of SMEs and LSEs in internationalization and global marketing, environmental analysis in deciding which market to enter (political, economic, sociocultural, and technological environment)</p> <p>Additional knowledge: Principles of transaction cost analysis.</p> <p>21 hours of lectures with interactive mini-case studies, 2nd period.</p> <p>14 hours of exercises including case study and group assignment (written report and class presentations), 2nd period.</p>
<b>Modes of Study</b>	Written final exam.
<b>Evaluation</b>	Final grade 0-5. Evaluation 0-100 points: written exam 70 points group assignment 30 points case work passed/failed.
<b>Study materials</b>	All assignments must be passed to obtain the final grade. 1. Hollensen, S. (2007) Global Marketing – A decision-oriented approach (older editions apply as well), Prentice Hall. 2. Welch, L. Benito, G., and Petersen, B. (2008) Foreign operation methods: Theory, analysis, strategy, Edward Elgar Publishing. 3. Additional reading and material assigned in class.
<b>Prerequisites</b>	Basic knowledge of international marketing.

<b>AC40A0452</b>	<b>INTERNATIONAL MARKETING OF HIGH TECHNOLOGY PRODUCTS AND INNOVATIONS</b>	<b>6 ECTS cr</b>
	<b>International Marketing of High Technology Products and Innovations</b>	
	<b>Replaces AC40A0451 High Technology Marketing. The number of students attending the course may have to be limited. In registration, priority is given to LUT School of Business Master's students. All instruction will be in English.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 2, Period 1	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Sanna-Katriina Asikainen	
<b>Aims</b>	<p>The course aims to provide a deep understanding of the functions of marketing regarding challenges and opportunities of high technology products and markets, assist the participants to understand the virtues and limitations of traditional marketing thinking and tools in emergent, high technology markets, and provide students with an innovation oriented mindset.</p> <p>After completing the course, students will be able to:</p> <ul style="list-style-type: none"> <li>- understand and interpret the special characteristics of a high technology marketing environment</li> <li>- evaluate innovations and interpret their role in marketing decision making</li> <li>- evaluate different marketing tools and strategies in the context of high technology markets and innovations</li> <li>- analyze product/innovation level entry strategies</li> <li>- analyze and criticize firms' marketing decisions in the context of high technology markets.</li> </ul>	
<b>Content</b>	<p>Updated insights regarding challenges and opportunities in high technology markets, the concepts of technology and "high-tech", innovations and new products in high-tech markets, industry structure, industry changes and marketing implications, marketing research in high-tech markets, partnering, entry timing, marketing strategies in high technology markets, organizing marketing activities in high-tech markets.</p> <p>Must know: (1) contingency model of high technology marketing, (2) special characteristics of technology intensive markets, (3) how to apply marketing</p>	

<b>Modes of Study</b>	tools in high technology companies. Should know: Industry evolution, innovation typologies, first mover advantages, technology maps, technology paradox in pricing, launch strategies, innovation adoption and diffusion, partnering. The course will be offered as a blend of lectures, guest lectures, and discussions of selected topics and practical problems. 21 h of interactive lectures in the 1st period. Term paper. Exam.
<b>Evaluation</b>	Final grade 0-5. Evaluation 0-100 points: Term paper 40 points Written exam 40 points Business case report (voluntary) – 20 points The term paper and exam have to be passed (at least 20 points from each) to obtain the final grade.
<b>Study materials</b>	1. Mohr, Jakki, Sanjit Sengupta, and Stanley Slater (2010) Marketing of High-Technology Products and Innovations. Third Edition. Pearson Prentice Hall. 2. Assigned reading.
<b>Prerequisites</b>	AC40A0900 Strategic Global Marketing Management, AC40A0202 Internationalization of the Firm and Global Marketing, AC60A0600 Technology and Innovation Management

<b>AC40A0502</b>	<b>CUSTOMER RELATIONSHIP MANAGEMENT</b>	<b>6 ECTS cr</b>
	<b>Customer Relationship Management</b>	
	<b>Replaces AC40A0501 Asiakassuhteiden hallinta.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 4	
<b>Teacher(s)</b>	Doctoral Student, M.Sc. (Econ. & Bus. Adm.) Hanna Salojärvi, Professor, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio	
<b>Aims</b>	The aim of the course is to familiarize students with the theory of relationship marketing, customer relationship management, related concepts and models. After completing the course, students <ul style="list-style-type: none"> <li>- can define the main concepts of relationship marketing</li> <li>- know the principles of relationship marketing theory</li> <li>- are familiar with customer relationship management as an organization wide strategic approach to managing customer relationships both in B2C and B2B markets</li> <li>- can define and explain the building blocks of long-term customer relationships</li> <li>- are able to analyze the customer base, evaluate performance of customer relationships, and apply various strategies for managing customer relationships</li> <li>- demonstrate an ability to utilize customer knowledge for learning about customers and creating customer value.</li> </ul>	
<b>Content</b>	Must know: Relationship marketing as a novel marketing paradigm, the development and categorization of customer relationships, specific features and building blocks of long-term customer relationships, the measurement of customer life-time value, the strategic framework for customer relationship management. Should know: The characteristics of a customer relationship oriented firm, specific features of large customer management, challenges of CRM system implementation. Additional knowledge: technical characteristics of front- and back-office CRM applications, call-centre management, loyalty schemes.	
<b>Modes of Study</b>	Lectures 21 h, 4th period, exercises 14 h, 4th period. Case study in groups. Term paper in groups. Written final exam.	
<b>Evaluation</b>	Final grade 0-5, evaluation 0-100 points: Case study 10 points	

<b>Study materials</b>	Term paper 30 points Written exam 60 points All assignments need to be passed in order to complete the course. 1. Payne, Adrian (2005), Handbook of CRM: Achieving Excellence through Customer Management, Butterworth-Heinemann 2. Gupta, Sunil & Lehmann, Donald (2005), Managing Customers as Investments: The Strategic Value of Customers in the Long Run, Wharton School Publishing. 3. Assigned reading.
<b>Prerequisites</b>	Basic knowledge of international marketing.

<b>AC40A0551</b>	<b>INTERNATIONAL ENTREPRENEURSHIP</b>	<b>6 ECTS cr</b>
<b>Year and Period</b>	<b>International Entrepreneurship</b>	
<b>Teacher(s)</b>	M.Sc. (Econ. & Bus. Adm.) 2, Period 1-2 Professor, D.Sc. (Econ. & Bus. Adm.) Sami Saarenketo	
<b>Aims</b>	After completing the course, the student will understand the processes of firm internationalization and global marketing. The learning outcomes of the course are the following: - to be able to analyze the processes of international entrepreneurship both from theoretical and practical standpoints. - to be able to identify the main characteristics of successful international entrepreneurs. - to be able to outline the nature, benefits and drawbacks of an international expansion strategy in entrepreneurial firms. - to be able to assess the actual opportunities and challenges that entrepreneurs have to deal with when internationalizing their businesses. - to be able to apply intercultural competence and be able to work in cross-cultural teams. - to be able to design and deliver various kinds of presentations focusing on international entrepreneurship and marketing for a corporate audience. - to enhance creativity and an innovative mindset by working on a challenging real-life field project.	
<b>Content</b>	Must know: The evolution of international entrepreneurship as a field of study, the development of an 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, tools and frameworks in the analysis of a particular international entrepreneurial opportunity and the creation of a business plan. Should know: Characteristics of successful international entrepreneurs, specific features of knowledge-intensive, high tech and software industries.	
<b>Modes of Study</b>	12 h of lectures including guest entrepreneurs as lecturers, 1st-2nd period. 12 h of field project presentations, 1st-2nd period. Group tutorials.	
<b>Evaluation</b>	Final grade 0-5. Evaluation 0-100 points: Active class and tutorial participation. Assignment 1: Case narrative of chosen firm/ entrepreneur (10 points). Assignment 2: Field project & Presentation (50 points). (Peer evaluation in the group work has an effect on the grade). Oral group examination (40 points).	
<b>Study materials</b>	All assignments must be passed to acquire the final grade. 1) Äijö Toivo, Kuivalainen Olli, Saarenketo Sami, Lindqvist Jani & Hanninen Hanna (2005) Internationalization Handbook for the Software Business, Centre of Expertise for Software Product Business, Espoo 2005. 2) Hisrich Robert D. (2009) International Entrepreneurship – Starting, Developing, and Managing a Global Venture, SAGE Publications. 3) Additional reading and material assigned in class.	
<b>Prerequisites</b>	AC40A0900 Strategic Global Marketing Management, AC60A0600 Technology and Innovation Management, AC40A0202 Internationalization of the Firm and	

<b>AC40A0651</b>	<b>INTERNATIONAL BUSINESS STRATEGIES</b>	<b>6 ECTS cr</b>
	<p><b>International Business Strategies</b></p> <p><b>The number of students attending the course may have to be limited based on a pre-exam if the number of students exceeds 80. In registration, priority is given to LUT School of Business Master's students and foreign exchange students with earlier knowledge of international business. During the academic year 2011-2012 this course will be lectured in 1st - 2nd period.</b></p>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 2, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Olli Kuivalainen, Post-Doctoral Researcher, D.Sc. (Econ. & Bus. Adm.) Anssi Tarkiainen	
<b>Aims</b>	<p><b>Aims:</b></p> <ul style="list-style-type: none"> <li>- The aim of the course is to familiarize students with strategic planning for international business in general and the management and execution of international business strategies within the context of multinational corporations in particular.</li> <li>- To help the students to develop an understanding of various international or global strategies and their advantages and disadvantages. The assignment aims to expose the students to actual management challenges in an international context.</li> </ul> <p>After completing the course the students should:</p> <ul style="list-style-type: none"> <li>- possess an understanding of international business in practice: e.g. how to analyse an international marketing environment and plan and develop, implement, coordinate and control different international/global business strategies;</li> <li>- have an in-depth knowledge and understanding of various international business strategies, and international business planning and implementation of international business strategy through the preparation of a group research project applied to a firm in a simulation;</li> <li>- be able to identify the main theories which explain the existence of multinational corporations;</li> <li>- have an understanding of how to compete with integrity in global business;</li> <li>- have the required skills for participating in discussions on topics of international business interest, and to stimulate and answer questions from a knowledgeable audience;</li> <li>- be able to deal with new information critically and systematically and be able to use it to develop and evaluate ideas and projects related to international business;</li> <li>- be able to apply knowledge gained from the course in addition to that provided by additional reading, analysis and discussion, to the events, activities and/or strategies of an actual firm or organization; and</li> <li>- be able to apply intercultural competence and be able work in cross-cultural teams.</li> </ul>	
<b>Content</b>	<p>The skills and application of critical inquiry into your reading, discussions, and situations and experiences that you encounter with regard to international business, both inside and outside the classroom setting.</p> <p><b>Must know:</b></p> <p>The international business planning process and its content especially related to international marketing. International and global business strategies. Strategic tools for analyzing the internal and external environment, for example resource and product positions. Organization of resources, capabilities and knowledge within a multinational corporation. Implementation methods of an international business strategy.</p> <p><b>Should know:</b></p> <p>International finance, international HRM, international production and sourcing</p>	

<b>Modes of Study</b>	<p>strategies, corporate social responsibility. Additional knowledge: OLI paradigm, institutional theory, international technology strategy, real-life firm strategy examples (provided by a guest lecturer). 18 h of interactive lectures, 1st period. 10 h of interactive lectures, 2nd period. Group assignment/project work based on simulation exercises in international groups (incorporating online simulation and written group assignments: a strategic plan and a reflective report) Mid-term tutorial (each group independently with tutors) Written exam.</p>
<b>Evaluation</b>	<p>Final grade 0-5. Evaluation 0-100 points: Active class participation Assignment(s): oral and written project work in groups, 70 points Exam, 30 points</p>
<b>Study materials</b>	<p>All assignments (including the exam) must be passed. Lasserre, P: (2007). Global Strategic Management. Peng, M.W. (2006). Global Strategy (or a newer 2nd edition). Assigned reading (collection of articles). Guide manual for the simulation. Slides from the lectures.</p>
<b>Prerequisites</b>	<p>AC40A0900 Strategic Global Marketing Management, AC60A0600 Technology and Innovation Management, AC40A0202 Internationalization of the Firm and Global Marketing</p>

<b>AC40A0850</b>	<b>CONTEMPORARY ISSUES IN INTERNATIONAL 6 ECTS cr MARKETING</b>
	<b>Contemporary Issues in International Marketing</b>
	<b>The course can be offered in various ways. Thus, two different evaluation schemes apply (see above).</b>
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1
<b>Teacher(s)</b>	N. N.
<b>Aims</b>	<p>Person in Charge: Professor, D.Sc. (Econ. &amp; Bus. Adm.) Sami Saarenketo On completion of the course students should:</p> <ul style="list-style-type: none"> <li>- be familiar with the contemporary concepts and issues ("hot topics") in international marketing.</li> <li>- be able to outline the current challenges in international marketing and develop skills for proposing solutions to these.</li> <li>- be able to discuss and debate on contemporary issues in international marketing.</li> <li>- be able to apply chosen contemporary marketing tools.</li> <li>- be able to work co-operatively in a cross-cultural team setting.</li> </ul>
<b>Content</b>	The specific content of this course will vary depending on the visiting international professor. However, the course covers chosen current theories, concepts and issues affecting international marketing today.
<b>Modes of Study</b>	<p>The format of the course is either a combination of lectures and student assignments (Mode A) or consulting projects (Mode B). We will be using the following teaching methods depending on the course mode:</p> <ul style="list-style-type: none"> <li>- International visiting professors as lecturers</li> <li>- Student assignments</li> <li>- Cases</li> <li>- Exam (not in Mode B)</li> </ul>
<b>Evaluation</b>	<p>Grade 0-5. Mode A Total 100 points:</p> <ul style="list-style-type: none"> <li>- Student assignments 20 points</li> <li>- Exam 80 points</li> </ul>



<b>Study materials</b> <b>Prerequisites</b>	Mode B Total 100 points: - Completed consulting project consisting of both written and verbal assignments 100 points Material to be assigned in class. Basic knowledge of international marketing
<b>AC40A0900</b>	<b>STRATEGIC GLOBAL MARKETING</b>
	<b>MANAGEMENT</b>
	<b>6 ECTS cr</b>
<b>Year and Period</b> <b>Teacher(s)</b>	<b>Strategic Global Marketing Management</b> M.Sc. (Econ. & Bus. Adm.) 1, Period 1 Professor, D.Sc. (Tech.) Sanna-Katriina Asikainen, Professor, D.Sc. (Econ. & Bus. Adm.) Sami Saarenketo, Professor, D.Sc. (Econ. & Bus. Adm.) Olli Kuivalainen, Professor, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio Person in Charge: Professor, D.Sc. (Tech.) Sanna-Katriina Asikainen
<b>Aims</b>	Course aims to provide a critical appreciation of the scope and underlying concepts of and theoretical perspectives on strategic marketing management in global contexts; to relate the relevant concepts of 'strategic marketing management' to contemporary practice; and to assess how strategic marketing management decisions contribute to organizational performance. After completing the course student will be able to:
<b>Content</b>	<ul style="list-style-type: none"> <li>- identify the underlying concepts and theoretical perspectives of marketing management strategy</li> <li>- explain the scope and the role of strategic global marketing analysis, formulation, choice, evaluation and implementation</li> <li>- evaluate the marketing strategies of global organizations and assess how the marketing strategies adopted in particular organizations have contributed to organizational performance</li> <li>- describe and assess the range of marketing strategies available to organizations in a range of environmental contexts</li> <li>- assess strategic options that will be responsive to changes facing a business</li> <li>- identify and assess the strategies based on sustainable competitive advantage</li> <li>- develop a global mindset in marketing management.</li> </ul> A course that integrates knowledge of market analysis with strategic global business considerations, to achieve superior performance and sustainable competitive advantage. Topics include: business strategy, strategic analysis, creating advantage, implementation. Must know: (1) how to monitor and understand a dynamic environment, (2) nature of strategy development process, (3) how to compete (brand and branding strategy, distribution strategy, positioning strategy), (4) where to compete (target market strategy, business scope strategy), (5) what is the overreaching strategy, (6) market entry and exit strategies, and (7) models and methods in strategic marketing management. Should know: Risks in high growth markets, strategies in declining and hostile markets, organizational culture,
<b>Modes of Study</b>	The course will be offered as a blend of lectures, guest lectures, and discussions of selected topics and practical problems. 24 h of lectures in the 1st period. 8 hours of seminar work in the 1st period Four written assignments. Exam.
<b>Evaluation</b>	Final grade 0-5. Evaluation 0-100 points: Assignment 50 points Written exam 50 points Assignments and Exam has to be passed (at least 25 points from each) to acquire the final grade.
<b>Study materials</b>	1. To be announced later.

<b>Prerequisites</b>	Basics in International Marketing.	
<b>AC40A9500</b>	<b>MASTER'S THESIS (INTERNATIONAL MARKETING MANAGEMENT)</b>	<b>30 ECTS cr</b>
	<b>Master's Thesis (International Marketing Management)</b>	
	<b>Replaces AC40A9000 Pro Gradu -tutkielma</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 2, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Sanna-Katriina Asikainen, Professor, D.Sc. (Econ. & Bus. Adm.) Sami Saarenketo	
<b>Aims</b>	<p>The aim of the research seminar is to support students' process of writing a thesis and conducting scientific research.</p> <p>The overall goal of the thesis is for the student to display the knowledge and capability required for independent work as a Master of Science in Economics and Business Administration and especially in the area of international marketing management.</p> <p>After completing the thesis, students will be able to carry out independently a scientific research project and will thus be able to:</p> <ul style="list-style-type: none"> <li>- delimit and define a research topic and tasks</li> <li>- demonstrate an ability to independently identify and formulate issues and to plan and, using appropriate methods, carry out advanced tasks within specified time limits</li> <li>- demonstrate knowledge and understanding in their main field of study, together with insight into current research</li> <li>- demonstrate deeper methodological knowledge in their main field of the study</li> <li>- demonstrate an ability to integrate knowledge and to analyse, assess and deal with complex phenomena, issues and situations</li> <li>- demonstrate an ability to report scientific research in written academic format</li> <li>- clearly present and discuss conclusions and the knowledge and arguments behind them.</li> </ul>	
<b>Content</b>	<p>The research seminar consists of three different parts. 1) Introductory lectures 6 hours 2) Research seminars: presentations of research plan, and 3) Mid-term examination of Master's thesis: comments on an almost final version of the Master's thesis. The seminar gives basic knowledge on how to conduct a research project.</p> <p>Must know: finding a good topic, showing a research gap, writing a research proposal, creating a theoretical framework, the structure of the thesis, synthesizing theories, academic writing, applying methodological tools</p> <p>Should know: evaluation criteria, formatting issues, referencing.</p>	
<b>Modes of Study</b>	<p>Active participation (minimum 50% of meetings).</p> <p>Written research proposal.</p> <p>Presentation of a research proposal.</p> <p>Written and oral feedback on others' research proposals.</p> <p>Master's Thesis.</p> <p>Maturity Test.</p>	
<b>Evaluation</b>	<p>Thesis: laudatur (best grade), eximia cum laude approbatur, magna cum laude approbatur, cum laude approbatur, non sine laude approbatur, lubenter approbatur, approbatur, improbatur (failed).</p> <p>Maturity Test: pass - fail.</p>	
<b>Study materials</b>	Material distributed in class.	
<b>Prerequisites</b>	<p>Compulsory Master's degree courses. Recommended also AB40A0100 Monimuuttujamenetelmät OR AC30A0000 Kvalitatiiviset tutkimusmenetelmät OR AC60A0350 Multivariate and Econometric Analysis Methods</p>	

<b>AC60A0350</b>	<b>MULTIVARIATE AND ECONOMETRIC ANALYSIS METHODS</b>	<b>6 ECTS cr</b>
	<b>Multivariate and Econometric Analysis Methods</b>	
	<b>Course is suitable for postgraduate studies. The number of attending students may have to be limited if the number of students exceeds 30. In registration priority is given to MITIM-students and postgraduate students.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1-2, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Kaisu Puumalainen, Post-Doctoral Researcher, D.Sc. (Econ. & Bus. Adm.) Heli Virta	
<b>Aims</b>	The course will familiarize students with basic multivariate and econometric methods of analysis. Empirical cross-sectional, time series and panel data from various fields of economics and business is used, and the students should be able to conduct both descriptive, predictive and explanatory research, and present the results of the analyses.	
<b>Content</b>	Multiple linear regression analysis, factor analysis, cluster analysis, general linear models. Special issues in regression modeling: dummy variables, non-linear models, simultaneous equations, probit/logit-models, limited dependent variables, instrumental variables. SAS software will be used.	
<b>Modes of Study</b>	Lectures 21 h, exercises 21 h, 3rd-4th period. Seminars 8 h, 4th period.	
<b>Evaluation</b>	Written seminar report and presentation. Final grade 0-5. Evaluation 0-100 points. Written seminar report max 75 points, presentation max 25 points. 50% of the maximum points are required for passing.	
<b>Study materials</b>	Hair, Joseph Jr. et al.: Multivariate data analysis. Prentice Hall, 1998. Hill, R. Carter – Griffiths, William E. – Judge, George G.: Undergraduate Econometrics, 2nd edition. 2001.	
<b>Prerequisites</b>	Basic courses in statistics and economics.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	
<b>AC60A0400</b>	<b>INTERNATIONAL ACCOUNTING AND ANALYSIS</b>	<b>6 ECTS cr</b>
	<b>International Accounting and Analysis</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 1-2	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Econ. & Bus. Adm.) Sheraz Ahmed Doctoral Student, M.Sc. (Econ. & Bus. Adm.) Sanna Hämäläinen	
<b>Aims</b>	At the end of the course a student is expected to be able to: <ul style="list-style-type: none"> <li>- compare and analyze the accounting and reporting practices around the world</li> <li>- understand the international aspects of accounting standards</li> <li>- assess the quality of accounting information</li> <li>- interpret the financial information</li> <li>- use the financial statements to assess the current and future performance of a firm</li> <li>- determine the valuation using the information reported in the financial statements</li> </ul>	
<b>Content</b>	The course is focused on international differences in accounting practices, harmonization of accounting standards, financial statement analysis, assessment of accounting quality, valuation and link between accounting and finance.	
<b>Modes of Study</b>	Lectures 28 h. Term paper, exam. Blackboard in use.	
<b>Evaluation</b>	Grade 0-5, evaluation 0-100 points on the basis of exam (80%) and term paper (20%).	

<b>Study materials</b>	1. Nobes and Parker: Comparative International Accounting, 2006 2. Penman: Financial Statement Analysis and Security Valuation, 2007
<b>Prerequisites</b>	Some basic courses in accounting and finance are recommended.
<b>AC60A0550</b>	<b>CONSULTING PROJECT AT LUT</b> <span style="float: right;"><b>6 ECTS cr</b></span>
	<b>Consulting Project at LUT</b>
	<b>The maximum amount of participants is 25. Preference is given to MITIM students and after that to Master's Students of LUT School of Business. In the possible selection of students, attention will be given to getting a versatile group from different areas of specializations.</b>
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1-2, Period 3-4
<b>Teacher(s)</b>	Adjunct Professor Timo Santalainen Professor, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio
<b>Aims</b>	Consulting Project at LUT is focused on strategy consulting with a very hands-on approach to learning: students take the role of strategy consultants to solve a case organization's concrete problem. The course and its ways of working are designed to help participants to explore strategic issues of selected companies/organizations from three perspectives: academic research and concepts (A), business practice (B), and consulting (C). Taking the role of strategy consultants participants are expected to develop value-generating ideas for their respective case organizations. Expected learning outcomes of the course are threefold: -to deepen participants' knowledge and insights in strategy and business management -to learn the roles and working modes of strategy consultants -to utilize all previous knowledge to develop viable recommendations for strategic action for the case-organizations -to increase innovative mindset by seeking creative solutions to concrete managerial problems The course is also aimed at development business "softskills" such as teamwork, leadership, project management, presentation and other communication skills.
<b>Content</b>	Must know: Evolving motivations and approaches in strategic management and thinking within the context of (hyper)competitive multinational business arenas. Conceptual tools for strategic situational analysis. The logic of developing customer-centric and resource-based strategies as well as value-capturing business models. Alternative roles, styles and practices of strategy consulting. Should know: Alternative modes and tools of "strategizing" in case- as well as in real business situations. Project management skills. Information collection and problem solving skills. Effective presentation skills.
<b>Modes of Study</b>	Prework: Reflective essay 16 hours of lectures (Kick-off workshop, attendance compulsory) 16 hours of seminars, including final presentations of the projects to the evaluation committee Independent project work in teams
<b>Evaluation</b>	Written final report, presentation of the project work Grade 0-5, evaluation 0-100 points. Max 100 points from project work. Grading of projects: 30 % case company 20 % academic advisors 50 % evaluation committee
<b>Study materials</b>	Santalainen, Timo (2006) Strategic Thinking, Talentum

Other material depending on the project work.

<b>AC60A0600</b>	<b>TECHNOLOGY AND INNOVATION MANAGEMENT</b>	<b>6 ECTS cr</b>
	<b>Technology and Innovation Management</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 2	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio, Professor, Ph.D. Karl-Erik Michelsen	
<b>Aims</b>	After completing the course, the students know how a firm manages its R&D and creates core technologies which are bases for innovation strategy. How the R&D is organized in-house and how it is connected to the regional, national and trans-national innovation systems. The learning outcomes are the following:	
<b>Content</b>	<ul style="list-style-type: none"> <li>• To recognize different types of innovations</li> <li>• To understand how technology changes and what are the instruments of change.</li> <li>• To understand how global firms manage both technological and business innovations.</li> <li>• To understand the culture of an innovative company.</li> </ul>	
	<p>The course explores the concept of innovation from various points of view: What are innovations, how they are made and how they affect company's strategy and performance. In modern large scale corporations innovations are necessary instruments for growth and competitive edge. Yet, innovation process must be managed and maintained and this requires strategic thinking, vision and courage. This course explores how core technologies are created and how they are developed further to serve the needs of company business strategy. Global companies use transparent innovation process in order to facilitate to serve the customers. This course also explores how users affect innovations and what is the role of customer in innovation process. Finally, innovations are not made in isolation, but rather in a context that is affected by regional, national and trans-national innovation systems.</p> <p>Must know:</p> <p>What is an innovation and how innovations are made  Innovation typologies: e.g. incremental vs. radical/discontinuous/disruptive innovations.  Technological and business innovations.  How technology change and what are the causes of change.  The role of R&amp;D and innovations in established firms  The role of R&amp;D in new start-up firms  Role of innovations in business strategy  Process of new product development  Commercialization of new innovations  Technology adoption life cycle</p> <p>Should know:</p> <p>Value creation through technology partnerships and networks  Innovations and business models  The role of customers and users in R&amp;D process.  Innovation, technology and growth.</p>	
<b>Modes of Study</b>	21 hours of lectures + 8 hours of seminar work	
<b>Evaluation</b>	Final grade 0-5. Evaluation 0-100 points, written exam 60 points, term paper 40 points. All assignments must be passed to get the final grade.	
<b>Study materials</b>	Tidd, J. & Bessant, J. (2009), Managing innovation: Integrating technological, market and organizational change, 4 <sup>th</sup> edition, John Wiley & Sons, Ltd.	

<b>AC60A0650</b>	<b>ORGANIZATION AND STRATEGY WORK IN GLOBAL CONTEXT</b>	<b>6 ECTS cr</b>
	<b>Organization and Strategy Work in Global Context</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 3	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Iiro Jussila Docent, D.Sc. (Econ. & Bus. Adm.) Janne Tienari	
<b>Aims</b>	After taking the course, students will have acquired a research-based and practically grounded understanding of a global organization and of how strategy work is carried out in firms that operate across national borders. Students will also be able to form a substantiated view of strategy work in a global context, and to critically scrutinize notions of strategy and strategic management.	
<b>Content</b>	The course introduces what some call the modern perspective to organization and strategy, which is followed by a critical perspective that some label postmodernism. The course pays particular attention to questions related to balancing global strategizing and local adaptation and translation. Case examples on strategy work in multinational firms are presented. Thematic sessions include (1) different perspectives into organizations and strategy work, (2) a modern perspective into global organizations, (3) a modern perspective into strategy work in global organizations, (4) the field of strategic management today, (5) strategy as practice and work, (6) strategy tools and management consultants, (7) strategy work in growth: mergers and acquisitions, (8) strategy work in decline: rationalization and shutdowns, (9) strategic foresight and scenarios, (10) students' presentations and preparation for the exam, (11) course exam.	
<b>Modes of Study</b>	Intensive three day course, including thematic sessions 10 x 3h (+ exam). Requires active participation in all sessions. Group work (oral presentation and written report). Reaction papers on different themes (written reports). Exam (completed in the last course session).	
<b>Evaluation</b>	Final grade 0–5. Evaluation 0–100 points. Group work (40% of course grade). Reaction papers on different themes (20% of course grade). Exam (40% of course grade), completed in the last course session.	
<b>Study materials</b>	Handouts and literature assigned during the course.	

## 6.3. Student Assessment Policy of School of Business

Approved by the faculty council 16 March 2010

### General assessment principles

#### *The key purposes of assessment*

- To monitor student attainment of learning outcomes
- To provide both students and teachers with feedback on the quality of learning
- To control compliance with the developing standards of higher education
- To motivate students in their studies

#### Objectives of the student assessment policies

- Be equal
  - Requirements are equal across courses and programmes
  - No discrimination based on gender, sexual orientation, ethnicity, religion, belief, age, class or disability
- Be transparent
  - Students understand how they are assessed
  - Students understand how they can influence their grades
- Be coherent
  - Assessment is in line with the intended learning outcomes of the courses
  - Assessment should appropriately reflect the level of the programme
- Be educational
  - Foster student efforts towards the intended learning outcomes
  - Be an integral part of the curriculum and the learning process → support student learning

### Practices to support the objectives of student assessment

#### *An equal assessment policy*

- All courses are assessed on a universal grading scale of 100 points
- The appropriateness of the assessment systems for individual courses is checked *ex ante*
- The assessment is as objective (e.g. evaluation rubric) as possible with minimal subjectivity
- The grade distributions are monitored
- The appropriateness of pass rates and progression are monitored
- School level policies regarding deadlines, retakes and resits are implemented
- The appropriateness of marking and grading standards is checked *ex post* (min. 20% of exams)\*

→ The objective is to increase the *ex post* checking of marking

→ The objective is to develop practices to enable anonymous marking of exams

\* Practice will be piloted by the Master's programme of International Marketing

#### *A transparent assessment policy*

- Clear assessment criteria and weighting of components
- The use of an evaluation rubric is strongly encouraged
- Students are informed of the assessment system (and related rubric) of each course during the introductory lectures
- Material explaining the assessment policies is also available online
- Explicit school level policy with regard of deadlines, re-takes, re-sits and appeals

#### *A coherent assessment policy*

- The appropriateness of the assessment systems of individual courses is checked *ex ante*
  - Balance with theory and practice
  - Facilitates deep learning (timing and amount of assessment)
  - No excessive or unnecessary assessment

- Workload in line with the course scope

#### *An educational assessment policy*

- Assessment methods are in line with the intended learning outcomes
- A varied range of assessment methods is employed on the course and programme levels to support different ways of learning
- Constructive feedback is provided in addition to the grades to support the personal development of the students (especially at the Master's level)
- Peer assessment, when appropriate, is encouraged to provide rapid feedback and promote the understanding of the assessment criteria

→ The objective is to increase the feedback on exams and other forms of student output to support personal development

#### **General assessment policies**

##### The timeliness of assessment

- All exams and other forms of student output are assessed within the period of one month

##### Extension of deadlines and late submission of student work

- Course deadlines will not be postponed without a clear and acceptable reason (e.g. teacher's illness)
- In the case of a clear and acceptable reason (e.g. illness, death of a close relative), students should contact the teacher responsible in advance and agree on the extension of the deadlines. In these cases, there will be no sanctions
- Student work submitted after a set deadline will not be assessed/accepted, unless agreed with the teacher responsible in advance
- Work-related reasons are not acceptable for extending the deadlines for an individual student

##### Retakes and resits

- Students have the possibility to retake an exam once (three exams will be organised and the student must choose which two he/she takes).
- In the case the student does not pass the exam during the two possible exams, he/she needs to retake the exam the following year.
- It is not possible to retake an assignment that has already been accepted (except an exam)
- When the student fails to pass an obligatory assignment, he/she has the possibility to retake that assignment the following year.
- The grade of an assignment that has been assessed and accepted, will be effective for a period of two years. After the two year period, the student needs to resit the course.
- Only in cases where the resit would postpone the graduation of the student (an ongoing Master's thesis process), he/she will be allowed e.g. to retake a failed assignment. This needs to be agreed on with the teacher responsible. It is the student's responsibility to prove that he/she will graduate soon (max. 1 course is missing and the thesis process is advanced) by submitting a transcript and personal study plan.

##### Plagiarism

- Various systems to check for plagiarism are used
- When a student has been noted to have submitted a thesis including a substantial amount of plagiarism, he/she needs to write a new thesis on a new topic
- When a student has been noted to have submitted an assignment including a substantial amount of plagiarism, he/she needs to write a new assignment on a new topic
- On the basis of the nature of the assignment, the teacher responsible will determine the amount of plagiarism that requires sanctions and starting the process of disciplinary measures

##### Correction of the assessment

- Students have the right to obtain information on the assessment criteria applied to them. After the assessment, students have the right to receive a duplicate of the paper assessed



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- Students dissatisfied with the assessment of a course-related assignment other than a final thesis may orally or in writing request a correction within 14 days of the publication of the assessment results
- The request shall be made to the instructor of the course and to the head of study affairs, or in the case of a Master's thesis, in writing to the faculty council (head of study affairs)
- Students who are dissatisfied with the decision may bring the matter to the degree board within 14 days of having been informed of the decision. The decision of the degree board is final; no appeals can be made
- The rector nominates the members of the degree board (the Student Union nominates student member(s))

## 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 School of Business, the Department of Industrial Management and the International Services.

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

The application deadline for the autumn semester / academic year is 15.5. and 15.10. for the spring semester.

More information on the programme and courses can be found at the following website:  
[www.lut.fi/exchange](http://www.lut.fi/exchange)

Inquiries should be addressed to the following E-mail address:  
[incomingexchange@lut.fi](mailto:incomingexchange@lut.fi)

### Autumn Semester 2010

#### August 30 – December 17

1<sup>st</sup> period/August 30 - October 22

2<sup>nd</sup> period/October 25 - December 17

#### Orientation Days, August 25-27

*Subject to alterations*

<i>Course number, Course</i>	<i>ECTS cr</i>
AB30A0301 International Finance and Emerging Markets	6
AC30A6000 Organizational Culture and Gender Aspects in Management	5
AC40A0101 Cross-Cultural Marketing Strategies	6
AC40A0202 Internationalization of the Firm and Global Marketing	6
AC40A0452 International Marketing of High Technology Products and Innovations	6
AC40A0551 International Entrepreneurship	6
AC40A0900 Strategic Global Marketing Management	6
AC40A6000 Introduction to International Business and Planning	3
AC50A0300 Organizational Learning and Competence Management	6
AC60A0400 International Accounting and Analysis	6
AC60A0450 Quantitative Methods for Business Research	3
AC60A0600 Technology and Innovation Management	6
AC60A0750 International Marketing Management	6
CS10A0260 Managing International Business	5
CS10A0550 International Business Methods	7
CS10A0651 Management of Innovations in Russia	5
CS10A0800 The Basics of Doing Business in Russia	5
CS10A7000 The Economies of the Baltic States	3
CS30A1551 System Dynamics and Industrial Management	5
CS30A7000 Technology Management in Japan	3
CS30A7100 Management of Technology	5
CS30A7200 Global Innovation Networks	3
CS34A0400 Strategic Entrepreneurship in Age of Uncertainty	5

<b>AB30A0301</b>	<b>INTERNATIONAL FINANCE AND EMERGING MARKETS</b> <b>6 ECTS cr</b>
	<b>International Finance and Emerging Markets</b>
	<b>The language of teaching is English.</b>
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 2
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Econ. & Bus. Adm.) Kashif Saleem Guest lecturers
<b>Aims</b>	At the end of the course the student is expected to know: <ul style="list-style-type: none"> <li>- how the theory of international trade and finance is formed</li> <li>- the basic relations in international asset pricing</li> <li>- the specifics in Russian financial markets: stock, bond, money and derivative markets.</li> <li>- the specifics in corporate governance, privatization and corporate finance in Russia.</li> <li>- the latest issues in empirical financial research on the Russian market.</li> <li>- the special characteristics of other emerging markets: BRIC countries, Frontier emerging markets, the Emerging Europe and the Middle East.</li> <li>- what are the different sources of risks involved in emerging markets</li> <li>- different episodes of financial crisis</li> </ul>
<b>Content</b>	Foundations of international finance theory, foreign exchange rates, interest rates, international financial markets, asset pricing, portfolio management. Emerging financial markets, especially Russia: recent development, main characteristics and future directions.
<b>Modes of Study</b>	Lectures 30 h. Written term paper. Exam. Blackboard in use.
<b>Evaluation</b>	Grade 0-5 on the basis of the exam (80%) and term paper (20%), evaluation 0-100 points.
<b>Study materials</b>	1. Eiteman, Stonehill, and Moffett: "Multinational Business Finance". Pearson International, 2007, 11th edition. Selected parts. 2. Papaioannou and Tsetsekos (1997): "Emerging Market Portfolios. Diversification and Hedging Strategies". Selected parts. 3. Handouts in class and all additional material required by the lecturer.
<b>Prerequisites</b>	Compulsory B.Sc. courses in Finance (except Bachelor's thesis)
<b>AC30A6000</b>	<b>ORGANIZATIONAL CULTURE AND GENDER ASPECTS IN MANAGEMENT</b> <b>5 ECTS cr</b>
	<b>Organizational Culture and Gender Aspects in Management</b>
	<b>Language of instruction is English</b>
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 2
<b>Teacher(s)</b>	Professor, Ph.D. Albert J. Mills, Saint Mary's University, Halifax
<b>Aims</b>	By the end of the course students will have <ul style="list-style-type: none"> <li>(i) a working knowledge of the concept of organizational culture and its implications for workplace equity;</li> <li>(ii) an in-depth understanding of gender and its influence on behaviour at work;</li> <li>(iii) a working knowledge of the role of management in the shaping of organizational culture and its relationship to organizational culture;</li> <li>(iv) an understanding of selected methods for understanding gender and organizational culture, and</li> <li>(v) the ability to apply understandings for organizational culture and gender to selected case studies</li> </ul>
<b>Content</b>	Managers and other experts working in organizations need appropriate skills to work with the multiple questions related to gender equality. The course will

	<p>provide students with an understanding of the interrelationships between organizational culture, management, and gendered practices at the workplace. The course focus is on how managers can identify, assess and address the organizational processes that lead to discriminatory outcomes for women and men at work. The course stresses that the cultures of organizations should be constructed to accommodate the needs of all members of the organization regardless of sex. To that end we will cover the following content:</p> <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 selected case studies.</li> <li>5. Managing gender at work - issues and debates.</li> </ol>
<b>Modes of Study</b>	<p>Intensive course (November 29 – December 3). 24 hours of lectures, case exercises and group work.</p> <p>An important element of the course will involve small groups of students analyzing and discussing assigned cases.</p>
<b>Evaluation</b>	<p>Graded 0-5; The final grade will consist of continuous assessment (60%) and a final case study/presentation (40%).</p>
<b>Study materials</b>	<p>Articles, book chapters and cases to be specified by the lecturers and read before the course.</p>
<b>Prerequisites</b>	<p>Basic courses in Human Resource Management advisable</p>
<b>Further Information</b>	<p>This course has 6-10 places for open university students. More information on the web site for open university instruction.</p>

<b>AC40A0101</b>	<b>CROSS-CULTURAL MARKETING STRATEGIES 6 ECTS cr</b>
	<b>Cross-Cultural Marketing Strategies</b>
	<b>The number of attending students may have to be limited if the number of students exceeds 70. If necessary, priority is given to students and exchange students of the LUT School of Business.</b>
<b>Year and Period</b>	B.Sc. (Econ. & Bus. Adm.) 2, Period 2
<b>Teacher(s)</b>	Doctoral Student, M.Sc. (Econ. & Bus. Adm.) Hanna Salojärvi
<b>Aims</b>	<p>The goal of the course is to give an understanding of how the cultural environment affects international marketing operations, and advance students' global mindset by giving conceptual tools to increase their intercultural competence. After completing the course the students can:</p> <ul style="list-style-type: none"> <li>- define and categorize culture</li> <li>- recognize the limits of the global marketing approach from the cultural perspective</li> <li>- understand the effects of the cultural environment on international marketing strategies</li> <li>- remember Hofstede's cultural dimensions</li> <li>- utilize cultural concepts in marketing strategy formulation</li> <li>- analyze cultural differences with different dimensions and categorizations of culture from the marketing perspective.</li> </ul>
<b>Content</b>	<p>Must know:          Definitions of culture, the Hofstede and GLOBE cultural dimensions, using cultural concepts to analyze a foreign market from the marketing perspective, the effects of the culture on a product, communication, pricing and distribution strategies.</p> <p>Should know:          The limits of globalization from the cultural perspective, standardization vs.</p>

<p><b>Modes of Study</b></p> <p><b>Evaluation</b></p> <p><b>Study materials</b></p> <p><b>Prerequisites Further Information</b></p>	<p>adaptation in international marketing, the country-of-origin effect. Nice to know: Country cases of cultural differences (term paper reports). 21 hours of lectures with integrated exercises, assignments, written exam, 2nd period</p> <p>Grade 0-5, evaluation 0-100 points: - written exam 60 points - term paper 40 points Both assignments must be passed to obtain the final grade. Optional bonus points from case report and attending the term paper session (+10 points).</p> <p>1. Broweys &amp; Price: Understanding Cross-Cultural Management, Prentice Hall 2008. 2. Usunier: Marketing Across Cultures, Prentice Hall 2000. 3. Lecture slides. 4. Additional material distributed in class.</p> <p>AC40A0000 Kansainvälisen markkinoinnin perusteet This course has 1-5 places for open university students. More information on the web site for open university instruction.</p>
<p><b>AC40A0202</b></p>	<p><b><i>INTERNATIONALIZATION OF THE FIRM AND GLOBAL MARKETING</i></b>     <b>6 ECTS cr</b></p>
<p><b>Year and Period</b></p> <p><b>Teacher(s)</b></p> <p><b>Aims</b></p> <p><b>Content</b></p> <p><b>Modes of Study</b></p>	<p><b>Internationalization of the Firm and Global Marketing</b></p> <p><b>Replaces AC40A0201 Internationalization of the Firm.</b></p> <p>M.Sc. (Econ. &amp; Bus. Adm.) 1, Period 2 Professor, D.Sc. (Econ. &amp; Bus. Adm.) Sami Saarenketo</p> <p>After completing the course the student will understand the processes of firm internationalization and global marketing. The learning outcomes of the course are the following:</p> <ul style="list-style-type: none"> <li>- to understand the characteristics of the international market environment and be familiar with essential theories of firm internationalization.</li> <li>- to be able to analyze, select and evaluate the appropriate conceptual frameworks for approaching the key management decisions connected with the internationalization of the firm and global marketing: Whether to internationalize, deciding which markets to enter, deciding how to enter the foreign market, designing the global marketing programme.</li> <li>- to be able to work in teams.</li> <li>- to be able to create and deliver a group presentation focusing on the mentioned internationalization decisions in a given Finnish company.</li> <li>- to cultivate a global mindset by understanding globalization as a multidimensional phenomenon.</li> </ul> <p>Must know: Chain of strategic decisions related to internationalization of the firm and global marketing, internationalization motives and barriers, internationalization theories (Uppsala model, Network approach, Born Global), the international market selection process, factors influencing the entry mode choice, characteristics of various entry modes (export modes, intermediate entry modes, hierarchical modes), designing a global marketing programme.</p> <p>Should know: Concept of value chain in internationalization, comparison of SMEs and LSEs in internationalization and global marketing, environmental analysis in deciding which market to enter (political, economic, sociocultural, and technological environment)</p> <p>Additional knowledge: Principles of transaction cost analysis. 21 hours of lectures with interactive mini-case studies, 2nd period. 14 hours of exercises including case study and group assignment (written report and class presentations), 2nd period. Written final exam.</p>

<b>Evaluation</b>	Final grade 0-5. Evaluation 0-100 points: written exam 70 points group assignment 30 points case work passed/failed. All assignments must be passed to obtain the final grade.
<b>Study materials</b>	1. Hollensen, S. (2007) <i>Global Marketing – A decision-oriented approach</i> (older editions apply as well), Prentice Hall. 2. Welch, L. Benito, G., and Petersen, B. (2008) <i>Foreign operation methods: Theory, analysis, strategy</i> , Edward Elgar Publishing. 3. Additional reading and material assigned in class.
<b>Prerequisites</b>	Basic knowledge of international marketing.

<b>AC40A0452</b>	<b>INTERNATIONAL MARKETING OF HIGH TECHNOLOGY PRODUCTS AND INNOVATIONS</b>	<b>6 ECTS cr</b>
	<b>International Marketing of High Technology Products and Innovations</b>	
	<b>Replaces AC40A0451 High Technology Marketing. The number of students attending the course may have to be limited. In registration, priority is given to LUT School of Business Master's students. All instruction will be in English.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 2, Period 1	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Sanna-Katriina Asikainen	
<b>Aims</b>	The course aims to provide a deep understanding of the functions of marketing regarding challenges and opportunities of high technology products and markets, assist the participants to understand the virtues and limitations of traditional marketing thinking and tools in emergent, high technology markets, and provide students with an innovation oriented mindset. After completing the course, students will be able to: - understand and interpret the special characteristics of a high technology marketing environment - evaluate innovations and interpret their role in marketing decision making - evaluate different marketing tools and strategies in the context of high technology markets and innovations - analyze product/innovation level entry strategies - analyze and criticize firms' marketing decisions in the context of high technology markets.	
<b>Content</b>	Updated insights regarding challenges and opportunities in high technology markets, the concepts of technology and "high-tech", innovations and new products in high-tech markets, industry structure, industry changes and marketing implications, marketing research in high-tech markets, partnering, entry timing, marketing strategies in high technology markets, organizing marketing activities in high-tech markets. Must know: (1) contingency model of high technology marketing, (2) special characteristics of technology intensive markets, (3) how to apply marketing tools in high technology companies. Should know: Industry evolution, innovation typologies, first mover advantages, technology maps, technology paradox in pricing, launch strategies, innovation adoption and diffusion, partnering.	
<b>Modes of Study</b>	The course will be offered as a blend of lectures, guest lectures, and discussions of selected topics and practical problems. 21 h of interactive lectures in the 1st period. Term paper. Exam.	
<b>Evaluation</b>	Final grade 0-5. Evaluation 0-100 points: Term paper 40 points Written exam 40 points Business case report (voluntary) – 20 points	

<b>Study materials</b>	The term paper and exam have to be passed (at least 20 points from each) to obtain the final grade. 1. Mohr, Jakki, Sanjit Sengupta, and Stanley Slater (2010) Marketing of High-Technology Products and Innovations. Third Edition. Pearson Prentice Hall.
<b>Prerequisites</b>	2. Assigned reading. AC40A0900 Strategic Global Marketing Management, AC40A0202 Internationalization of the Firm and Global Marketing, AC60A0600 Technology and Innovation Management

<b>AC40A0551</b>	<b>INTERNATIONAL ENTREPRENEURSHIP</b>	<b>6 ECTS cr</b>
	<b>International Entrepreneurship</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 2, Period 1-2	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Sami Saarenketo	
<b>Aims</b>	After completing the course, the student will understand the processes of firm internationalization and global marketing. The learning outcomes of the course are the following: - to be able to analyze the processes of international entrepreneurship both from theoretical and practical standpoints. - to be able to identify the main characteristics of successful international entrepreneurs. - to be able to outline the nature, benefits and drawbacks of an international expansion strategy in entrepreneurial firms. - to be able to assess the actual opportunities and challenges that entrepreneurs have to deal with when internationalizing their businesses. - to be able to apply intercultural competence and be able to work in cross-cultural teams. - to be able to design and deliver various kinds of presentations focusing on international entrepreneurship and marketing for a corporate audience. - to enhance creativity and an innovative mindset by working on a challenging real-life field project.	
<b>Content</b>	Must know: The evolution of international entrepreneurship as a field of study, the development of an 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, tools and frameworks in the analysis of a particular international entrepreneurial opportunity and the creation of a business plan. Should know: Characteristics of successful international entrepreneurs, specific features of knowledge-intensive, high tech and software industries.	
<b>Modes of Study</b>	12 h of lectures including guest entrepreneurs as lecturers, 1st-2nd period. 12 h of field project presentations, 1st-2nd period.	
<b>Evaluation</b>	Group tutorials. Final grade 0-5. Evaluation 0-100 points: Active class and tutorial participation. Assignment 1: Case narrative of chosen firm/ entrepreneur (10 points). Assignment 2: Field project & Presentation (50 points). (Peer evaluation in the group work has an effect on the grade). Oral group examination (40 points).	
<b>Study materials</b>	All assignments must be passed to acquire the final grade. 1) Äijö Toivo, Kuivalainen Olli, Saarenketo Sami, Lindqvist Jani & Hanninen Hanna (2005) Internationalization Handbook for the Software Business, Centre of Expertise for Software Product Business, Espoo 2005. 2) Hisrich Robert D. (2009) International Entrepreneurship – Starting, Developing, and Managing a Global Venture, SAGE Publications. 3) Additional reading and material assigned in class.	
<b>Prerequisites</b>	AC40A0900 Strategic Global Marketing Management, AC60A0600 Technology and Innovation Management, AC40A0202 Internationalization of the Firm and Global Marketing	

<b>AC40A0900</b>	<b>STRATEGIC GLOBAL MARKETING MANAGEMENT</b>	<b>6 ECTS cr</b>
	<b>Strategic Global Marketing Management</b>	
<b>Year and Period Teacher(s)</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 1 Professor, D.Sc. (Tech.) Sanna-Katriina Asikainen, Professor, D.Sc. (Econ. & Bus. Adm.) Sami Saarenketo, Professor, D.Sc. (Econ. & Bus. Adm.) Olli Kuivalainen, Professor, D.Sc. (Econ. & Bus. Adm.) Liisa-Majja Sainio Person in Charge: Professor, D.Sc. (Tech.) Sanna-Katriina Asikainen	
<b>Aims</b>	Course aims to provide a critical appreciation of the scope and underlying concepts of and theoretical perspectives on strategic marketing management in global contexts; to relate the relevant concepts of 'strategic marketing management' to contemporary practice; and to assess how strategic marketing management decisions contribute to organizational performance. After completing the course student will be able to:	
<b>Content</b>	<ul style="list-style-type: none"> <li>- identify the underlying concepts and theoretical perspectives of marketing management strategy</li> <li>- explain the scope and the role of strategic global marketing analysis, formulation, choice, evaluation and implementation</li> <li>- evaluate the marketing strategies of global organizations and assess how the marketing strategies adopted in particular organizations have contributed to organizational performance</li> <li>- describe and assess the range of marketing strategies available to organizations in a range of environmental contexts</li> <li>- assess strategic options that will be responsive to changes facing a business</li> <li>- identify and assess the strategies based on sustainable competitive advantage</li> <li>- develop a global mindset in marketing management.</li> </ul> <p>A course that integrates knowledge of market analysis with strategic global business considerations, to achieve superior performance and sustainable competitive advantage. Topics include: business strategy, strategic analysis, creating advantage, implementation.</p> <p>Must know: (1) how to monitor and understand a dynamic environment, (2) nature of strategy development process, (3) how to compete (brand and branding strategy, distribution strategy, positioning strategy), (4) where to compete (target market strategy, business scope strategy), (5) what is the overreaching strategy, (6) market entry and exit strategies, and (7) models and methods in strategic marketing management.</p> <p>Should know: Risks in high growth markets, strategies in declining and hostile markets, organizational culture,</p>	
<b>Modes of Study</b>	The course will be offered as a blend of lectures, guest lectures, and discussions of selected topics and practical problems. 24 h of lectures in the 1st period. 8 hours of seminar work in the 1st period Four written assignments. Exam.	
<b>Evaluation</b>	Final grade 0-5. Evaluation 0-100 points: Assignment 50 points Written exam 50 points Assignments and Exam has to be passed (at least 25 points from each) to acquire the final grade.	
<b>Study materials</b>	1. To be announced later.	
<b>Prerequisites</b>	Basics in International Marketing.	



<b>AC40A6000</b>	<b>INTRODUCTION TO INTERNATIONAL BUSINESS AND PLANNING</b>	<b>3 ECTS cr</b>
	<b>Introduction to International Business and Planning</b>	
	<b>Language of instruction is English</b>	
<b>Year and Period</b>	B.Sc. (Econ. & Bus. Adm.) 2-3, Period 1	
<b>Teacher(s)</b>	D.Sc. (Econ.) 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. To provide the students with the analytical skills required for critical evaluation of actual international business strategies.	
<b>Content</b>	The global environment and its effects on international business and strategies. Latest challenges and ideas in international business. Collecting data to support strategic planning for 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 and other functional strategies, such as financing, production, and HR. Case studies.	
<b>Modes of Study</b>	Intensive course (September 2-3 & 8-10). 25 hours of lectures and case exercises. Written examination.	
<b>Evaluation</b>	Graded 0-5 on the basis of case studies 20 % and written examination 80 %	
<b>Study materials</b>	1. James Taggart – Michael McDermott: The Essence of International Business, Prentice-Hall 1993 2. Other material will be announced during lectures	
<b>Prerequisites</b>	Basic course in marketing	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	
<b>AC50A0300</b>	<b>ORGANIZATIONAL LEARNING AND COMPETENCE MANAGEMENT</b>	<b>6 ECTS cr</b>
	<b>Organizational Learning and Competence Management</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 2	
<b>Teacher(s)</b>	Associate Professor, Ph.D. (Psych) Jianzhong Hong	
<b>Aims</b>	By the end of the course, students will be able to: - familiarize themselves with the state of the art literature on the studied subject - identify basic concepts, functioning principles and enabling tools for organizational learning and competence management - have first-hand virtual learning experience - apply what has been learnt to real-life cases - conduct group work collaboratively .	
<b>Content</b>	The course consists of three parts of virtual participation and interaction: 1) active participation in individual literature study (e.g. intensive reading of the course materials presented on the web and required journal articles and book chapters), 2) a case analysis and written report in a group, and 3) case presentation and discussion in a virtual discussion forum. The case analysis is conducted based on the problem-based learning (PBL) method.	
<b>Modes of Study</b>	2nd period. Introductory session (2 h) at the beginning of the course (optional) and face-to-face guiding session for the case analysis (5 h) halfway through the course before the start of the group work (participation is compulsory). Reading assigned articles and writing summaries, commenting on others' work, online exam, group case analysis and discussion through the LUT virtual learning platform Blackboard.	
<b>Evaluation</b>	Grade 0-5, evaluation 0-100 points, individual literature study 40%, group work	

<b>Study materials</b>	on the case analysis 60% 1. Course materials presented on Blackboard. 2. Assigned reading to be announced on the course web page.
<b>AC60A0400</b>	<b>INTERNATIONAL ACCOUNTING AND ANALYSIS</b> <b>6 ECTS cr</b>
<b>Year and Period</b>	<b>International Accounting and Analysis</b>
<b>Teacher(s)</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 1-2 Associate Professor, D.Sc. (Econ. & Bus. Adm.) Sheraz Ahmed Doctoral Student, M.Sc. (Econ. & Bus. Adm.) Sanna Hämäläinen
<b>Aims</b>	At the end of the course a student is expected to be able to: - compare and analyze the accounting and reporting practices around the world - understand the international aspects of accounting standards - assess the quality of accounting information - interpret the financial information - use the financial statements to assess the current and future performance of a firm - determine the valuation using the information reported in the financial statements
<b>Content</b>	The course is focused on international differences in accounting practices, harmonization of accounting standards, financial statement analysis, assessment of accounting quality, valuation and link between accounting and finance.
<b>Modes of Study</b>	Lectures 28 h. Term paper, exam. Blackboard in use.
<b>Evaluation</b>	Grade 0-5, evaluation 0-100 points on the basis of exam (80%) and term paper (20%).
<b>Study materials</b>	1. Nobes and Parker: Comparative International Accounting, 2006 2. Penman: Financial Statement Analysis and Security Valuation, 2007
<b>Prerequisites</b>	Some basic courses in accounting and finance are recommended.
<b>AC60A0450</b>	<b>QUANTITATIVE METHODS FOR BUSINESS RESEARCH</b> <b>3 ECTS cr</b>
	<b>Quantitative Methods for Business Research</b>
	<b>Only for the students of the Master's Degree Program (CBU) in Business and Administration. The course will be lectured at LUT.</b>
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 1-2
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Kaisu Puumalainen
<b>Aims</b>	The objective of the course is to give the students an understanding of the quantitative research process and methodology. The course provides the students with skills in practical research design, analysis and reporting issues. After the course the students should be able to: - understand the role of quantitative empirical research - write a research proposal - use databases to search for existing publications and empirical data - critically evaluate the research design and results of quantitative studies - design an empirical study - evaluate validity and reliability - understand the applicability of the most typical quantitative analysis methods - use SAS software for simple statistical analyses.
<b>Content</b>	1) What is scientific research? Basic issues of the philosophy of science, research process, requirements for a Master's thesis. 2) Using databases: finding research publications, introduction of secondary data sources. 3) Research design: sampling, collecting secondary data, designing surveys (soliciting responses, analyzing non-response bias, survey data collection)

<b>Modes of Study</b>	<p>methods, questionnaire design, pre-testing, typical problems with survey data), reliability and validity, observational and experimental research designs.</p> <p>4) Analysis methods (descriptive, crosstabs, correlation, t-test, ANOVA, linear regression) and SAS software.</p> <p>5) Reporting: Research proposal, literature review, reporting the methodology, presenting the results.</p> <p>Participation in lectures, 18 hours.</p> <p>Evaluation of a research proposal and a Master's thesis.</p> <p>Data collection and analysis exercises, 6 hours.</p>
<b>Evaluation</b>	<p>Written exam based on the lectures and course material.</p> <p>Final grade 0-5. Evaluation 0-100 points.</p> <p>Evaluation of research proposal and Master's thesis passed vs. failed.</p> <p>Report on data collection and analysis exercise max. 25 points.</p> <p>Written exam max. 75 points.</p>
<b>Study materials</b>	<p>50% of the maximum score is required for passing.</p> <p>Cooper, D.R. &amp; Schindler, P.S. (2001) Business Research Methods. New York: McGraw-Hill. Chapters 1-18, 20</p>
<b>Prerequisites</b>	None

<b>AC60A0600</b>	<b>TECHNOLOGY AND INNOVATION MANAGEMENT</b>	<b>6 ECTS cr</b>
<b>Year and Period</b>	<b>Technology and Innovation Management</b>	
<b>Teacher(s)</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 2 Professor, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio, Professor, Ph.D. Karl-Erik Michelsen	
<b>Aims</b>	<p>After completing the course, the students know how a firm manages its R&amp;D and creates core technologies which are bases for innovation strategy. How the R&amp;D is organized in-house and how it is connected to the regional, national and trans-national innovation systems. The learning outcomes are the following:</p> <ul style="list-style-type: none"> <li>• To recognize different types of innovations</li> <li>• To understand how technology changes and what are the instruments of change.</li> <li>• To understand how global firms manage both technological and business innovations.</li> <li>• To understand the culture of an innovative company.</li> </ul>	
<b>Content</b>	<p>The course explores the concept of innovation from various points of view: What are innovations, how they are made and how they affect company's strategy and performance. In modern large scale corporations innovations are necessary instruments for growth and competitive edge. Yet, innovation process must be managed and maintained and this requires strategic thinking, vision and courage. This course explores how core technologies are created and how they are developed further to serve the needs of company business strategy. Global companies use transparent innovation process in order to facilitate to serve the customers. This course also explores how users affect innovations and what is the role of customer in innovation process. Finally, innovations are not made in isolation, but rather in a context that is affected by regional, national and trans-national innovation systems.</p> <p>Must know:</p> <p>What is an innovation and how innovations are made</p> <p>Innovation typologies: e.g. incremental vs. radical/discontinuous/disruptive innovations.</p> <p>Technological and business innovations.</p> <p>How technology change and what are the causes of change.</p> <p>The role of R&amp;D and innovations in established firms</p> <p>The role of R&amp;D in new start-up firms</p> <p>Role of innovations in business strategy</p> <p>Process of new product development</p>	

	Commercialization of new innovations Technology adoption life cycle Should know: Value creation through technology partnerships and networks Innovations and business models The role of customers and users in R&D process. Innovation, technology and growth. 21 hours of lectures + 8 hours of seminar work Final grade 0-5. Evaluation 0-100 points, written exam 60 points, term paper 40 points. All assignments must be passed to get the final grade.
<b>Modes of Study Evaluation</b>	
<b>Study materials</b>	Course literature will be announced later.

<b>AC60A0750</b>	<b>INTERNATIONAL MARKETING MANAGEMENT 6 ECTS cr</b>
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	<b>International Marketing Management</b>
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 1
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio
<b>Aims</b>	After completing the course, the students know what the goals and elements are of international marketing strategy and how international marketing is planned and managed in an organization. The learning outcomes are the following: - To analyze the logic of customer value creation in an international context - To define marketing as a discipline - To analyze the decision-making process related to internationalization - To compare different options of international marketing strategies - To promote a market-oriented mindset by viewing marketing as a strategic orientation of a firm
<b>Content</b>	Must know: Theoretical foundations of marketing: market orientation and relationship marketing. Defining competitive advantage in an international context. An international marketing environment. Standardization vs. adaptation in international marketing. The process of internationalization. Managing the value chain in an international context: market entry choices, downstream vs. upstream internationalization. Elements of an international marketing strategy. Should know: Customer relationship management and marketing information systems. International branding decisions. Additional knowledge: International market research. Corporate social responsibility in an international context.
<b>Modes of Study</b>	21 hours of lectures and 14 hours of exercises, 1st period. Article summaries, groupwork presentations.
<b>Evaluation</b>	Final grade 0-5. Evaluation 0-100 points, written exam 40 points, groupwork 40 points, article summaries 20 points. All assignments must be passed to get the final grade.
<b>Study materials</b>	Albaum & Duerr (2008): International marketing and export management, Prentice Hall. Selected articles.

<b>CS10A0260</b>	<b>MANAGING INTERNATIONAL BUSINESS</b>	<b>5 ECTS cr</b>
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	<b>Managing International Business</b>
<b>Year and Period</b>	B.Sc. (Tech.) 3, Period 2
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Risto Salminen Professor, D.Sc. (Tech.) Juha Väättänen
<b>Aims</b>	Student

<b>Content</b>	<ul style="list-style-type: none"> <li>• recognizes the different entry modes and is able to describe the advantages and disadvantages between the different operation methods</li> <li>• is able to describe the most well known internationalization theories and evaluate the international operations of enterprises based on these theories</li> <li>• recognizes the characteristics of international relationships and understands the key practices of global account management</li> <li>• knows the principles of building a global marketing strategy and the factors affecting it.</li> </ul>
<b>Modes of Study</b>	<ul style="list-style-type: none"> <li>• entry modes in international business</li> <li>• internationalization theories</li> <li>• multinational Enterprises in global business</li> <li>• marketing strategies</li> <li>• international relationships and business networks.</li> </ul>
<b>Evaluation</b>	Lectures 21 h, period 2, exam and written report
<b>Study materials</b>	0 - 5 Hollensen, S., 2004, Global Marketing: A Decision-oriented approach, Harlow : FT Prentice Hall.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>CS10A0550</b>	<b>INTERNATIONAL BUSINESS METHODS</b>	<b>7 ECTS cr</b>
<b>Year and Period</b>	International Business Methods, Kansainvälisen liiketoiminnan menetelmät	
<b>Teacher(s)</b>	M.Sc. (Tech.) 1, Period 1-2	
<b>Aims</b>	Professor, Ph.D. Tauno Tiusanen	
<b>Content</b>	Student <ul style="list-style-type: none"> <li>• is able to distinguish and evaluate the advantages and disadvantages of different entry modes</li> <li>• is able to evaluate risks and opportunities in the global markets and justify the choice of entry method for different markets.</li> <li>• various trade theories and the usefulness of them in practice</li> <li>• main features of international trading and business relations since the Second World War</li> <li>• markets and methods to evaluate them</li> <li>• modes of international operations; special attention will be paid to exporting</li> <li>• contractual arrangements and foreign direct investment (FDI)</li> <li>• theoretical approaches which explain international factor mobility</li> <li>• different currency regimes</li> <li>• trade agreements between nations</li> <li>• risks in international business</li> <li>• international financial markets</li> <li>• cultural factors in international business.</li> </ul>	
<b>Modes of Study</b>	Lectures 42 h 1. period, excercises 14 h 1. period and 14 h 2. period. Web-based learning environment platform Blackboard is used in this course.	
<b>Evaluation</b>	0-5, examination 50 %, excercises 25 %, research report 25 %.	
<b>Study materials</b>	Lecture handouts. Bradley, Frank: International marketing strategy. London 2002. Luostarinen, Reijo - Welch, Lawrence: International Business Operations. Helsinki 1990.	
<b>Prerequisites</b>	CS10A0260 Managing International Business	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>CS10A0651</b>	<b>MANAGEMENT OF INNOVATIONS IN RUSSIA 5 ECTS cr</b>
<p><b>Year and Period</b></p> <p><b>Teacher(s)</b></p> <p><b>Aims</b></p> <p><b>Content</b></p> <p><b>Modes of Study</b></p> <p><b>Evaluation</b></p> <p><b>Study materials</b></p> <p><b>Prerequisites</b></p>	<p><b>Management of Innovations in Russia</b></p> <p><b>Replaces the course CS10A0650 Management of High-Tech Enterprises and Innovations in Russia.</b></p> <p>M.Sc. (Tech.) 1, Period 4  Professor, D.Sc. (Tech.) Juha Väätänen  Professor, D.Sc. (Tech.) Marko Torkkeli  Doctoral Student, M.Sc. Daria Podmetina  Doctoral Student, M.Sc. (Econ. &amp; Bus. Adm.) Irina Savitskaya  Person in Charge: Professor, D.Sc. (Tech.) Juha Väätänen  Student</p> <ul style="list-style-type: none"> <li>• knows how to apply theories of national/regional innovation systems</li> <li>• knows how to analyze the interaction between main players of the innovation system (universities and research organizations, enterprises, government and industries)</li> <li>• knows how innovation process is managed in Russia</li> <li>• knows how global environment and international collaboration influence the innovation management process</li> <li>• knows how to study the innovativeness of the enterprises</li> <li>• knows aspects of open innovations.</li> </ul> <p>• National Innovation System (NIS) in Russia. Models, main players, role of government, innovation policy, role of universities and research institutions, regional diversity of innovations (regional innovation system RIS), science parks and innovation centers</p> <ul style="list-style-type: none"> <li>• innovative industries in Russia, high-tech and low-tech industries</li> <li>• international cooperation and innovations. Role of FDIs, spillovers, exports</li> <li>• innovations as the source of competitive advantage</li> <li>• key issues of technology and innovation management in Russia</li> <li>• aspects of open innovations, Internal R&amp;D, technology transfer and business model innovations.</li> </ul> <p>Suitable also for postgraduate studies.  Lectures 14 h, Research report and presentation  0-5</p> <p>OECD (2005). <i>Fostering Public-Private Partnership for innovation in Russia</i>. OECD. ISBN 92-64-00965-5.  Gianella, C. and Tompson W. (2007). "Stimulating Innovation in Russia: The Role of Institutions and Policies", OECD Economics Department Working Papers, No. 539, OECD Publishing.  Gurkov, I. (2004) <i>Business Innovation in Russian Industry, Post-Communist Economies</i>, Vol. 16, No. 4, pp. 423-438  Torkkeli, M., Vaatanen, J , Podmetina, D., Yla-Kojola, A-M.,. (2009) <i>Knowledge absorption in an emerging economy – the role of foreign investments and trade flows in Russia</i>, <i>International Journal of Business Excellence</i>, Vol. 2, No.3/4 pp. 269 – 284  Desai, R.M., Goldberg, I, <i>Enhancing Russia's competitiveness and innovative capacity</i>, The World Bank</p> <p>Additional material will be announced at the lectures.</p> <p>CS10A0800 <i>The Basics of Doing Business in Russia</i>, not required from foreign exchange students. Sufficient prior business studies required. Due to the teaching methods, the amount of participants may be limited. In this case the priority would be given to the students of Industrial Management.</p>

<b>CS10A0800</b>	<b>THE BASICS OF DOING BUSINESS IN RUSSIA 5 ECTS cr</b>
	<b>The Basics of Doing Business in Russia, Venäjän kaupan perusteet</b>
<b>Year and Period</b>	B.Sc. (Tech.) 3, Period 2
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Juha Väättänen
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• is able to define the special characteristics of Russian business environment</li> <li>• is able to explain the transition process from communism to market economy</li> <li>• is able to distinguish Russian markets and society from the world economy</li> <li>• is able to produce reliable information about Russia, its economy, society and investment opportunities</li> </ul>
<b>Content</b>	<ul style="list-style-type: none"> <li>• is able to recognize Russia's competitive advantages and disadvantages.</li> <li>• transition of Russian society and business environment</li> <li>• living standard analysis</li> <li>• industrial sectors and foreign direct investments</li> <li>• Russia's competitiveness</li> <li>• economic and political integration with the world economy</li> </ul>
<b>Modes of Study</b>	Lectures 28 h, presentation, seminar work, 2nd period.
<b>Evaluation</b>	0-5, examination.
<b>Study materials</b>	Tiusanen, T.: Russia and Foreign Direct Investment. Northern Dimension Research Centre, Publication n:o 52, Lappeenranta University of Technology 2008. Tiusanen, T.: Russia in the Global Economy. Northern Dimension Research Centre, Publication n:o 49, Lappeenranta University of Technology 2008. Lecture materials.
<b>Prerequisites</b>	Additional material will be announced on lectures. Sufficient prior business studies required. Due to the teaching methods, the amount of participants may be limited. In this case the priority would be given to the students of Industrial Management.
<b>CS10A7000</b>	<b>THE ECONOMIES OF THE BALTIC STATES 3 ECTS cr</b>
	<b>The Economies of the Baltic States</b>
	<b>Language of instruction is English</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 2
<b>Teacher(s)</b>	Professor, D.Sc. (Econ.) Alari Purju
<b>Aims</b>	Tallinn University of Technology and Estonian Business School To familiarize the students with the Baltic economies including historical background, present characteristics and future trends.
<b>Content</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>Modes of Study</b>	Intensive course (November 8-12). 20 hours of lectures, case studies and written examination (during last lectures). An essay.
<b>Evaluation</b>	Graded 0-5 on the basis of active class participation and group case studies 60 % . A written examination 40 %.
<b>Study materials</b>	1. Nielsen, Jorgen Ulf-Moller, Erik Strojer Madsen, Kurt Pedersen, International Economics. The wealth of open nations. Berkshire: McGraw-Hill Book Company, First print 1994. 2. Lumiste, Rünno, Robert Pefferly and Alari Purju, 2008, "Estonia's Economic

<b>Prerequisites</b>	Development: Trends, Practices, and Sources"; The Commission on Growth and Development, The World Bank, Working Paper No.25, 46 p.
<b>Further Information</b>	3. Purju, Alari, 2004, "The institutional framework and trade pattern of the Baltic states after EU membership in trade with the CIS ", Turku School of Economics and Business Administration, Series C Discussion, ISSN 1456-4793, 20 p. 4. Case studies of enterprises, material <a href="http://www.hex.com/tallinn/riga/vilnius">http://www.hex.com/tallinn/riga/vilnius</a> Basic courses in international economics and marketing This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b>CS30A1551</b>	<b>SYSTEM DYNAMICS AND INDUSTRIAL MANAGEMENT</b>	<b>5 ECTS cr</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, Period 1-2 int.	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Olli-Pekka Hilmola	
<b>Aims</b>	Student	
<b>Content</b>	<ul style="list-style-type: none"> <li>• is able to construct different systems from the main research topics of industrial management, and identifies the dynamic interconnected nature (time dependent) of the performance of these systems</li> <li>• is able to use system dynamics simulation for quantifying the behavior of different systems by using simulation elements and levels</li> <li>• identifies the situations, where system dynamics based quantitative modelling is applicable, and possibly using these skills in thesis phase (M.Sc. and Dr.).</li> </ul> <p>In this course system dynamics is used in the modelling of logistics systems (distribution and supply chains) and product development processes. Objective of the course is to give an understanding for a student how to analyze systems through relationships of different modeling elements (delay, feedback/feed forward, flow and stock), which often create complex interactions. Implications of system behavior on company level as well as country level issues of decision making in logistics as well as innovation management are discussed. During the course we also use and analyze practical problem solving tasks, using simulation models from the previous research. Suitable also for postgraduate studies.</p>	
<b>Modes of Study</b>	Lectures 12 h, and exercises as well as final seminar 14 h. 1.-2. period in intensive form.	
<b>Evaluation</b>	0-5, exam (50 %) and seminar work (50 %).	
<b>Study materials</b>	<ol style="list-style-type: none"> <li>1. John D. Sterman (2000). Business Dynamics - Systems Thinking and Modeling for a Complex World, McGraw-Hill/Irwin.</li> <li>2. Senge, Peter (1994). The Fifth Discipline. Currency Doubleday.</li> <li>3. Article collection provided by the lecturer.</li> </ol>	
<b>Prerequisites</b>	Recommended: At least introductory courses taken from logistics/supply chain management as well as technology/innovation management.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	

<b>CS30A7000</b>	<b>TECHNOLOGY MANAGEMENT IN JAPAN</b>	<b>3 ECTS cr</b>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 1 int.	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Ichimura Takaya	
<b>Aims</b>	Student	
	<ul style="list-style-type: none"> <li>• will be provided by the background information needed to understand how the Japanese system of technology management operates</li> <li>• will be informed about the characteristics of Japanese management</li> </ul>	



<b>Content</b>	<ul style="list-style-type: none"> <li>• will be informed about the contribution of technology management to the development of Japanese industry</li> <li>• will also be give an outline of the Japanese production system and its based on Japanese culture.</li> </ul> <ol style="list-style-type: none"> <li>1. Technology management as an innovation process</li> <li>2. Management technology and the effectiveness</li> <li>3. The cultural and historical background of Japan</li> <li>4. Industrial development of Japan and their causes</li> <li>5. The approach to establish an technology management system</li> <li>6. Cases of Technology Management System in Japan               <ol style="list-style-type: none"> <li>6.1 Toyota production system</li> <li>6.2 Product development and improvement system</li> <li>6.3 Work design for quality of working life(QWL)</li> <li>6.4 Quality management system in Japan</li> <li>6.5 The process and tools of problem solving</li> <li>6.6 Environmental management system</li> </ol> </li> <li>7. Technology management in the global world</li> </ol>
<b>Modes of Study</b>	16 hours of lectures and class discussions in English.
<b>Evaluation</b>	0-5, active participation in classes and a written assignment.
<b>Study materials</b>	Written material will be distributed during lectures.
<b>Prerequisites</b>	Basic knowledge of production management.
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.

<b>CS30A7100</b>	<b>MANAGEMENT OF TECHNOLOGY</b>	<b>5 ECTS cr</b>
<b>Year and Period</b>	Teknologian johtaminen	
<b>Teacher(s)</b>	Language of instruction is English	
<b>Aims</b>	M.Sc. (Tech.) 1, Period 1-2 Professor, D.Sc. (Tech.) Tuomo Kässi	
<b>Content</b>	<p>After having passed the course the student can identify the main concepts and definitions of innovation and technology management; explain the different viewpoints of enterprise operations through the frameworks of new product/service development as well as explain the phases, risks and challenges related to the growth of innovative enterprises, especially new technology-based start-ups. He/she can identify the significance of networks and industrial property rights in innovation and technology management, and apply the principles of innovation and technology management on selected problem area. He/she can build up company networks and develop solutions for the issues relating to them. The student can produce, propose, and manage the build-up of product families, product systems and product platforms in tangible products and services.</p> <p>The course reviews basic ideas and concepts of strategic and operational technology management including:</p> <ul style="list-style-type: none"> <li>- The concept of strategy</li> <li>- Strategy alternatives</li> <li>- Management product systems</li> <li>- Management of innovation</li> <li>- The process of technology strategy formulation, implementation and management at company level, and of integration of technology strategy with business strategy</li> <li>- Management of innovative organizations</li> </ul>	
<b>Modes of Study</b>	28 hours of lectures in English. Written exam.	
<b>Evaluation</b>	Graded 0-5 on the basis of a written examination 100 %	
<b>Study materials</b>	<ol style="list-style-type: none"> <li>1. Tidd, Joe - Bessant, John - Pavitt, Keith: Managing Innovation, Integrating Technological, Market and Organizational Change, John Wiley &amp; Sons, England, 2005 or newer or other at the lecture advised book</li> <li>2. Other materials assigned given at lectures.</li> </ol>	

<b>Prerequisites Further Information</b>	Basic knowledge of strategic management This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>CS30A7200</b>	<b>GLOBAL INNOVATION NETWORKS</b>	<b>3 ECTS cr</b>
	<b>Global Innovation Networks</b>	
	<b>Language of instruction is English</b>	
<b>Year and Period Teacher(s)</b>	B.Sc. (Tech.) 3, Period 1 Karol Pelc, Ph.D., Professor Michigan Technological University	
<b>Aims</b>	At the end of the course a student is expected to know: <ul style="list-style-type: none"> <li>• How to define innovation and distinguish it from invention or discovery, and how to classify innovations</li> <li>• How to explain the open innovation approach to collaborative product development</li> <li>• How to distinguish major types of global innovation networks</li> <li>• How to calculate the transnationality index for a company</li> <li>• How to define the modules of a global project management system</li> <li>• How to evaluate an international high-tech project network organization</li> <li>• How to analyze the scope and contents of a non-disclosure agreement between partners in an innovation project</li> <li>• How to distinguish the options for intellectual property allocation in a collaborative R&amp;D agreement</li> </ul>	
<b>Content</b>	The course presents conceptual models and empirical data on innovation networks in the context of global scale projects and organizations. It includes the following topics: <ul style="list-style-type: none"> <li>- Schumpeterian perspective on innovation networks and basic concepts related to technological innovation</li> <li>- Global networks for knowledge generation, and collaborative practices in global product development, production, marketing and distribution</li> <li>- Strategic roadmapping and knowledge management in a global organization</li> <li>- Issues of intellectual property in the global networking environment.</li> </ul> Discussion will include issues related to impact of global economic down- and up-turns on innovation strategies.	
<b>Modes of Study</b>	Intensive course (September 27 - October 1). 20 hours of lectures, class discussions, case study workshop, reporting and written examination.	
<b>Evaluation</b>	Graded 0-5 on the basis of case study assignment, active participation, and a written examination. The grade will be based on the following components: <ul style="list-style-type: none"> <li>• Case study review 10%,</li> <li>• Class discussion 10%,</li> <li>• Final exam 80%.</li> </ul>	
<b>Study materials</b>	The students will have access to lecture materials prior to each class and will receive case descriptions for study. LITERATURE: <ol style="list-style-type: none"> <li>1. Boutellier, R., Gassman, O., Von Zedtwitz, M., Managing Global Innovation, Third Edition, Springer, Berlin and Heidelberg 2008.</li> <li>2. Chesbrough, H., Vanhaverbeke, W., West, J. (eds.), Open Innovation: Researching New Paradigm, Oxford University Press, Oxford and New York 2008 (paperback edition).</li> <li>3. Nambisan, S., Sawhney, M., The Global Brain: Your Roadmap for Innovating Faster and Smarter in a Networked World, Wharton School Publishing, Upper Saddle River, New Jersey, 2008.</li> </ol>	
<b>Prerequisites Further Information</b>	Basic knowledge of management and economics. This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>CS34A0400</b>	<b>STRATEGIC ENTREPRENEURSHIP IN AGE OF 5 ECTS cr UNCERTAINTY</b>
	<b>Strategic Entrepreneurship in Age of Uncertainty, Strateginen yrittäjyys ja epävarmuuden hallinta</b>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 1
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Marko Torkkeli
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• can effectively convert assumptions to knowledge</li> <li>• can understand the power of entrepreneurial mindset and strategic entrepreneurship</li> <li>• can cope with uncertainty in new business creation</li> </ul>
<b>Content</b>	Entrepreneurial thinking, uncertainty management, strategic entrepreneurship. "Managing in a knowledge-based economy", "Managing by Core Competences", "Knowledge intensive firms", "Uncertainty and Change management". The latest buzz words or another passing managerial fad? Old wine in new bottles? Or perhaps, just perhaps, a fundamental means of survival and success for modern day corporations? Given the amount of effort that has been devoted to the topic by both academics and practitioners, it appears worth our while to take a deep and dispassionate look at the role of entrepreneurial thinking in sustained competitive advantage.
<b>Modes of Study</b>	Lectures 28 h, 1. period. Exam
<b>Evaluation</b>	0-5
<b>Study materials</b>	Lectures. McGrath Rita and MacMillan Ian, (2000). The Entrepreneurial Mindset. Harvard Business School Pr.
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.

## Spring Semester 2011

### January 10 - May 13

3<sup>rd</sup> period/January 10 - March 4

4<sup>th</sup> period/March 7 - May 13

### Orientation Day, January 5

*Subject to alterations*

### SG IBTM Spring

		<i>ECTS cr</i>
AB30A0550	International Financial Management	6
AB30A0800	Managerial Finance	6
AC40A0150	Integrated Marketing Communication	5
AC40A0251	Sales Management and Personal Selling	6
AC40A0502	Customer Relationship Management	6
AC40A0651	International Business Strategies	6
AC40A6050	Cross-Cultural Encounters	3
AC60A0150	Strategic Management of Growth	6
AC60A0350	Multivariate and Econometric Analysis Methods	6
AC60A0700	Introduction to Modern Economics	6
CS10A0600	Doing Business in Transitional Economies	7
CS10A0651	Management of Innovations in Russia	5
CS10A0751	Enterprises and Competition in Russia	6
CS10A0852	European Union – Competitiveness and Enlargement	5
CS10A0890	Business Ethics	5
CS30A1500	Transportation Systems	5
CS30A1660	Open Innovation	5
CS34A0500	Technology Commercialization and Corporate Venturing	5

<b>AB30A0550</b>	<b>INTERNATIONAL FINANCIAL MANAGEMENT</b>	<b>6 ECTS cr</b>
	<b>International Financial Management</b>	
	<b>The language of teaching is English.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 3	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Econ. & Bus. Adm.) Sheraz Ahmed	
<b>Aims</b>	At the end of this course a student is expected to be able to: <ul style="list-style-type: none"> <li>- understand the structure and functions of MNCs</li> <li>- analyze cross-border financing and investment decisions</li> <li>- evaluate the different legal environments, tax considerations and country risks involved in the financial management of MNCs</li> <li>- assess the impacts of exchange rates on the profitability, growth and valuation of MNCs</li> <li>- know the valuation and risk management strategies used by multinational corporations</li> <li>- measure cross-border diversification benefits in order to undertake effective risk management strategies</li> </ul>	
<b>Content</b>	The course covers four different areas in international financial management: 1) currencies exchange rates and asset pricing, 2) multinational financial decision making, 3) cross-border valuation and financing diversification and 4) institutions, risk management and investors' behavior.	
<b>Modes of Study</b>	Lectures 24 h, term paper (written individually or in groups of up to three members on a topic agreed on mutually), exam. Blackboard/Noppa in use.	
<b>Evaluation</b>	Grade 0–5 on the basis of the exam (80%) and term paper (20%), evaluation 0-100 points.	
<b>Study materials</b>	1. Madura and Fox: International Financial Management, 8th edition, or later version 2. Handouts in class and all additional material required by the lecturer	
<b>Prerequisites</b>	Compulsory B.Sc. courses in Finance (except Bachelor's thesis)	
<b>AB30A0800</b>	<b>MANAGERIAL FINANCE</b>	<b>6 ECTS cr</b>
	<b>Managerial Finance</b>	
	<b>The language of teaching is English.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 3	
<b>Teacher(s)</b>	Associate Professor, D.Sc. (Econ. & Bus. Adm.) Kashif Saleem	
<b>Aims</b>	At the end of the course, the student is expected to know: <ul style="list-style-type: none"> <li>- how corporate finance and business strategies are linked to each other</li> <li>- the process and players involved in raising a firm's capital</li> <li>- the methods of valuing real assets</li> <li>- how to make investment decisions based on the riskiness of projects</li> <li>- how corporate taxes impact on asset valuation and financial decisions</li> <li>- how optimal capital structure is linked to corporate strategies of firms</li> <li>- how managerial incentives affect financial decisions</li> <li>- the importance of risk management in corporate financial decisions</li> </ul>	
<b>Content</b>	Introduction to financial instruments, debt financing, equity financing, discounting and valuation, asset allocation, corporate taxes and capital structure, bankruptcy, managerial incentives, asymmetric information, mergers and acquisitions and risk management.	
<b>Modes of Study</b>	Lectures 30 h. Written term paper. Exam.	
<b>Evaluation</b>	Grade: 0–5 on the basis of the exam (80%) and term paper (20%), evaluation 0-100 points.	
<b>Study materials</b>	1. David Hiller, Mark Grinblatt and Sheridan Titman: Financial markets and corporate strategy – European edition 2007 (Text book) 2. Brealey Myers: Principles of corporate finance, seventh edition ( additional readings)	

<b>Prerequisites</b>	3. Handouts in class and all additional material required by the lecturer Compulsory B.Sc. courses in Finance (except Bachelor's thesis)
<b>AC40A0150</b>	<b>INTEGRATED MARKETING COMMUNICATION 5 ECTS cr</b>
<b>Year and Period</b>	<b>Integrated Marketing Communication</b> B.Sc. (Econ. & Bus. Adm.) 2, Period 4
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio
<b>Aims</b>	After completing the course the student will understand how integrated marketing communication (IMC) is planned and implemented in an organization. The learning outcomes of the course are the following: - to define and explain the concept and process of integrated marketing communication - to recognize the role of MC in marketing strategy - to apply consumer behavior concepts to MC analysis - to define the characteristics of different MC tools and evaluate their usability in different situations - to be able to design, implement and manage marketing communication strategy as part of the marketing process - to be able to analyze the message and logic of an advertising campaign - to enhance a market-oriented mindset by understanding how customer value is communicated through IMC
<b>Content</b>	Must know: The role of MC in the marketing strategy of a firm. The concept of integrated marketing communication, MC process models. High vs. low involvement in consumer behavior and the impact on marketing communication strategy. The characteristics of basic MC tools with a focus on mass media communication. Marketing communications strategy process, message and media strategy. Should know: Legal and ethical issues in advertising. The creative process and execution of a promotion campaign. Brands in MC. Additional knowledge: Strong vs. weak theory of advertising. The services in campaign planning. The advertiser-agency relationship. The Finnish media scene.
<b>Modes of Study</b>	28 hours of lectures with interactive mini-exercises, 4th period. 14 hours of exercises with groupwork presentations, 4th period. Individual ad analysis of a chosen advertising campaign. Written final exam.
<b>Evaluation</b>	Final grade 0-5. Evaluation 0-100 points: written exam 50 points ad analysis 30 points groupwork 20 points.
<b>Study materials</b>	All assignments must be passed to obtain the final grade Course book: Percy, Rossiter & Elliott: Strategic Advertising Management, Oxford University Press, 2001. Lecture slides.
<b>Prerequisites</b>	Additional material distributed in class. AC40A0000 Kansainvälisen markkinoinnin perusteet (or basic course in marketing)
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>AC40A0251</b>	<b>SALES MANAGEMENT AND PERSONAL SELLING</b>	<b>6 ECTS cr</b>
	<b>Sales Management and Personal Selling</b>	
<b>Year and Period</b>	B.Sc. (Econ. & Bus. Adm.) 3, Period 3-4	
<b>Teacher(s)</b>	Post-Doctoral Researcher, D.Sc. (Econ. & Bus. Adm.) Anssi Tarkiainen	
<b>Aims</b>	To familiarize 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. Learning outcomes of the course: - to recognize and understand the fundamental concepts and issues in managing a sales force in the B2B context. - to define and explain the key processes of personal selling and sales management. - to recognize the role of sales management in marketing strategy - to design and implement a sales program - to improve sales negotiation and problem-solving skills - to enhance a market-oriented mindset by understanding the importance of customer-oriented and value-added selling.	
<b>Content</b>	Must know: The general model of sales management and processes of buying and selling. Should know: Special characteristics of business-to-business, industrial and organizational selling. The responsibilities and tasks of sales management. Additional knowledge: Taxonomy of selling positions, different decision-making tools for sales management decisions, negotiation skills.	
<b>Modes of Study</b>	Lectures 24 h, 3rd period. Exercises 12 h, 4th period. Exam.	
<b>Evaluation</b>	Final Grade 0-5. Evaluation 0-100 points: written final exam 60 points role play exercise 40 points	
<b>Study materials</b>	Course books: - Johnston, Mark W. and Greg Marshall, 2006. Churchill/Ford/Walker's Sales Force Management. McGraw-Hill/Irwin, New York. - Manning, Gerald L., and Barry Reece, 2004. Selling Today, Creating Customer Value. 9th edition. Pearson Prentice hall, New Jersey. Lecture slides.	
<b>Prerequisites</b>	Additional material distributed in class. Ka6720000 Markkinoinnin ja hankintoimen perusteet or AC40A0000 Kansainvälisen markkinoinnin perusteet (AC40A0050 Vienti- ja tuontitoiminta recommended).	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>AC40A0502</b>	<b>CUSTOMER RELATIONSHIP MANAGEMENT</b>	<b>6 ECTS cr</b>
	<b>Customer Relationship Management</b>	
	<b>Replaces AC40A0501 Asiakassuhteiden hallinta.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 4	
<b>Teacher(s)</b>	Doctoral Student, M.Sc. (Econ. & Bus. Adm.) Hanna Salojärvi, Professor, D.Sc. (Econ. & Bus. Adm.) Liisa-Maija Sainio	
<b>Aims</b>	The aim of the course is to familiarize students with the theory of relationship marketing, customer relationship management, related concepts and models. After completing the course, students	

<b>Content</b>	<ul style="list-style-type: none"> <li>- can define the main concepts of relationship marketing</li> <li>- know the principles of relationship marketing theory</li> <li>- are familiar with customer relationship management as an organization wide strategic approach to managing customer relationships both in B2C and B2B markets</li> <li>- can define and explain the building blocks of long-term customer relationships</li> <li>- are able to analyze the customer base, evaluate performance of customer relationships, and apply various strategies for managing customer relationships</li> <li>- demonstrate an ability to utilize customer knowledge for learning about customers and creating customer value.</li> </ul> <p>Must know: Relationship marketing as a novel marketing paradigm, the development and categorization of customer relationships, specific features and building blocks of long-term customer relationships, the measurement of customer life-time value, the strategic framework for customer relationship management.</p> <p>Should know: The characteristics of a customer relationship oriented firm, specific features of large customer management, challenges of CRM system implementation.</p> <p>Additional knowledge: technical characteristics of front- and back-office CRM applications, call-centre management, loyalty schemes.</p>
<b>Modes of Study</b>	<p>Lectures 21 h, 4th period, exercises 14 h, 4th period.</p> <p>Case study in groups.</p> <p>Term paper in groups.</p> <p>Written final exam.</p>
<b>Evaluation</b>	<p>Final grade 0-5, evaluation 0-100 points:</p> <p>Case study 10 points</p> <p>Term paper 30 points</p> <p>Written exam 60 points</p>
<b>Study materials</b>	<p>All assignments need to be passed in order to complete the course.</p> <ol style="list-style-type: none"> <li>1. Payne, Adrian (2005), Handbook of CRM: Achieving Excellence through Customer Management, Butterworth- Heinemann</li> <li>2. Gupta, Sunil &amp; Lehmann, Donald (2005), Managing Customers as Investments: The Strategic Value of Customers in the Long Run, Wharton School Publishing.</li> <li>3. Assigned reading.</li> </ol>
<b>Prerequisites</b>	Basic knowledge of international marketing.

<b>AC40A0651</b>	<b>INTERNATIONAL BUSINESS STRATEGIES</b>	<b>6 ECTS cr</b>
	<b>International Business Strategies</b>	
	<b>The number of students attending the course may have to be limited based on a pre-exam if the number of students exceeds 80. In registration, priority is given to LUT School of Business Master's students and foreign exchange students with earlier knowledge of international business. During the academic year 2011-2012 this course will be lectured in 1st - 2nd period.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 2, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Olli Kuivalainen, Post-Doctoral Researcher, D.Sc. (Econ. & Bus. Adm.) Anssi Tarkiainen	
<b>Aims</b>	<p>Aims:</p> <ul style="list-style-type: none"> <li>- The aim of the course is to familiarize students with strategic planning for international business in general and the management and execution of international business strategies within the context of multinational corporations in particular.</li> <li>- To help the students to develop an understanding of various international or global strategies and their advantages and disadvantages. The assignment aims to expose the students to actual management challenges in an international context.</li> </ul>	



	<p>After completing the course the students should:</p> <ul style="list-style-type: none"> <li>- possess an understanding of international business in practice: e.g. how to analyse an international marketing environment and plan and develop, implement, coordinate and control different international/global business strategies;</li> <li>- have an in-depth knowledge and understanding of various international business strategies, and international business planning and implementation of international business strategy through the preparation of a group research project applied to a firm in a simulation;</li> <li>- be able to identify the main theories which explain the existence of multinational corporations;</li> <li>- have an understanding of how to compete with integrity in global business;</li> <li>- have the required skills for participating in discussions on topics of international business interest, and to stimulate and answer questions from a knowledgeable audience;</li> <li>- be able to deal with new information critically and systematically and be able to use it to develop and evaluate ideas and projects related to international business;</li> <li>- be able to apply knowledge gained from the course in addition to that provided by additional reading, analysis and discussion, to the events, activities and/or strategies of an actual firm or organization; and</li> <li>- be able to apply intercultural competence and be able work in cross-cultural teams.</li> </ul> <p><b>Content</b></p> <p>The skills and application of critical inquiry into your reading, discussions, and situations and experiences that you encounter with regard to international business, both inside and outside the classroom setting.</p> <p>Must know: The international business planning process and its content especially related to international marketing. International and global business strategies. Strategic tools for analyzing the internal and external environment, for example resource and product positions. Organization of resources, capabilities and knowledge within a multinational corporation. Implementation methods of an international business strategy.</p> <p>Should know: International finance, international HRM, international production and sourcing strategies, corporate social responsibility.</p> <p>Additional knowledge: OLI paradigm, institutional theory, international technology strategy, real-life firm strategy examples (provided by a guest lecturer).</p> <p><b>Modes of Study</b></p> <p>18 h of interactive lectures, 1st period. 10 h of interactive lectures, 2nd period. Group assignment/project work based on simulation exercises in international groups (incorporating online simulation and written group assignments: a strategic plan and a reflective report) Mid-term tutorial (each group independently with tutors) Written exam.</p> <p><b>Evaluation</b></p> <p>Final grade 0-5. Evaluation 0-100 points: Active class participation Assignment(s): oral and written project work in groups, 70 points Exam, 30 points</p> <p><b>Study materials</b></p> <p>All assignments (including the exam) must be passed. Lasserre, P: (2007). Global Strategic Management. Peng, M.W. (2006). Global Strategy (or a newer 2nd edition). Assigned reading (collection of articles). Guide manual for the simulation. Slides from the lectures.</p> <p><b>Prerequisites</b></p> <p>AC40A0900 Strategic Global Marketing Management, AC60A0600 Technology and Innovation Management, AC40A0202 Internationalization of the Firm and Global Marketing</p>
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<b>AC40A6050</b>	<b>CROSS-CULTURAL ENCOUNTERS</b>	<b>3 ECTS cr</b>
	<b>Cross-Cultural Encounters</b>	
	<b>Language of instruction is English</b>	
<b>Year and Period</b>	B.Sc. (Econ. & Bus. Adm.) 2, Period 3	
<b>Teacher(s)</b>	M.A. Tanja Karppinen, Coordinator M.A. Kristiina Korjonen-Kuusipuro, Researcher M.A. Aino Harinen, Planning Officer Person in Charge: Tanja Karppinen	
<b>Aims</b>	By the end of the course, students will know why it is important to understand and appreciate cultural differences both in business and private life. Students will be able to explain the basic concepts of intercultural communication by the main course themes: cultures and communication, verbal and nonverbal communication, national stereotypes, intercultural sensitivity, cross-cultural interaction, culture shock, adaptation, cultures and organizations, expatriate assignments. Students will be able to describe themselves as an intercultural communicator, recognize symptoms of culture shock in their own life and know how to make intercultural adaptation process easier.	
<b>Content</b>	The purpose of the course is to develop students' abilities to understand and appreciate cultural differences both in business and private life. Cultures and communication, verbal and nonverbal communication, national stereotypes, intercultural sensitivity, cross-cultural interaction, culture shock, adaptation, intercultural effectiveness, cultures and organizations, expatriate assignments	
<b>Modes of Study</b>	24 hours of lectures and case exercises in English.	
<b>Evaluation</b>	Graded 0-5 on the basis of activity, assignments given during the lectures and a portfolio composed of them. Case exercises 80 %, active participation and attendance 20 %.	
<b>Study materials</b>	Reading material for the course provided by the lecturer.	
<b>Prerequisites</b>	Active participation and 80 % attendance.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	
<b>AC60A0150</b>	<b>STRATEGIC MANAGEMENT OF GROWTH</b>	<b>6 ECTS cr</b>
	<b>Strategic Management of Growth</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 3	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Timo Pihkala Person in Charge: Professor, D.Sc. (Econ. & Bus. Adm.) Timo Pihkala	
<b>Aims</b>	The objective of the course is to provide students with up-to-date insights into business growth strategies and their implications on management and on research. The course deals with the concept of strategy, the models of business growth, the relationship between growth and strategy, the barriers to growth, traditional routes of growth, external growth models and business growth analysis.	
<b>Content</b>	Objectives of firms. The connection between business growth and strategy. Dimension and directions of growth and development. External growth.	
<b>Modes of Study</b>	Lectures and assignments 20 h. Exam.	
<b>Evaluation</b>	Final grade 0-5. Evaluation 0-100 points. Assignment 50%, exam 50%.	
<b>Study materials</b>	Articles, lecture notes and material announced during lectures.	
<b>Prerequisites</b>	Introduction to Management	

<b>AC60A0350</b>	<b>MULTIVARIATE AND ECONOMETRIC ANALYSIS METHODS</b>	<b>6 ECTS cr</b>
	<b>Multivariate and Econometric Analysis Methods</b>	
	<b>Course is suitable for postgraduate studies. The number of attending students may have to be limited if the number of students exceeds 30. In registration priority is given to MITIM-students and postgraduate students.</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1-2, Period 3-4	
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Kaisu Puumalainen, Post-Doctoral Researcher, D.Sc. (Econ. & Bus. Adm.) Heli Virta	
<b>Aims</b>	The course will familiarize students with basic multivariate and econometric methods of analysis. Empirical cross-sectional, time series and panel data from various fields of economics and business is used, and the students should be able to conduct both descriptive, predictive and explanatory research, and present the results of the analyses.	
<b>Content</b>	Multiple linear regression analysis, factor analysis, cluster analysis, general linear models. Special issues in regression modeling: dummy variables, non-linear models, simultaneous equations, probit/logit-models, limited dependent variables, instrumental variables. SAS software will be used.	
<b>Modes of Study</b>	Lectures 21 h, exercises 21 h, 3rd-4th period. Seminars 8 h, 4th period.	
<b>Evaluation</b>	Written seminar report and presentation. Final grade 0-5. Evaluation 0-100 points. Written seminar report max 75 points, presentation max 25 points. 50% of the maximum points are required for passing.	
<b>Study materials</b>	Hair, Joseph Jr. et al.: Multivariate data analysis. Prentice Hall, 1998. Hill, R. Carter – Griffiths, William E. – Judge, George G.: Undergraduate Econometrics, 2nd edition. 2001.	
<b>Prerequisites</b>	Basic courses in statistics and economics.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	
<b>AC60A0700</b>	<b>INTRODUCTION TO MODERN ECONOMICS</b>	<b>6 ECTS cr</b>
	<b>Introduction to Modern Economics</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 4	
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Kalevi Kyläheiko Post-Doctoral Researcher, D.Sc. (Econ. & Bus. Adm.) Heli Virta Associate Professor, Ph.D. Jorma Sappinen Person in Charge: Associate Professor, Ph.D. Jorma Sappinen	
<b>Aims</b>	By the end of the course, the student will be able to describe the principles of a modern market economy. The student will be able to explain the basic concepts of microeconomics and macroeconomics and can apply models of the consumer, firm, markets and economy in simple situations. Furthermore, the student will be able to draw conclusions about the efficiency of the function of the market, and will understand when and how a public sector intervention may improve efficiency. The student will also be able to analyze the role and consequences of monetary and fiscal policy. In addition, the student will understand the special role of knowledge in modern economy, and will be able to explain how bits of knowledge affect productivity both at the micro and macro levels. Moreover, the student will be able to apply basic models of modern strategy research (transaction cost economics, the resource-based and dynamic capability views) when explaining how to achieve and sustain a competitive advantage.	
<b>Content</b>	Principles of microeconomics and macroeconomics. Demand, supply and market equilibrium, production and markets for the factors of production,	

<b>Modes of Study</b>	economics of the public sector. Economic growth, unemployment, inflation, economic fluctuations, monetary and fiscal policy. The formulation of technology, pricing and networking strategies as tools to profit from innovation. Knowledge related positive externalities from the point of view of firms and macro economy. Economics-based theories of strategy research.
<b>Evaluation</b>	Lectures 18 h, May 2011. Final grade 0-5, evaluation 0-100 points. Written exam (60%) and home assignments (40%)
<b>Study materials</b>	Mankiw, N. Gregory: Principles of Economics, chapters will be announced later. Articles required by the teachers.

<b>CS10A0600</b>	<b>DOING BUSINESS IN TRANSITIONAL ECONOMIES</b>	<b>7 ECTS cr</b>
<b>Year and Period</b>	<b>Doing Business in Transitional Economies, Liiketoiminta siirtymätalouksissa</b>	
<b>Teacher(s)</b>	M.Sc. (Tech.) 1, Period 3-4 Professor, Ph.D. Tauno Tiusanen	
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• knows the special economic and business features and development of the emerging markets</li> <li>• can evaluate and analyze the risks and opportunities for investment, and choose the right modes of operations in TEs.</li> </ul>	
<b>Content</b>	<ul style="list-style-type: none"> <li>• country profiles of European transitional economies (TEs)</li> <li>• the communist legacy in TEs</li> <li>• macro-economic framework of the transitional process</li> <li>• post-communist region in the global economy</li> <li>• risks and opportunities in the TE markets</li> <li>• investment climate and foreign direct investment in the TEs</li> <li>• EU's enlargement process.</li> </ul>	
<b>Modes of Study</b>	Lectures 42 h 3. period, exercises 14 h 3. period and 14 h 4. period. Web-based learning environment platform Blackboard is used in this course.	
<b>Evaluation</b>	0-5, examination 50 %, exercises 25 %, research report 25 %.	
<b>Study materials</b>	Lecture handouts. Tiusanen, Tauno: Foreign Investors in Transitional Economies: Cases in manufacturing and Services, Northern Dimension Research Centre, Publication n:o 27, Lappeenranta University of Technology 2006. Tiusanen Tauno, Karhu Anna: Twenty Years of Post-Communist Transition in Europe, Northern Dimension Research Centre, Publication n:o 56, Lappeenranta University of Technology 2009. Tiusanen Tauno: Business Climate in Transitional Economies, Northern Dimension Research Centre, Publication n:o 48, Lappeenranta University of Technology 2008. Tiusanen Tauno: Development of rouble exchange rate in Russia, Northern Dimension Research Centre, Publication n:o 45, Lappeenranta University of Technology 2007. Tiusanen, Tauno: Romania and Bulgaria - Two New EU Members, Northern Dimension Research Centre, Publication n:o 44, Lappeenranta University of Technology 2007. Tiusanen Tauno, Karhu Anna: Twenty Years of Post-Communist Transition in Europe, Northern Dimension Research Centre, Publication n:o 56, Lappeenranta University of Technology 2009.	
<b>Prerequisites</b>	CS10A0550 International Business Methods.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>CS10A0651</b>	<b>MANAGEMENT OF INNOVATIONS IN RUSSIA 5 ECTS cr</b>
<p><b>Year and Period</b></p> <p><b>Teacher(s)</b></p> <p><b>Aims</b></p> <p><b>Content</b></p> <p><b>Modes of Study</b></p> <p><b>Evaluation</b></p> <p><b>Study materials</b></p> <p><b>Prerequisites</b></p>	<p><b>Management of Innovations in Russia</b></p> <p><b>Replaces the course CS10A0650 Management of High-Tech Enterprises and Innovations in Russia.</b></p> <p>M.Sc. (Tech.) 1, Period 4          Professor, D.Sc. (Tech.) Juha Väättäen          Professor, D.Sc. (Tech.) Marko Torkkeli          Doctoral Student, M.Sc. Daria Podmetina          Doctoral Student, M.Sc. (Econ. &amp; Bus. Adm.) Irina Savitskaya          Person in Charge: Professor, D.Sc. (Tech.) Juha Väättäen          Student</p> <ul style="list-style-type: none"> <li>• knows how to apply theories of national/regional innovation systems</li> <li>• knows how to analyze the interaction between main players of the innovation system (universities and research organizations, enterprises, government and industries)</li> <li>• knows how innovation process is managed in Russia</li> <li>• knows how global environment and international collaboration influence the innovation management process</li> <li>• knows how study the innovativeness of the enterprises</li> <li>• knows aspects of open innovations.</li> </ul> <p>• National Innovation System (NIS) in Russia. Models, main players, role of government, innovation policy, role of universities and research institutions, regional diversity of innovations (regional innovation system RIS), science parks and innovation centers</p> <ul style="list-style-type: none"> <li>• innovative industries in Russia, high-tech and low-tech industries</li> <li>• international cooperation and innovations. Role of FDIs, spillovers, exports</li> <li>• innovations as the source of competitive advantage</li> <li>• key issues of technology and innovation management in Russia</li> <li>• aspects of open innovations, Internal R&amp;D, technology transfer and business model innovations.</li> </ul> <p>Suitable also for postgraduate studies.          Lectures 14 h, Research report and presentation          0-5</p> <p>OECD (2005). Fostering Public-Private Partnership for innovation in Russia. OECD. ISBN 92-64-00965-5.          Gianella, C. and Tompson W. (2007). "Stimulating Innovation in Russia: The Role of Institutions and Policies", OECD Economics Department Working Papers, No. 539, OECD Publishing.          Gurkov, I. (2004) Business Innovation in Russian Industry, Post-Communist Economies, Vol. 16, No. 4, pp. 423-438          Torkkeli, M., Vaatanen, J , Podmetina, D., Yla-Kojola, A-M.,. (2009) Knowledge absorption in an emerging economy – the role of foreign investments and trade flows in Russia, International Journal of Business Excellence, Vol. 2, No.3/4 pp. 269 – 284          Desai, R.M., Goldberg, I, Enhancing Russia's competitiveness and innovative capacity, The World Bank</p> <p>Additional material will be announced at the lectures.</p> <p>CS10A0800 The Basics of Doing Business in Russia, not required from foreign exchange students. Sufficient prior business studies required. Due to the teaching methods, the amount of participants may be limited. In this case the priority would be given to the students of Industrial Management.</p>

<b>CS10A0751</b>	<b>ENTERPRISES AND COMPETITION IN RUSSIA 6 ECTS cr</b>
	<p><b>Enterprises and Competition in Russia, Yritykset ja kilpailu Venäjällä</b></p> <p><b>Replaces the course CS10A0750 Enterprises and Competition in Russia.</b></p>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 3
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Juha Väättänen
<b>Aims</b>	<p>Student</p> <ul style="list-style-type: none"> <li>• is able to explain the theory of transition from centrally planned economy (CPE) to market economy</li> <li>• is able to assess competitiveness of industrial sectors and enterprises</li> <li>• is able to evaluate the impact of foreign direct investment on the development of transitional economy</li> <li>• is able to explain the methods of increasing competitiveness and productivity on national, industrial and enterprise level.</li> </ul>
<b>Content</b>	<ul style="list-style-type: none"> <li>• privatization process and deregulation of the economy</li> <li>• Russian enterprise structures and emergence of new enterprises</li> <li>• natural resources and consumer markets</li> <li>• Russia's competitiveness and foreign direct investment development</li> <li>• role of government in transition process.</li> </ul>
<b>Modes of Study</b>	Lectures 28 h, presentations, seminar work, 3rd period.
<b>Evaluation</b>	0-5, examination.
<b>Study materials</b>	<p>The World Bank. Transition, the First Ten Years - Analysis and Lessons for Eastern Europe and the Former Soviet Union. 2002.</p> <p>Raj, D. and Goldberg, I. 2007. Enhancing Russia's Competitiveness and Innovative Capacity. The World Bank. Washington DC. 185 p.</p> <p>Additional material will be announced on lectures.</p>
<b>Prerequisites</b>	CS10A0800 The Basics of Doing Business in Russia, not required from foreign exchange students. Sufficient prior business studies required. Due to the teaching methods, the amount of participants may be limited. In this case the priority would be given to the students of Industrial Management.
<b>CS10A0852</b>	<b>EUROPEAN UNION – COMPETITIVENESS AND 5 ECTS cr ENLARGEMENT</b>
	<p><b>European Union – Competitiveness and Enlargement</b></p> <p><b>Replaces the course CS10A0851 Transitional Countries Integration with the European Union.</b></p>
<b>Year and Period</b>	M.Sc. (Tech.) 1, Period 4
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Juha Väättänen
<b>Aims</b>	<p>Student</p> <ul style="list-style-type: none"> <li>• is able to assess the competitiveness of EU in global economy</li> <li>• is able to explain the process of European Union enlargement and its influence on the competitiveness of EU</li> <li>• is able to identify the factors affecting competitiveness and analyze the state and development of a country according to these measures.</li> </ul>
<b>Content</b>	<ul style="list-style-type: none"> <li>• European Union global competitiveness</li> <li>• enlargement process and profiles of new EU members</li> <li>• trade and investment flows</li> <li>• country competitiveness research methodologies.</li> </ul>
<b>Modes of Study</b>	Lectures 25 h, presentations, seminar work, 4th period.
<b>Evaluation</b>	0-5, examination.
<b>Study materials</b>	<p>UNCTAD, World Investment Report 2010, United Nations 2010.</p> <p>World Economic Forum, Global Competitiveness Report 2010-2011, WEF 2010.</p> <p>Tiusanen, T., Karhu, A.: Twenty Years of Post-Communist Transition in</p>

<b>Prerequisites</b>	Europe. Northern Dimension Research Centre, Publication n:o 56, Lappeenranta University of Technology 2009. Additional material will be announced on lectures. Sufficient prior business studies required. Due to the teaching methods, the amount of participants may be limited. In this case the priority would be given to the students of Industrial Management.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>CS10A0890</b>	<b>BUSINESS ETHICS</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>Year and Period</b>	<b>Vastuullinen liiketoiminta</b> M.Sc. (Tech.) 1, Period 3-4
<b>Teacher(s)</b>	Professor, Lic.Sc. (Econ. & Bus. Adm.) Seppo Pitkänen Person in Charge: Professor, Lic.Sc. (Econ. & Bus. Adm.) Seppo Pitkänen
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• understands the globalization-related challenges for business</li> <li>• knows the principles of corporate governance</li> <li>• understands the essentials of stakeholder theory and its influence to business</li> <li>• is able to manage company operations taking into account the key principles of business ethics.</li> </ul>
<b>Content</b>	<ul style="list-style-type: none"> <li>• challenges for business due to globalization</li> <li>• stakeholder theory and its influence to firm's customer-, employee-, supplier- and society relationships</li> <li>• principles of corporate governance</li> <li>• ethical issues in marketing.</li> </ul>
<b>Modes of Study</b>	Lectures 28 h, written report, 3-4. period.
<b>Evaluation</b>	0-5, exam 50 %, written report 50 %.
<b>Study materials</b>	To be announced in the beginning of the course.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>CS30A1500</b>	<b>TRANSPORTATION SYSTEMS</b> <span style="float: right;"><b>5 ECTS cr</b></span>
<b>Year and Period</b>	<b>Transportation Systems, Kuljetusjärjestelmät</b> M.Sc. (Tech.) 1-2, Period 4 int.
<b>Teacher(s)</b>	Professor, D.Sc. (Econ. & Bus. Adm.) Olli-Pekka Hilmola
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• understands the application of different transportation modes in transportation logistics area, particularly in Eurasia</li> <li>• knows the most suitable international routes and their performance</li> <li>• knows organizational and technology development in transportation logistics, and their application and relationship on the overall performance</li> <li>• has a knowledge from environmental issues of transportation logistics – especially from the use of railways, intermodality, and containers</li> <li>• understands the environmental emissions caused by transportation systems, and the usage of dry ports for the reduction of these emissions.</li> </ul>
<b>Content</b>	Among lectures, course contains case exercises (which will combine the issues of different transportation modes together), and by participating in all of these, student will have some amount of basic points for exam.
<b>Modes of Study</b>	Lectures 14 h and cases 12 h as intensive teaching in the 4th period.
<b>Evaluation</b>	0-5, examination (70 %) ja accepted case exercises (30 %).
<b>Study materials</b>	1. Häkkinen, Lotta (2005). Operations Integration and Value Creation in Horizontal Cross-Border Acquisitions. Turku School of Economics and Business Administration, A-6 (Doctoral Diss.). Available at URL: <a href="http://www.tukkk.fi/julkaisut/vk/Ae6_2005.pdf">http://www.tukkk.fi/julkaisut/vk/Ae6_2005.pdf</a> 2. Roso, Violeta (2009). The Dry Port Concept. Chalmers University of Technology, Doctoral Dissertation. ISBN 978-91-7385-338-5. Available at URL: <a href="http://publications.lib.chalmers.se/cpl/record/index.xhtml?pubid=101601">http://publications.lib.chalmers.se/cpl/record/index.xhtml?pubid=101601</a>

	<p>3. Hilmola, Olli-Pekka, Ulla Tapaninen, Erik Terk &amp; Ville-Veikko Savolainen (2007). Container Transit in Finland and Estonia – Current Status, Future Demand and Implications on Infrastructure Investments in Transportation Chain. Publications from the Centre for Maritime Studies, University of Turku, A44. Available at URL: <a href="http://www.okt-infra.fi/file/lid199/files/attachment/OKT_Infra_Cont_Report.pdf">http://www.okt-infra.fi/file/lid199/files/attachment/OKT_Infra_Cont_Report.pdf</a></p> <p>4. Terk, Erik, Ulla Tapaninen, Olli-Pekka Hilmola &amp; Tonis Hunt (2007). Oil Transit in Estonia and Finland – Current Status, Future Demand, and Implications on Infrastructure Investments in Transportation Chain. Publications of Estonian Maritime Academy, No. 4, 2007. Available at URL: <a href="http://www.okt-infra.fi/file/lid206/files/attachment/OKT_Infra_Oil_Report_a.pdf">http://www.okt-infra.fi/file/lid206/files/attachment/OKT_Infra_Oil_Report_a.pdf</a></p> <p>5. Ivanova, Oksana, Tero Toikka &amp; Olli-Pekka Hilmola (2006). Eurasian Container Transportation Market: Current Status and Future Development Trends with Consideration of Different Transportation Modes. Lappeenranta University of Technology, Department of Industrial Engineering and Management. Research Report 179. Available at URL: <a href="http://kouvola.lut.fi/file/lid980/files/attachment/Research_Report_179_Nora.pdf">http://kouvola.lut.fi/file/lid980/files/attachment/Research_Report_179_Nora.pdf</a></p> <p>6. Additional material provided by the lecturer (notes, articles and case exercises).</p>
<b>Prerequisites</b>	Recommended to have taken some logistical courses before, e.g. from topics of supply chain management and production control.
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b>CS30A1660</b>	<b>OPEN INNOVATION</b>	<b>5 ECTS cr</b>
	<b>Open Innovation</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 3	
<b>Teacher(s)</b>	Researcher, M.Sc. (Tech.) Antero Kutvonen Visiting lecturers Person in Charge: Professor, D.Sc. (Tech.) Marko Torkkeli	
<b>Aims</b>	Student <ul style="list-style-type: none"> <li>• can explain the concept of open innovation through both theory and examples (to e.g. a company executive)</li> <li>• identifies open innovation activities in real life companies and explain the motives for engaging in them and the mechanisms through which they create value for the company</li> <li>• can distinguish between modes of inbound and outbound open innovation</li> <li>• can analyze the relation between a company's strategic choices and application of open innovation</li> <li>• attains a basic familiarity with the scientific literature on the theme and the ability to view open innovation in the context of other innovation management theories.</li> </ul>	
<b>Content</b>	<p>Must know: The fundamental definitions and concept of open innovation. Modes of inbound open innovation, i.e. external acquisition of knowledge, and outbound open innovation, i.e. external exploitation of knowledge. Difference between closed and open innovation in managing technology. Identifying open innovation activities in real life firms. Monetary and strategic motives for engaging in open innovation.</p> <p>Should know: Process models of inbound and outbound open innovation. The role and importance of the individual process phases. The relation between corporate strategy, technology strategy and open innovation activities. Most common examples of firms used to explain open innovation. Varying topics from state-of-the-art open innovation research, depending on guest lecturer.</p> <p>Nice to know: Development of the open innovation concept on the basis of prior innovation management theories. Knowledge of the main scientific literature surrounding open innovation. Theoretical determinants of open innovation.</p>	
<b>Modes of Study</b>	Lectures and guest speakers 28h as intensive teaching. Small group assignments during lectures. Group exams (or substituting them with summaries of scientific articles) on each intensive day.	



<b>Evaluation</b>	Graded on a scale of 0 - 5. Continuous evaluation based on small group exams (80%) and participation in lectures (20%). Possibility to substitute group exams with literary work (summaries of scientific articles) in case of absence.
<b>Study materials</b>	Chesbrough, Vanhaverbeke and West (eds.): Open Innovation: Researching a New Paradigm. 2006. Oxford: Oxford University Press. Available freely online. Theoretical determinants of open innovation, LUT Research report. 2010. Scientific journal articles. Lecture handouts.
<b>Prerequisites</b>	Recommended: CS30A1001 Product and Technology Strategy: Advanced Course in Innovation Management, CS34A0500 Technology Commercialization and Corporate Venturing

<b>CS34A0500</b>	<b>TECHNOLOGY COMMERCIALIZATION AND CORPORATE VENTURING</b> <b>5 ECTS cr</b>
	<b>Technology Commercialization and Corporate Venturing, Teknologian kaupallistaminen</b>
<b>Year and Period</b>	M.Sc. (Tech.) 2, Period 4 int.
<b>Teacher(s)</b>	Professor, D.Sc. (Tech.) Marko Torkkeli Visiting lecturers
<b>Aims</b>	Student understands the characteristics of technology commercialization and high growth technology ventures.
<b>Content</b>	This course examines issues related technology commercialization, corporate venturing, and ways to profitably exploit business opportunities. Business models. Suitable also for postgraduate studies.
<b>Modes of Study</b>	Lectures 28 h, 4. period. Exam
<b>Evaluation</b>	0-5
<b>Study materials</b>	Lectures and course pack. Block Zenas and MacMillan Ian (1985) Corporate Venturing: Creating New Businesses Within the Firm. Harvard Business School Pr. McGrath Rita and MacMillan Ian, (2005). MarketBusters: 40 Strategic Moves That Drive Exceptional Business Growth. Harvard Business School Pr.
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.

## 8 Language Centre Courses 2010–2012

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

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

You can register for courses through WebOodi. Students will be informed of admissions by e-mail. Please make sure that your e-mail address in WebOodi is correct.

Remember to register for courses and exams separately.

	<i>ECTS cr</i>
FV11A1001 English for Marketing	4
FV11A2201 Technical English Reading Course	2
FV11A2600 Business English Reading Course	2
FV11A3200 Information Technology	2
FV11A4200 Writing for Business	2
FV11A4601 Energy Issues	4
FV11A4900 Financial English	2
FV11A5801 Aspects of Work	4
FV11A6202 English for Meetings and Discussions	4
FV11A6500 Presenting in English	2
FV11A7401 Technology and the Environment	4
FV11A8501 Machines and Processes	4
FV11A8900 Academic Writing in English	4
FV11A9200 Technical and Current Issues	2
FV11A9501 Directed Independent Study	2
FV11A9701 English Exemption Portfolio	2 - 12
FV12A1210 Basic Course in German 1	2
FV12A1220 Basic Course in German 2	2
FV12A1410 Intermediate Course in German 1	2
FV12A1420 Intermediate Course in German 2	2
FV12A1610 German for Working Life 1	2
FV12A1620 German for Working Life 2	2
FV12A2000 Activation of German Skills	2
FV12A3201 Finland and Germany - Business Partner Scenario	2
FV12A3300 Information on Germany	2
FV12A4400 German for Mechanical Engineering	2
FV12A4600 German for Energy Technology	2
FV12A5201 German Independent Study	1 - 2
FV12A5400 German Self Study Course on Economics	2
FV12A6201 Listening Comprehension in German	2
FV12A7111 Business German 1	2
FV12A7121 Business German 2	2
FV12A7400 German for Forest Industry	2
FV12A7801 Environmental Issues in German	2
FV12A8401 Written Business Communication in German	2
FV14A1801 Cases in Russian	3
FV14A3001 Russian Intensive Course in St. Petersburg	3
FV14A8500 Working in Russia and Reporting	3
FV14A9000 Russian Studies in Russia	9
FV15A1210 Basic Course in French 1	2

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FV15A1220	Basic Course in French 2	2
FV15A1410	Intermediate Course in French 1	2
FV15A1420	Intermediate Course in French 2	2
FV15A1500	French Pronunciation	2
FV15A1550	Listening Skills in French	2
FV15A1610	French for Working Life 1	2
FV15A1620	French for Working Life 2	2
FV15A5010	Business French 1	2
FV15A5020	Business French 2	2
FV15A5500	Suggestopedic Course in Business French	2
FV15A6001	Intercultural course in French	3
FV15A9301	French Independent Study	1 - 4
FV16A1210	Basic Course in Spanish 1	2
FV16A1220	Basic Course in Spanish 2	2
FV16A1251	Essential Spanish Vocabulary	1
FV16A1410	Intermediate Course in Spanish 1	2
FV16A1420	Intermediate Course in Spanish 2	2
FV16A1602	Spanish for Working Life	3
FV16A1702	Understanding Spanish Around the World	3
FV16A2203	Facts about Spain	4
FV16A3201	Business Spanish	3
FV16A5202	Intercultural Spanish Course	4
FV18A9101	Finnish 1	2
FV18A9201	Finnish 2	2
FV18A9301	Finnish 3	2
FV18A9820	Learning Together - Conversation and Culture in French and Finnish	1
FV19A1000	Chinese 1	3
FV19A2000	Chinese 2	3
FV19A3500	Business Chinese	3
FV19A5000	Chinese for Oral Communication	3

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<b><i>FV11A1001</i></b>	<b><i>ENGLISH FOR MARKETING</i></b>	<b><i>4 ECTS cr</i></b>
	<b>English for Marketing</b>	
<b>Year and Period</b>	Period 1-2, 3-4	
<b>Teacher(s)</b>	EFL Instructor, B.A. Riitta Gröhn	
<b>CEF Level</b>	Student entry level: B2 level according to the Common European Framework.	
<b>Aims</b>	By the end of the course, students are expected to have developed their oral, listening and writing skills, to be able to use English in more specific scenarios such as negotiations, presentations and customer service, and to have expanded their marketing vocabulary.	
<b>Content</b>	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>Modes of Study</b>	The language of instruction is English. 48 contact lessons, with at least 56 hours required for homework and self-study.	
<b>Evaluation</b>	This class is oriented towards students in business and marketing and they will be given priority. If there are spaces available, students from other disciplines will be welcome. Pass/Fail.	
<b>Study materials</b>	Student marks will be determined through continuous assessment as well as self-assessment. Students who are not eligible for continuous assessment but have finished all of the assignments are able to sit the final exam, which is made up of a speaking, listening and writing component.	
<b>Prerequisites</b>	Materials will be provided by the teacher. B2 level according to the Common European Framework.	
<b>Further Information</b>	Students should 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 independent language work to improve their level to the point that they can participate in the course (B2). This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b><i>FV11A2201</i></b>	<b><i>TECHNICAL ENGLISH READING COURSE</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Technical English Reading Course</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 1-3, M.Sc. (Tech.) 1, Period 1, 2, 3, 4, 5	
<b>Teacher(s)</b>	Lecturer, M.A. Jukka Taipale	
<b>CEF Level</b>	The course will be taught at a B2/B2+ level according to the Common European Framework.	
<b>Aims</b>	By the end of the course, students are expected to be able to demonstrate the ability to learn and master general technical vocabulary and the ability to read quickly and effectively.	
<b>Content</b>	Vocabulary exercises, skimming, scanning and affixes, reading comprehension exercises, individual, pair or group work.	
<b>Modes of Study</b>	The language of instruction: English. 28 hours of contact or online lessons, with 24 hours required for homework and self-study. 50% attendance and active participation are required.	
<b>Evaluation</b>	Marks are based on a reading comprehension test (duration 90 minutes). Pass/Fail. Students are expected to attend classes regularly, take an active part in classes and complete all assignments.	
<b>Study materials</b>	All assignments must be completed to be eligible to sit the exam.	
<b>Prerequisites</b>	Provided by the teacher. 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 FV11A2600	

<b>Further Information</b>	Business English Reading Course are not eligible for this course. This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>FV11A2600</b>	<b>BUSINESS ENGLISH READING COURSE</b>	<b>2 ECTS cr</b>
	<b>Business English Reading Course</b>	
<b>Year and Period</b>	M.Sc. (Econ. & Bus. Adm.) 1, Period 1, 2, 3, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Jukka Taipale Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	The course will be taught at B2/B2+ level according to the Common European Framework.	
<b>Aims</b>	By the end of the course, students are expected to be able to demonstrate the ability to learn and master general business vocabulary and the ability to read quickly and effectively.	
<b>Content</b>	Vocabulary exercises, skimming, scanning and affixes, reading comprehension exercises, individual, pair or group work. The languages of instruction is English.	
<b>Modes of Study</b>	28 contact lessonss, with 24 hours required for homework and self-study. Classroom-based teaching. 50% attendance required.	
<b>Evaluation</b>	Marks are based on a reading comprehension test (duration 90 minutes). Pass/Fail. Students are expected to attend classes regularly, take an active part in classes and complete all assignments. All assignments must be completed to be eligible to sit the exam.	
<b>Study materials</b>	Provided by the teacher.	
<b>Prerequisites</b>	Students who have taken FV11A2201 Technical English Reading Course are not eligible for this course.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>FV11A3200</b>	<b>INFORMATION TECHNOLOGY</b>	<b>2 ECTS cr</b>
	<b>Information Technology</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 2-3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 2-3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 1, 2, 3, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Jukka Taipale	
<b>CEF Level</b>	The course will be taught at a B2/B2+ level according to the Common European Framework.	
<b>Aims</b>	By the end of the course, students are expected to be able to demonstrate the ability to learn and master the language needed to read and talk about issues connected with information technology and skills required to follow lectures given in English.	
<b>Content</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. The language of instruction is English.	
<b>Modes of Study</b>	28 contact hours, with 24 hours required for homework and self-study. Classroom-based teaching. 80% attendance required. Continuous assessment of the student's participation in class, resulting in an oral mark, and written exercises approved by the teacher.	
<b>Evaluation</b>	Pass/Fail. Students are expected to attend classes regularly, take an active part in classes and complete all assignments. All assignments must be completed to be eligible to be assed. Oral mark 50%, written exercises 50%.	
<b>Study materials</b>	Provided by the teacher and the students.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b><i>FV11A4200</i></b>	<b><i>WRITING FOR BUSINESS</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Writing for Business</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 1-3, B.Sc. (Econ. & Bus. Adm.) 1-3, Period 1, 2, 3, 4, 5	
<b>Teacher(s)</b>	Lecturer, HBA Paula Haapanen Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	B2 and above	
<b>Aims</b>	By the end of the course, students are expected to be able to use stock phrases and functional language to help them correspond in a number of professional situations in different registers, differentiate between formal and informal business correspondence, find sources of reference in connection with writing, and critically read and constructively comment on other students' work through peer review.	
<b>Content</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. The language of instruction is English.	
<b>Modes of Study</b>	This class is based on Web Enhanced Language Learning. The course will mainly use the Blackboard platform so that students can share ideas, critique each other's work and receive feedback from the teacher in pairs. Students will have 4 hours of contact and 48 hours of individual study, virtual group work and peer evaluation. Students of all disciplines are welcome.	
<b>Evaluation</b>	The marks are based on assignments and a joint portfolio done with your partner. Those students who feel that they already have the language and correspondence skills being taught on the course can apply for the course credits. Please contact Lecturer Paula Haapanen for more information. Pass/Fail.	
<b>Study materials</b>	Students will be assessed at the B2 level. There is no specific book requirement. However, students are advised to obtain Andrew Littlejohn's book <i>Company to Company</i> .	
<b>Prerequisites</b>	Students with a writing skill level of B1 or lower should consider independent language work to work on basic writing skills and to improve their level to the point that they can participate on the course. Writing levels can be assessed using Dialang ( <a href="http://www.dialang.org">www.dialang.org</a> ).	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b><i>FV11A4601</i></b>	<b><i>ENERGY ISSUES</i></b>	<b><i>4 ECTS cr</i></b>
	<b>Energy Issues</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 2-3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 2-3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 3-4	
<b>Teacher(s)</b>	Lecturer, B.A. (Hons), P.G.C.E. Peter G. Jones	
<b>CEF Level</b>	B2 and above	
<b>Aims</b>	To develop and maintain speaking, listening and reading skills based on the theme of energy. On completion of the course, students will be able to read and understand written texts about energy issues, understand spoken texts about energy issues, and discuss topical energy issues with a degree of fluency permitting active participation in study and work related to the field of energy technology.	
<b>Content</b>	Language practice and exercises based on texts, both written and spoken, concerning various topical energy issues - ranging from technological challenges to economic and environmental considerations. Language of instruction: English.	
<b>Modes of Study</b>	Contact hours: 48 (24+24) Homework: approx. 56 hours. Classroom-based course. 75 % attendance required. Written test and continuous assessment/oral test.	
<b>Evaluation</b>	0 - 5, written test (50%), continuous assessment/oral test (50%). Students must	

<b>Study materials Further Information</b>	successfully complete all course assignments to be eligible for the examination. Provided by the teacher. This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b><i>FV11A4900</i></b>	<b><i>FINANCIAL ENGLISH</i></b> <span style="float: right;"><b><i>2 ECTS cr</i></b></span>
<b>Year and Period</b>	<b>Financial English</b> B.Sc. (Tech.) 2-3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 2-3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 1, 2
<b>Teacher(s)</b>	Lecturer, B.A. (Hons), P.G.C.E. Peter G. Jones
<b>CEF Level</b>	B2 and above
<b>Aims</b>	To improve English skills in the field of economics and finance. On completion of the course, students will be able to read and understand written texts about economics and finance quickly and effectively and will have an adequate mastery of basic terminology from the field, thus permitting active participation in study and work related to the area.
<b>Content</b>	Texts and tasks from the field of economics and finance, for example, taxation, investment, macroeconomics, ethics etc. Language of instruction: English.
<b>Modes of Study</b>	Contact hours: 24 Homework: 25+ Classroom-based course. 75 % attendance required.
<b>Evaluation</b>	Written test. 0 - 5, written test (100%). Students must successfully complete all course assignments to be eligible for the examination.
<b>Study materials Further Information</b>	Provided by the teacher. This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b><i>FV11A5801</i></b>	<b><i>ASPECTS OF WORK</i></b> <span style="float: right;"><b><i>4 ECTS cr</i></b></span>
<b>Year and Period</b>	<b>Aspects of Work</b> Period 1-2, 3-4
<b>Teacher(s)</b>	Lecturer, B.A. Hwei-Ming Boey
<b>CEF Level</b>	B2 and above
<b>Aims</b>	By the end of the course students will be able to communicate (with varying degrees of competence) about issues dealt with during the course, use the communication skills developed in circumstances outside of class and differentiate between various types of CVs and letters of application.
<b>Content</b>	Issues concerning work. Language of instruction: English.
<b>Modes of Study</b>	48 contact hours + 56 hours independent study Tests: 1) A reading comprehension and writing test. 2) An oral expression test. 3) A conversation test. (Students may be exempted from the oral expression and conversation tests if they actively participate in at least 75% of the lessons.)
<b>Evaluation</b>	Pass/Fail.
<b>Study materials Further Information</b>	Provided by the teacher. This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b><i>FV11A6202</i></b>	<b><i>ENGLISH FOR MEETINGS AND DISCUSSIONS 4 ECTS cr</i></b>
	<b>English for Meetings and Discussions</b>
<b>Year and Period</b>	Weeks 42 - 43 / 2010, weeks 1 - 2 / 2011
<b>Teacher(s)</b>	Lecturer, B.A. Hwei-Ming Boey
<b>CEF Level</b>	B2 and above
<b>Aims</b>	By the end of the course, students will be able to communicate more fluently in all kinds of meetings and discussions.
<b>Content</b>	Discussion and practice of the language for effective oral communication, participation in simulations of meetings. Language of instruction: English.
<b>Modes of Study</b>	Students who have taken FV11A6200 English for Negotiating are not eligible for this course. 48 contact hours + 56 hours independent study. Continuous assessment. Regular attendance required. (There are 3 sessions per day, and a total of 8 days. Participants are allowed absences from not more than 4 sessions in total, and not more than 1 session per day.) Reason: interaction among students is vital to the learning process of this course.
<b>Evaluation</b>	Pass/Fail.
<b>Study materials</b>	Provided by the teacher.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b><i>FV11A6500</i></b>	<b><i>PRESENTING IN ENGLISH 2 ECTS cr</i></b>
	<b>Presenting in English</b>
<b>Year and Period</b>	B.Sc. (Tech.) 2-3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 2-3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 1, 2, 3, 4
<b>Teacher(s)</b>	Lecturer, B.A. (Hons), P.G.C.E. Peter G. Jones Lecturer, HBA Paula Haapanen
<b>CEF Level</b>	B2 and above
<b>Aims</b>	By the end of the course, students will be able to deliver carefully constructed, clear and effective presentations for academic and professional purposes.
<b>Content</b>	The language of presentations: Starting a presentation, controlling the flow, the language of diagrams, summing up, handling questions etc. Establishing and maintaining contact with the audience. Delivering presentations in a supportive context. Analysing one's own performance and establishing areas in need of further development. Language of instruction: English.
<b>Modes of Study</b>	Contact lessons: 24 Homework: 25+ Classroom exercises, presentation practice, and homework. Classroom-based course. 80 % attendance required.
<b>Evaluation</b>	Pass/Fail. Evaluated presentation (100%).
<b>Study materials</b>	Provided by the teacher.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b><i>FV11A7401</i></b>	<b><i>TECHNOLOGY AND THE ENVIRONMENT 4 ECTS cr</i></b>
	<b>Technology and the Environment</b>
<b>Year and Period</b>	Period 1-2
<b>Teacher(s)</b>	Lecturer, B.A. Hwei-Ming Boey
<b>CEF Level</b>	B2 and above
<b>Aims</b>	By the end of the course, students will be able to communicate (with varying degrees of competence) about issues dealt with in the course and use the language skills developed in instances of communication beyond the



<b>Content</b>	classroom. Issues concerning the environment.
<b>Modes of Study</b>	Language of instruction: English. 48 contact hours + 56 hours independent study. 1) A listening comprehension test. 2) An oral expression test. 3) A conversation test. (Students may be exempted from the oral expression and conversation tests if they actively participate in at least 75% of the lessons.)
<b>Evaluation</b>	Pass/Fail.
<b>Study materials</b>	Provided by the teacher.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b><i>FV11A8501</i></b>	<b><i>MACHINES AND PROCESSES</i></b>	<b><i>4 ECTS cr</i></b>
	<b>Machines and Processes</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 1-3, Period 3-4, 5	
<b>Teacher(s)</b>	Lecturer, HBA Paula Haapanen Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	B2 - C1	
<b>Aims</b>	By the end of the course, the student is expected to be able to give a technical description of a machine in his/her own professional field/field of study in some detail, to present common processes and operations related to his/her own professional field/field of study and to discuss issues common to all fields of engineering.	
<b>Content</b>	Using technically-oriented materials, students will mainly work on oral communication skills, active listening skills and some writing skills.	
<b>Modes of Study</b>	The overall working time for the course is 104 hours and it will be divided up into various modes of study, including mainly contact lessons, but online and independent work will be carried out as well. This class is for students in engineering. If there are spaces available, students from other disciplines are welcome.	
<b>Evaluation</b>	Pass/Fail, which will be determined through continuous assessment. Students who do not participate enough to qualify for continuous assessment but complete all of the assignments will be eligible to sit the final exam, which is made up of a speaking (50%), listening (25%) and writing (25%) component.	
<b>Study materials</b>	Materials will be provided by the students and the teacher.	
<b>Prerequisites</b>	B2 level according to the Common European Framework. Students are also expected to know the following before coming to class: the names of basic shapes and their adjective forms, and how to read numbers and decimals in English. Self-study materials are available online and in the self-access room (1410B) for review.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b><i>FV11A8900</i></b>	<b><i>ACADEMIC WRITING IN ENGLISH</i></b>	<b><i>4 ECTS cr</i></b>
	<b>Academic Writing in English</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 1-2, 3, 3-4, 5	
<b>Teacher(s)</b>	Lecturer, HBA Paula Haapanen Lecturer, B.A. (Hons), P.G.C.E. Peter G. Jones Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	B2 - C1	
<b>Aims</b>	At the end of the course, students are expected to be able to identify the characteristics of academic writing in their field and apply them to their own writing, write an academic paper meeting academic conventions in their field	

<b>Content</b>	and give a presentation of the academic text produced for the course. Students will study features of English for academic and scientific writing, after which they will be responsible for producing a paper. The paper will be presented either as part of another course or in seminar presentation sessions organized for this course. Language of instruction: English.
<b>Modes of Study</b>	Students who have taken the course FV11A5200 English for Academic Seminars, FV11A9151 English for Writing Bachelor's Thesis or FV11A9000 Academic Seminar for International Programs are not eligible for this course. The course is made up of 104 hours of work, which will be delivered using multiple modes of study including contact, online and individual work.
<b>Evaluation</b>	Pass/Fail.
<b>Study materials</b>	Various sources of information will be used, including books, the Internet, magazines etc. as well as handouts provided by the teacher.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>FV11A9200</b>	<b>TECHNICAL AND CURRENT ISSUES</b>	<b>2 ECTS cr</b>
	<b>Technical and Current Issues</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 2-3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 2-3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 3, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Jukka Taipale Lecturer, HBA Paula Haapanen Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	Level coming into the course: C1.	
<b>Aims</b>	By the end of the course, students are expected to be able to demonstrate an increase in fluency in spoken English, and an increased ability to understand spoken discourse on technical, business and general issues covered during the course.	
<b>Content</b>	Language practice and exercises based on audio and video material from a variety of sources concerning topics of interest, both technical and general. Language of instruction: English.	
<b>Modes of Study</b>	Contact hours: 26. Homework: 25+ Classroom-based teaching. 80 % attendance required.	
<b>Evaluation</b>	Listening comprehension test. Continuous assessment/speaking test. Pass/Fail. Students are expected to attend classes regularly, take an active part in classes and complete all assignments. All assignments must be completed to be eligible to sit the exam. listening comprehension test (50%), continuous assessment/speaking test (50%).	
<b>Study materials</b>	Provided by the teacher.	
<b>Prerequisites</b>	Students' spoken ability should be at a C1 level.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>FV11A9501</b>	<b>DIRECTED INDEPENDENT STUDY</b>	<b>2 ECTS cr</b>
	<b>Directed Independent Study</b>	
<b>Year and Period</b>	B.Sc. (Tech.) 3, M.Sc. (Tech.) 1-2, B.Sc. (Econ. & Bus. Adm.) 3, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 1-2, 3-4, 5	
<b>Teacher(s)</b>	Lecturer, HBA Paula Haapanen Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	Dependent on the needs of individual students.	
<b>Aims</b>	By the end of this course, students are expected to show an improvement in independent study skills, show improvement in the linguistic areas set out in their learning plans, be able to critically reflect on learning experiences in order to continue learning and working towards linguistic goals and be able to show a record of learning experiences carried out according to an autonomous learning plan.	

<b>Content</b>	Students follow a programme of language studies set out by the teacher. Language of instruction: English.	
<b>Modes of Study</b>	Students first enrol using WebOodi. When the enrolment period has ended, the students selected to the course will be contacted regarding an initial information meeting. Students will receive individual tutoring sessions with the lecturer of approximately 30 minutes each. 52 hours independent study.	
<b>Evaluation</b>	Pass/Fail.	
<b>Prerequisites</b>	Students must be able to show that they are well-prepared for the course and can work independently in a productive manner. Please note that enrolment is limited. All students should write detailed reasons about why they should be chosen for this course when they apply. Use the section marked "Lisätietoja/Additional Information" in the WebOodi application.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>FV11A9701</b>	<b>ENGLISH EXEMPTION PORTFOLIO</b>	<b>2 - 12 ECTS cr</b>
	<b>English Exemption Portfolio</b>	
	<b>The English Exemption Portfolio's (EEP) main purpose is to give students an opportunity to show proficiency in English and communication skills in his or her field of study for recognition and credit. This option should be considered by those who have earned a degree from an English-speaking university, or have worked abroad for an extended period of time (2 years or more) and used English as their main language of communication, have extensively used English at work as their main language of communication (5 years or more).</b>	
<b>Year and Period</b>	M.Sc. (Tech.) 1-2, M.Sc. (Econ. & Bus. Adm.) 1-2, Period 3-4	
<b>Teacher(s)</b>	Person in Charge: Lecturer, HBA Paula Haapanen	
<b>CEF Level</b>	B2 - C1	
<b>Aims</b>	The English Exemption Portfolio's (EEP) main purpose is to give students an opportunity to show proficiency in English and communication skills in his or her field of study for recognition and credit.	
<b>Content</b>	The EEP is a three-step process: 1) Initial level diagnosis, 2) Claim for exemption/written evaluation, and 3) Oral evaluation More detailed information about application requirements and procedures can be found at the EEP website at: <a href="http://www.lut.fi/en/kike/studies/eep/Pages/Default.aspx">http://www.lut.fi/en/kike/studies/eep/Pages/Default.aspx</a>	
<b>Modes of Study</b>	Student compiles the claim and supporting portfolio independently with the help of instructions and tutoring from the teacher as necessary.	
<b>Evaluation</b>	The teachers assessing the EEP MUST be able to see that the student is proficient at a certain level in English and that he/she can talk about his/her field or discipline in such a way that he/she will not have difficulties functioning in an international environment. The assessment designations for the different degree levels are as follows: Master's level - good, Bachelor's level - adequate, inadequate. Information about the assessment criteria can be found from the EEP website at <a href="http://www.lut.fi/EEP">http://www.lut.fi/EEP</a>	
<b>Study materials</b>	The EEP is to show proficiency in English skills that relate to the student's field of study and not general English. Therefore students must present appropriate and relevant samples to support their claim. Please note that confidentiality issues are taken seriously. Should any of the work presented be of a sensitive or confidential nature, anyone involved in handling the material is prepared to sign a confidentiality agreement.	

<b>Prerequisites</b>	More detailed information about application requirements and procedures can be found from the EEP website at: <a href="http://www.lut.fi/en/kike/studies/eep/Pages/Default.aspx">http://www.lut.fi/en/kike/studies/eep/Pages/Default.aspx</a>
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b><i>FV12A1210</i></b>	<b><i>BASIC COURSE IN GERMAN 1</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Saksan peruskurssi 1</b>	
<b>Year and Period</b>	Period 1, 2, 3, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Pirjo Rantonen Lecturer, Jörg Wunderlich Part-time Untenured Teacher, M.A. Sanna Heikkeri	
<b>CEF Level</b>	A1	
<b>Aims</b>	By the end of the course, students are expected to understand spoken language when it is slow, clear and related to topics discussed during the course, to use simple sentences to talk about topics of the course, to write short and simple texts related to topics discussed during the course and to use polite phrases and expressions typical of the German communication culture.	
<b>Content</b>	Situations: personal data, introducing oneself, time and days of the week, food, using public transport. Structures: verbs in the present tense, negation, word order, use of articles, accusative, numerals, personal pronouns.	
<b>Modes of Study</b>	Languages of instruction: German, Finnish and English. Exercises that support communication skills. Contact hours 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Possibility for independent study: successfully completed written assignments, a written examination and an oral test required for a passing grade. Students who have passed the course FV12A1200 German 1 are not eligible for this course because of the similar contents of the courses.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Alltag, Beruf & Co. 1, chapters 1 - 5.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	

<b><i>FV12A1220</i></b>	<b><i>BASIC COURSE IN GERMAN 2</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Saksan peruskurssi 2</b>	
<b>Year and Period</b>	Period 1, 2, 3, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Pirjo Rantonen Lecturer Jörg Wunderlich Part-time Untenured Teacher, M.A. Sanna Heikkeri	
<b>CEF Level</b>	Teaching level: A1.	
<b>Aims</b>	By the end of the course, students are expected to understand spoken language when it is slow, clear and related to topics discussed during the course, to use simple sentences to talk about topics of the course, to write short and simple texts related to topics discussed during the course and to use polite phrases and expressions typical of the German communication culture.	
<b>Content</b>	Situations: making purchases and placing orders, giving directions, agreeing on schedules, family, greetings. Structures: modal verbs, ordinals, accusative and dative use of personal pronouns, possessive pronouns, imperative.	
<b>Modes of Study</b>	Languages of instruction: German, Finnish and English. Exercises that support communication skills. Contact hours 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation.	

<b>Evaluation</b>	Possibility for independent study: successfully completed written assignments, a written examination and an oral test required for a passing grade.
<b>Study materials</b>	Students who have passed the course FV12A1200 German 1 are not eligible for this course because of the similar contents of the courses.
<b>Prerequisites</b>	Pass/Fail.
<b>Further Information</b>	Alltag, Beruf & Co. 1, chapters 6 - 10. FV12A1210 Basic Course in German 1 or corresponding skills. This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b><i>FV12A1410</i></b>	<b><i>INTERMEDIATE COURSE IN GERMAN 1</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Saksan jatkokurssi 1</b>	
<b>Year and Period</b>	Period 1, 2, 3, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Pirjo Rantonen Lecturer Jörg Wunderlich Part-time Untenured Teacher, M.A. Sanna Heikkeri	
<b>CEF Level</b>	Teaching Level A1.	
<b>Aims</b>	By the end of the course, students are expected to be able to discuss topics introduced during the course, to be able to write short texts on topics discussed during the course, to understand the main idea of texts on topics discussed during the course and to understand and apply the most important German customs.	
<b>Content</b>	Situations: describing oneself, organisation of travels and meetings, talking about health. Structures: imperative, separable verbs, perfect tense, sein and haben in the past tense. Languages of instruction: German, Finnish and English.	
<b>Modes of Study</b>	Exercises that support communication skills. Contact hours 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Possibility for independent study: successfully completed written assignments, a written examination and an oral test required for a passing grade. Students who have passed the course FV12A1400 German 2 are not eligible for this course because of the similar contents of the courses.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Alltag, Beruf & Co. 2, chapters 1 - 5.	
<b>Prerequisites</b>	FV12A1220 Basic Course in German 2, FV12A1200 German 1 or equivalent skills.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	

<b><i>FV12A1420</i></b>	<b><i>INTERMEDIATE COURSE IN GERMAN 2</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Saksan jatkokurssi 2</b>	
<b>Year and Period</b>	Period 2, 3, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Pirjo Rantonen Lecturer Jörg Wunderlich	
<b>CEF Level</b>	Teaching Level A1.	
<b>Aims</b>	By the end of the course, students are expected to be able to discuss topics introduced during the course, to be able to write short texts on topics discussed during the course, to understand the main idea of texts on topics discussed during the course and to understand and apply the most important German customs.	
<b>Content</b>	Situations: home and decorating, situations on the phone, informal meetings, small talk. Structures: two-way prepositions, subordinate clauses, adjective endings, possessive pronouns.	

<b>Modes of Study</b>	Languages of instruction: German, Finnish and English. Exercises that support communication skills. Contact hours 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Possibility for independent study: successfully completed written assignments, a written examination and an oral test required for a passing grade. Students who have passed the course FV12A1400 German 2 are not eligible for this course because of the similar contents of the courses.
<b>Evaluation</b>	Pass/Fail.
<b>Study materials</b>	Alltag, Beruf & Co. 2, chapters 6 - 10.
<b>Prerequisites</b>	FV12A1410 Intermediate Course in German 1 or equivalent skills.
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b><i>FV12A1610</i></b>	<b><i>GERMAN FOR WORKING LIFE 1</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Työelämän saksaa 1</b>	
<b>Year and Period</b>	Period 1, 2, 3, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Pirjo Rantonen Part-time Untenured Teacher, M.A. Sanna Heikkeri	
<b>CEF Level</b>	Teaching Level A2	
<b>Aims</b>	By the end of the course, students are expected to be able to talk about themselves and their career, to describe other people and to talk about their place of work and domicile.	
<b>Content</b>	Situations: introducing oneself and others, talking about one's career, describing people and duties at work, describing the weather, atmosphere at work, where you live and where you work. Structures: past tense, genitive, conjugation of adjectives, word formation, subordinate clauses.	
<b>Modes of Study</b>	Languages of instruction: German, Finnish and English. Exercises that support communication skills. Contact lessons 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Possibility for independent study: successfully completed written assignments, a written examination and an oral test required for a passing grade. Students who have passed the course FV12A1600 German for Working Life are not eligible for this course because of the similar contents of the courses.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Alltag, Beruf & Co. 3, chapters 1 - 5.	
<b>Prerequisites</b>	FV12A1420 Intermediate Course in German 2 or equivalent skills.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b><i>FV12A1620</i></b>	<b><i>GERMAN FOR WORKING LIFE 2</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Työelämän saksaa 2</b>	
<b>Year and Period</b>	Period 2, 3, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Pirjo Rantonen Part-time Untenured Teacher, M.A. Sanna Heikkeri	
<b>CEF Level</b>	Teaching level A2	
<b>Aims</b>	By the end of the course, students are expected to be able to talk about their day at work and recreational activities, make polite requests, write a simple CV, have simple phone conversations and compare the working cultures of Finland and Germany.	
<b>Content</b>	Situations: leisure, expressing wishes and requests, phone conversations, day at work, describing events in one's life. Structures: comparative forms of adjectives, reflexive verbs, conditional,	

<b>Modes of Study</b>	infinitive. Languages of instruction: German, Finnish and English. Exercises that support communication skills. Contact lessons 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Possibility for independent study: successfully completed written assignments, a written examination and an oral test required for a passing grade. Students who have passed the course FV12A1600 German for Working Life are not eligible for this course because of the similar contents of the courses.
<b>Evaluation</b>	Pass/Fail.
<b>Study materials</b>	Alltag, Beruf & Co. 3, chapters 6 - 10.
<b>Prerequisites</b>	FV12A1610 German for Working Life 1 or equivalent skills.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b><i>FV12A2000</i></b>	<b><i>ACTIVATION OF GERMAN SKILLS</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Saksan kielitaidon aktivointi</b>	
<b>Year and Period</b>	Period 1, 2, 3	
<b>Teacher(s)</b>	Lecturer, M.A. Pirjo Rantonen Part-time Untenured Teacher, M.A. Sanna Heikkeri	
<b>CEF Level</b>	Teaching level A2	
<b>Aims</b>	By the end of the course, students are expected to know the basic German grammar, to be able to write texts at the proficiency level in question and to be able to have everyday discussions in German.	
<b>Content</b>	Contact lessons: revision of grammar, spoken exercises, pair work, writing assignments. Homework: grammar exercises.	
<b>Modes of Study</b>	Languages of instruction: German, Finnish and English. Contact lessons 28, independent work approx. 24 hours. Active participation and successfully completed exercises or a written and oral test. Continuous assessment requires 75% attendance and active participation.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Materials provided by the teacher.	
<b>Prerequisites</b>	Approx. two years of German studies.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b><i>FV12A3201</i></b>	<b><i>FINLAND AND GERMANY - BUSINESS PARTNER SCENARIO</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Finnland als Partner</b>	
<b>Year and Period</b>	Period 1, 2, 3	
<b>Teacher(s)</b>	Lecturer Jörg Wunderlich Lecturer, M.A. Pirjo Rantonen	
<b>CEF Level</b>	Teaching level B1	
<b>Aims</b>	By the end of the course, students are expected to be able to use their oral skills in cooperation with German partners and to recognise differences and similarities between the Finnish and German cultures.	
<b>Content</b>	Students prepare an international project and practise their project-related communication skills (project planning, project meeting, invitation, communication on the phone, meeting programme, presenting tourist attractions, preparing informal meetings, restaurant and hotel situations). Discussions on cultural differences between Finland and Germany. Language of instruction: German.	
<b>Modes of Study</b>	Contact hours 28, independent work approx. 24 hours. Pair and group assignments, role play.	

<b>Evaluation</b>	Active participation.
<b>Study materials</b>	Grade based on continuous assessment or an oral and written test. Continuous assessment requires 75% attendance and active participation. Students who have taken the course FV12A3400 Mündliche Kommunikation: Projektarbeit are not eligible for this course because of the similar contents of the courses.
<b>Prerequisites</b>	Pass/Fail.
<b>Further Information</b>	Materials provided by the teacher and online material in the Blackboard learning environment. Courses at the level A2 or equivalent skills. This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>FV12A3300</b>	<b>INFORMATION ON GERMANY</b>	<b>2 ECTS cr</b>
<b>Year and Period</b>	<b>Info Deutschland</b>	
<b>Teacher(s)</b>	Period 1, 2, 4 Lecturer Jörg Wunderlich Lecturer, M.A. Pirjo Rantonen	
<b>CEF Level</b>	Teaching level B1.	
<b>Aims</b>	By the end of the course, students are expected to be able to recognise differences and similarities between the Finnish and German cultures, to use their oral skills in cooperation with German partners, to give presentations in German and to know the basic information on Germany.	
<b>Content</b>	Students prepare a short presentation on a topic related to the country, e.g. geography, culture, media, history, politics, sports, or climate. Discussions on cultural differences between Finland and Germany. Language of instruction: German.	
<b>Modes of Study</b>	Contact lessons 28, independent work approx. 24 hours. Pair and group assignments, role play. Grade based on continuous assessment or an oral and written test. Continuous assessment requires 75% attendance and active participation. Students who have taken the course FV12A3200 Finnland als Partner or FV12A3400 Mündliche Kommunikation: Projektarbeit are not eligible for this course because of the similar contents of the courses.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Materials provided by the teacher and online material in the Blackboard learning environment.	
<b>Prerequisites</b>	Courses at the level A2 or equivalent skills.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>FV12A4400</b>	<b>GERMAN FOR MECHANICAL ENGINEERING</b>	<b>2 ECTS cr</b>
	<b>Deutsch im Maschinenbau</b>	
	<b>The course will be lectured every other year, next during the academic year 2011 - 2012.</b>	
<b>Teacher(s)</b>	Lecturer Jörg Wunderlich	
<b>CEF Level</b>	Teaching level: B1	
<b>Aims</b>	By the end of the course, students are expected to know basic terminology in the field, to be able to describe a technical process, to understand texts on mechanical engineering and to know grammar needed in technical language.	
<b>Content</b>	Revision of grammatical structures for technical language. Written and spoken description of technical procedures and processes. Exercises in spoken language once a week during contact lessons. Language of instruction: German.	
<b>Modes of Study</b>	Contact lessons 14, independent work (online) approx. 38 hours. Continuous assessment requires 75% attendance and active participation.	



<b>Evaluation</b>	Successfully completed written and spoken assignments or written and oral test.
<b>Study materials</b>	Self-study possibility: written examination and oral test. Briefing in the beginning of the course. Pass/Fail.
<b>Prerequisites</b>	Online material and exercises: <a href="http://www.uni-tuebingen.de/ael/deuma/deuma_overview.htm">http://www.uni-tuebingen.de/ael/deuma/deuma_overview.htm</a>
<b>Further Information</b>	Courses at the level A2 or equivalent skills. This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b><i>FV12A4600</i></b>	<b><i>GERMAN FOR ENERGY TECHNOLOGY</i></b> <span style="float: right;"><b><i>2 ECTS cr</i></b></span>
	<b>Energietechnik</b>
	<b>The course will be lectured every other year, next during the academic year 2011 - 2012.</b>
<b>Teacher(s)</b>	Lecturer Jörg Wunderlich
<b>CEF Level</b>	Teaching Level B1.
<b>Aims</b>	By the end of the course, students are expected to know basic terminology in the field, to know the grammatical structures needed in technical language, to be able to discuss energy issues, to be able to describe a process, to understand texts on energy technology and to be able to give a presentation in German.
<b>Content</b>	Revision of grammar needed in technical language. Spoken and written exercises on technical language. Topics include e.g. energy production, power plants and energy sources. Language of instruction: German.
<b>Modes of Study</b>	Contact lessons 28, independent work approx. 24 hours. Successfully completed written and spoken assignments or written and oral test. Continuous assessment requires 75% attendance and active participation.
<b>Evaluation</b>	Pass/Fail.
<b>Study materials</b>	Material provided by the teacher.
<b>Prerequisites</b>	Courses at the level A2 or equivalent skills.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b><i>FV12A5201</i></b>	<b><i>GERMAN INDEPENDENT STUDY</i></b> <span style="float: right;"><b><i>1 - 2 ECTS cr</i></b></span>
	<b>Saksan itseopiskelukurssi</b>
<b>Year and Period</b>	Period 1-4
<b>Teacher(s)</b>	Lecturer Jörg Wunderlich
<b>CEF Level</b>	Teaching level: A2.2 - C2.
<b>Aims</b>	Students can improve their German skills at their own pace and according to their own needs following a schedule agreed on with the teacher.
<b>Content</b>	Independent work in German in the student's own field. Can be combined with the student's professional studies. Dependent on what is agreed between the student and teacher, e.g. goals, contents and schedule.
<b>Modes of Study</b>	Independent work approx. 26 or 52 hours. Assessment based on a learning journal and assignments.
<b>Evaluation</b>	Pass/Fail.
<b>Prerequisites</b>	Courses at the level A2 or equivalent skills.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>FV12A5400</b>	<b>GERMAN SELF STUDY COURSE ON ECONOMICS</b>	<b>2 ECTS cr</b>
	<b>Selbststudiumkurs Wirtschaft</b>	
<b>Year and Period</b>	Period 1-4	
<b>Teacher(s)</b>	Lecturer, M.A. Pirjo Rantonen	
<b>CEF Level</b>	B1	
<b>Aims</b>	By the end of the course students are expected to be able to read and understand German texts on economics and be able to apply the vocabulary to their own communication.	
<b>Content</b>	German company strategies, annual reports, result overviews. Texts on management and leadership.	
<b>Modes of Study</b>	Independent study course. Independent work approx. 52 hours. Learning journal. Assessment based on a learning journal and assignments.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Web material.	
<b>Prerequisites</b>	Skills at the level B1.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>FV12A6201</b>	<b>LISTENING COMPREHENSION IN GERMAN</b>	<b>2 ECTS cr</b>
	<b>Hörkurs Deutsch</b>	
<b>Year and Period</b>	Period 1-4	
<b>Teacher(s)</b>	Lecturer Jörg Wunderlich	
<b>CEF Level</b>	Teaching level B1.	
<b>Aims</b>	By the end of the course, students are expected to understand spoken language at a normal pace.	
<b>Content</b>	Listening comprehension exercises. Learning new standard language vocabulary. Language of instruction: German.	
<b>Modes of Study</b>	Self study course. Independent work approx. 26 hours. Listening comprehension test.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	On Blackboard.	
<b>Prerequisites</b>	Courses at the level A2 or equivalent skills.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>FV12A7111</b>	<b>BUSINESS GERMAN 1</b>	<b>2 ECTS cr</b>
	<b>Wirtschaft 1</b>	
<b>Year and Period</b>	Period 1, 3	
<b>Teacher(s)</b>	Part-time Untenured Teacher, M.A. Sanna Heikkeri	
<b>CEF Level</b>	Teaching level B1.	
<b>Aims</b>	By the end of the course, students will be expected to know the most important company forms in Germany and describe them briefly in German, to tell about the structure of one's company extensively in spoken and written form, to evaluate the advantages and disadvantages of different company forms in German, to understand the main practices and principles when applying for a job in Germany, to be able to write an application in German and to be able to act in a job interview according to German customs.	
<b>Content</b>	Fields: company forms, start-up and presentation of a business, applying for a job, recruitment. Vocabulary, spoken, reading and writing exercises related to the field of the course. The course is suitable for students of all faculties.	

<b>Modes of Study</b>	Language of instruction: German. Individual, pair and group work. Contact lessons 28, independent work approx. 24 hours. Continuous assessment and successfully completed written and oral assignments or a written and oral test. Continuous assessment requires 75% attendance and active participation. Students who have taken the course FV12A7600 Wirtschaftssprache Deutsch, FV12A7110 Wirtschaft 1: Personalmanagement tai FV12A7120 Wirtschaft 2: Unternehmen are not eligible for this course because of the similar contents of the courses.
<b>Evaluation</b>	Pass/Fail.
<b>Study materials</b>	Provided by the teacher and on the web.
<b>Prerequisites</b>	Courses at the level A2 or equivalent skills.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>FV12A7121</b>	<b>BUSINESS GERMAN 2</b>	<b>2 ECTS cr</b>
	<b>Wirtschaft 2</b>	
<b>Year and Period</b>	Period 2, 4	
<b>Teacher(s)</b>	Part-time Untenured Teacher, M.A. Sanna Heikkeri	
<b>CEF Level</b>	Teaching level B1.	
<b>Aims</b>	By the end of the course, students are expected to understand the main points of texts on economy in German, know the basic concepts of economics in German and use them in both spoken and written contexts, describe briefly the characteristics of the Finnish and German economies and compare them to other countries.	
<b>Content</b>	Topics dealt with: labour market, wages, cost of living, foreign trade, business cycles. Individual, pair and group work. Vocabulary, reading, discussion and writing exercises related to the topics of the course. Suits students from all faculties. Language of instruction: German.	
<b>Modes of Study</b>	Contact lessons 28, independent work approx. 24 hours. Continuous assessment and successfully completed written and oral assignments or a written and oral test. Continuous assessment requires 75% attendance and active participation. Students who have taken the course FV12A7140 Wirtschaft 4: Volkswirtschaft are not eligible for this course because of the similar contents of the courses.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Provided by the teacher and online.	
<b>Prerequisites</b>	Courses at the level A2 or equivalent skills.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>FV12A7400</b>	<b>GERMAN FOR FOREST INDUSTRY</b>	<b>2 ECTS cr</b>
	<b>Wald und Holz</b>	
	<b>The course will be lectured every other year, next during the academic year 2010 - 2011.</b>	
<b>Year and Period</b>	Period 1	
<b>Teacher(s)</b>	Lecturer Jörg Wunderlich	
<b>CEF Level</b>	Teaching level: B1	
<b>Aims</b>	By the end of the course, students will know basic terminology related to the field, be able to describe issues related to the forest industry, understand texts on the forest industry and know the grammatical structures related to technical language.	
<b>Content</b>	Forestry, wood trade, harvesting, wood processing (sawmills). Revision of grammatical structures needed in technical language.	

<b>Modes of Study</b>	Oral exercises during contact lessons once a week. Language of instruction: German. Contact lessons 14, independent work (online) approx. 38 hours. Successfully completed written and spoken assignments or written and oral test. Continuous assessment requires 75% attendance and active participation. Possibility for independent study: a written examination and an oral test required for a passing grade. Briefing at the beginning of the course.
<b>Evaluation</b>	Pass/Fail.
<b>Study materials</b>	Material and exercises online: <a href="http://www.uni-tuebingen.de/ael/ilegefes/ilegefes_overview.htm">http://www.uni-tuebingen.de/ael/ilegefes/ilegefes_overview.htm</a>
<b>Prerequisites</b>	Courses at the level A2 or equivalent skills.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>FV12A7801</b>	<b>ENVIRONMENTAL ISSUES IN GERMAN</b>	<b>2 ECTS cr</b>
	<b>Deutsch für die Umwelt</b>	
	<b>The course will be lectured every other year, next during the academic year 2010 - 2011.</b>	
<b>Year and Period</b>	Period 3	
<b>Teacher(s)</b>	Lecturer Jörg Wunderlich	
<b>CEF Level</b>	Teaching level B1.	
<b>Aims</b>	By the end of the course, students are expected to know the basic terminology in the field, be able to describe the environment orally and in writing, understand texts on nature's processes, know the necessary grammatical structures and be able to study in an international environment.	
<b>Content</b>	Basic environmental issues, such as air, water, soil, waste. Language of instruction: German.	
<b>Modes of Study</b>	Contact lessons 14, independent work (online) approx. 38 hours. Spoken exercises during contact lessons once a week. Successfully completed written and spoken assignments or written and oral test. Continuous assessment requires 75% attendance and active participation. Possibility for independent study: a written examination and an oral test required for a passing grade. Briefing at the beginning of the course.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Online exercises ( <a href="http://www.uni-tuebingen.de/entecnet/">http://www.uni-tuebingen.de/entecnet/</a> ) and handouts in class.	
<b>Prerequisites</b>	Courses at the level A2 or equivalent skills.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>FV12A8401</b>	<b>WRITTEN BUSINESS COMMUNICATION IN GERMAN</b>	<b>2 ECTS cr</b>
	<b>Schriftliche Geschäftskommunikation</b>	
<b>Year and Period</b>	Period 1-4	
<b>Teacher(s)</b>	Lecturer Jörg Wunderlich	
<b>CEF Level</b>	Teaching level B1.	
<b>Aims</b>	By the end of the course, students will be able to communicate in German in a business environment, know basic terminology in the field and know the basic grammatical structures.	
<b>Content</b>	Written business communication, such as e-mails and letters. Topics: enquiry, call for tenders, tender, order, confirmation, complaint, reply to complaint, request for payment.	

<b>Modes of Study</b>	Language of instruction: German. Independent study course. Independent work approx. 52 hours. Written test. Briefing at the beginning of the course.
<b>Evaluation</b>	Students who have taken the course FV12A8400 Geschäftskommunikation are not eligible for this course because of the similar contents of the courses.
<b>Study materials</b>	Pass/Fail. Online course.
<b>Prerequisites</b>	Courses at the level A2.2 or equivalent skills.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>FV14A1801</b>	<b>CASES IN RUSSIAN</b>	<b>3 ECTS cr</b>
	<b>Venäjän sijamuodot, Русские падежи</b>	
	<b>Independent study course.</b>	
<b>Year and Period</b>	Period 3-4	
<b>Teacher(s)</b>	Lecturer, B.A. Natalia Kurilova	
<b>CEF Level</b>	Entry and target level: A2.	
<b>Aims</b>	By the end of the course, students will recognise the Russian cases and be able to use them in a variety of phrases.	
<b>Content</b>	Five grammar exercise packages. Improving and developing knowledge of grammar, especially cases in Russian texts (singular and plural nouns, adjectives and pronouns in the nominative, genitive, dative, accusative, instrumental and prepositional). The different meanings of Russian cases. Can be included in minor studies in Russian.	
<b>Modes of Study</b>	Language of instruction: Russian. Independent work approx. 78 hours. Introductory lecture at the beginning of the 3rd period. The observation of schedules and deadlines is important. Continuous assessment based on online assignments or a written exam.	
<b>Evaluation</b>	0 - 5.	
<b>Study materials</b>	This is a Blackboard course. Material available online for the course participants.	
<b>Prerequisites</b>	Basic knowledge of cases in Russian.	

<b>FV14A3001</b>	<b>RUSSIAN INTENSIVE COURSE IN ST. PETERSBURG</b>	<b>3 ECTS cr</b>
	<b>Venäjän kielen intensiivikurssi Pietarissa, Русский язык интенсивно в Санкт-Петербурге</b>	
<b>Year and Period</b>	Period 3	
<b>Teacher(s)</b>	Person in Charge: Russia Coordinator, B.A. Riitta Salminen	
<b>CEF Level</b>	Target level: A2	
<b>Aims</b>	By the end of the course, students will be expected to speak Russian more fluently and understand spoken language better and understand the Russian way of life.	
<b>Content</b>	Oral communication exercises and revision of grammar with a native Russian instructor. The course can be included in Russian as a minor subject.	
<b>Modes of Study</b>	Language of instruction: Russian. Contact lessons approx. 24, independent work approx. 54 h. The course will be held in the spring semester, exact dates and times will be given later. Registration in October. Five to ten students will be accepted. The course is aimed at students at a more advanced level. Active participation required. Written and oral tests at the end of the course.	

<b>Evaluation</b>	Pass/Fail.
<b>Prerequisites</b>	An advanced course in Russian, at least Russian for Working Life/Russian 3 required.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>FV14A8500</b>	<b>WORKING IN RUSSIA AND REPORTING</b> <b>3 ECTS cr</b>
	<b>Työskentely Venäjällä ja raportointi</b>
<b>Year and Period</b>	Period 1-4
<b>Teacher(s)</b>	Part-time Untenured Teacher, N. N.
<b>CEF Level</b>	Entry level: C1.
<b>Aims</b>	Getting to know Russian culture and developing practical language skills.
<b>Content</b>	Students who have worked in Russia for at least a month write a report in Russian based on learning assignments, analysing what they have learned about the language and culture. Can be included in minor studies in Russian. Languages of instruction: Finnish and Russian.
<b>Modes of Study</b>	Independent work approx. 78 h. The instructor gives the student learning assignments before going to Russia.
<b>Evaluation</b>	An oral presentation on the report will be given to the instructor after the trip. Assessment based on the report and presentation. 0 - 5.
<b>Prerequisites</b>	A basic knowledge of Russian.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>FV14A9000</b>	<b>RUSSIAN STUDIES IN RUSSIA</b> <b>9 ECTS cr</b>
	<b>Opiskelu venäläisessä yliopistossa, Изучение русского языка в российском вузе</b>
<b>Year and Period</b>	Period 1-4
<b>Teacher(s)</b>	Person in Charge: Lecturer, M.A. Pirjo Seppänen-Katajisto
<b>CEF Level</b>	Entry level: B1
<b>Content</b>	Students may have a maximum of 9 ECTS credits transferred for Russian language studies completed at a university in Russia. Language of instruction: Russian.
<b>Evaluation</b>	Pass/Fail.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.
<b>FV15A1210</b>	<b>BASIC COURSE IN FRENCH 1</b> <b>2 ECTS cr</b>
	<b>Ranskan peruskurssi 1</b>
<b>Year and Period</b>	Period 1, 2, 3
<b>Teacher(s)</b>	Lecturer, M.A. David Erent Lecturer, M.A. Vuokko Paakkonen
<b>CEF Level</b>	Entry level: 0, target level: A1
<b>Aims</b>	By the end of the course, students are expected to understand spoken language when it is slow, clear and related to topics discussed during the course, to use simple sentences to talk about themselves, to write a very simple text, to understand key words in a text related to topics discussed during the course and to use polite phrases and expressions typical of the French communication culture.
<b>Content</b>	Communication: introducing and describing oneself, communicating on the phone and by e-mail (in a very simple way), basic differences between formal and informal communication, proposing questions, expressing preferences. Structures: verbs in the present tense, articles, prepositions of place,

<b>Modes of Study</b>	prepositions à and de, personal pronouns, structures expressing ownership, negations, questions, numerals. Languages of instruction: French, Finnish and English. Exercises that support communication skills. Contact lessons 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous evaluation. Continuous evaluation requires 75% attendance and active participation. Students who have taken the course FV15A1200 French 1 are not eligible for this course because of the similar contents of the courses.
<b>Evaluation</b>	Possibility for independent study: successfully completed written assignments, a written examination and an oral test required for a passing grade.
<b>Study materials</b>	Pass/Fail. Written exam 50%, oral test or continuous evaluation 50%. Béatrice TAUZIN, Anne-Lyse DUBOIS: Objectif Express, units 1 - 3. Material on Blackboard.
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b>FV15A1220</b>	<b>BASIC COURSE IN FRENCH 2</b>	<b>2 ECTS cr</b>
<b>Year and Period</b>	<b>Ranskan peruskurssi 2</b>	
<b>Teacher(s)</b>	Period 2, 3, 4 Lecturer, M.A. David Erent Lecturer, M.A. Vuokko Paakkonen	
<b>CEF Level</b>	Entry level: A1.1, target level: A1.2	
<b>Aims</b>	By the end of the course, students are expected to understand spoken language when it is slow, clear and related to topics discussed during the course, to use simple sentences to talk about themselves and their work, to use and understand simple sentences on the phone, to write very simple texts, to understand key words in a text related to topics discussed during the course and to use polite phrases and expressions typical of the French communication culture.	
<b>Content</b>	Communication: communication when travelling, describing residences, describing objects, expressing and understanding times and timetables, communication on the phone and by e-mail. Structures: articles, personal pronouns, verbs in the future tense, passé composé, construction and placement of adjectives, prepositions of place. Languages of instruction: French, Finnish and English.	
<b>Modes of Study</b>	Exercises that support communication skills. Contact lessons 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous evaluation. Continuous evaluation requires 75% attendance and active participation. Students who have taken the course FV15A1200 French 1 are not eligible for this course because of the similar contents of the courses.	
<b>Evaluation</b>	Possibility for independent study: successfully completed written assignments, a written examination and an oral test required for a passing grade. Pass/Fail.	
<b>Study materials</b>	Written exam 50%, oral test or continuous evaluation 50% Béatrice TAUZIN, Anne-Lyse DUBOIS: Objectif Express 1, units 4 - 5. Material on Blackboard.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	

<b>FV15A1410</b>	<b>INTERMEDIATE COURSE IN FRENCH 1</b>	<b>2 ECTS cr</b>
<b>Year and Period</b>	<b>Ranskan jatkokurssi 1</b>	
<b>Teacher(s)</b>	Period 1, 3 Lecturer, M.A. David Erent	
<b>CEF Level</b>	Entry level: A1.2, target level: A2.1	
<b>Aims</b>	By the end of the course, students are expected to cope in situations practised	

<b>Content</b>	during the course, to be able to discuss topics introduced during the course using simple sentences, to write short texts on topics introduced during the course, to understand the main idea of texts on topics discussed during the course and to understand and apply the most important French customs. Communication: talking about work, the working place and conditions, presenting a company (very briefly), talking about products, going to a restaurant, shopping, talking about food, communication related to job application: writing a CV. Structures: articles, prepositions, imperfect, partitive, interrogative pronouns, demonstratives, personal pronouns.
<b>Modes of Study</b>	Languages of instruction: French, Finnish and English. Exercises that support communication skills. Contact lessons 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Students who have taken the course FV15A1400 French 2 are not eligible for this course because of the similar contents of the courses. Possibility for independent study: successfully completed written assignments, a written examination and an oral test required for a passing grade.
<b>Evaluation</b>	Pass/Fail.
<b>Study materials</b>	Written examination 50%, oral test or continuous assessment 50% Béatrice TAUZIN, Anne-Lyse DUBOIS: Objectif Express 1, units 6 - 8. Material on Blackboard.
<b>Prerequisites</b>	French 1 or equivalent skills.
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b><i>FV15A1420</i></b>	<b><i>INTERMEDIATE COURSE IN FRENCH 2</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Ranskan jatkokurssi 2</b>	
<b>Year and Period</b>	Period 2, 4	
<b>Teacher(s)</b>	Lecturer, M.A. David Erent	
<b>CEF Level</b>	Entry level: A2.1, target level: A2.2	
<b>Aims</b>	By the end of the course, students are expected to cope in situations practised during the course, to be able to discuss topics introduced during the course using simple phrases, to write a short and simple text related to topics discussed during the course, to understand the main idea of texts on topics discussed during the course ja to understand and apply the most important French customs.	
<b>Content</b>	Communication: talking about the working day, describing production processes (in an very simple way), giving and understanding instructions, prohibitions and suggestions, talking about failures and fixing them, going to the bank, going to a doctor, describing people, talking about the past and future. Structures: articles, imperfect and passé composé, future, conditional, imperative, objects of personal pronouns, relative pronouns. Languages of instruction: French, Finnish and English.	
<b>Modes of Study</b>	Exercises that support communication skills. Contact lessons 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Students who have taken the course FV15A1400 French 2 are not eligible for this course because of the similar contents of the courses. Possibility for independent study: successfully completed written assignments, a written examination and an oral test required for a passing grade.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Written examination 50%, oral test or continuous assessment 50%. Béatrice TAUZIN, Anne-Lyse DUBOIS: Objectif Express 1, units 8 - 10. Material on Blackboard.	



<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	
<b>FV15A1500</b>	<b>FRENCH PRONUNCIATION</b>	<b>2 ECTS cr</b>
	<b>Ranskan ääntämiskurssi</b>	
<b>Year and Period</b>	Period 1	
<b>Teacher(s)</b>	Lecturer, M.A. David Erent	
<b>CEF Level</b>	Entry level: A1.	
<b>Aims</b>	By the end of the course, students are expected to pronounce correctly the speech sounds practised during the course, to identify the speech sounds practised during the course based on their spelling, read texts aloud according to French liaison rules, read texts aloud according to French intonation and rhythm, to identify the sounds practised during the course in speech and utilise them in listening comprehension, to utilise phonetic writing to support correct pronunciation and to identify mistakes in their own pronunciation and to correct them.	
<b>Content</b>	The French vowel and consonant sounds, of which the most important ones for oral communication will be handled in more detail. The writing corresponding to the sounds. Phonetic symbols. Liaison, rhythm and intonation. Languages of instruction: French or Finnish. If there are exchange students in the group, they will get instruction in English, if needed.	
<b>Modes of Study</b>	Pronunciation and listening comprehension exercises in the language lab. Contact lessons 28, independent work approx. 24 hours. Approved exercises. Continuous assessment (requires at least 50% attendance and active participation) or a final exam.	
<b>Evaluation</b>	Pass/Fail. Exercises 50%, continuous assessment or the final exam 50%.	
<b>Study materials</b>	Provided by the teacher. Material on Blackboard.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	
<b>FV15A1550</b>	<b>LISTENING SKILLS IN FRENCH</b>	<b>2 ECTS cr</b>
	<b>Ranskan kuullunymmärtämiskurssi</b>	
<b>Year and Period</b>	Period 3	
<b>Teacher(s)</b>	Lecturer, M.A. Vuokko Paakkonen	
<b>CEF Level</b>	Entry level A2.	
<b>Aims</b>	By the end of the course, students are expected globally to understand short recordings and short speech in standard language.	
<b>Content</b>	Characteristics of spoken language: intonation, liaison, elision, expressions of spoken language. Methods supporting listening comprehension (for instance recognition of key words).	
<b>Modes of Study</b>	Listening comprehension exercises in class and as homework. Contact lessons 14, independent study approx. 38 hours. Continuous assessment or listening comprehension test.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Provided by the teacher.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	

<b>FV15A1610</b>	<b>FRENCH FOR WORKING LIFE 1</b>	<b>2 ECTS cr</b>
	<b>Työelämän ranskaa 1</b>	
<b>Year and Period</b>	Period 1	
<b>Teacher(s)</b>	Lecturer, M.A. David Erent	
<b>CEF Level</b>	Entry level: A2.2, target level: B1.1	
<b>Aims</b>	By the end of the course, students are expected to be able to cope orally and in writing in the work-related situations practised on the course and to understand and apply the most important French work related customs.	
<b>Content</b>	Communication: describing tasks, describing action plans, describing the operation of equipment, describing products, communicating in meetings, talking about projects, talking about marketing, communicating on the phone and by e-mail. Structures: articles, prepositions, pronouns, present tense, passé composé and imperfect, future and conditional. Language of instruction: French.	
<b>Modes of Study</b>	Exercises that support communication skills. Contact lessons 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Students who have taken the course FV15A1600 French for working life are not eligible for this course because of the similar contents of the courses. Possibility for independent study: successfully completed written assignments, a written examination and an oral test required for a passing grade.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Written examination 50%, oral test or continuous assessment 50% Béatrice TAUZIN, Anne-Lyse DUBOIS: Objectif Express 2, units 1 - 3. Material on Blackboard.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	

<b>FV15A1620</b>	<b>FRENCH FOR WORKING LIFE 2</b>	<b>2 ECTS cr</b>
	<b>Työelämän ranskaa 2</b>	
<b>Year and Period</b>	Period 2	
<b>Teacher(s)</b>	Lecturer, M.A. David Erent	
<b>CEF Level</b>	Entry level: B1.1, target level: B1.2	
<b>Aims</b>	By the end of the course, students are expected to be able to cope orally and in writing in various work-related situations practised on the course and to understand and apply the most important French work related customs.	
<b>Content</b>	Communication: making a complaint and responding to it, responding to problems, explaining and specifying problems, expressing one's will and intentions, recommendations, giving operating instructions, talking about the past, describing companies, communicating on the phone and by mail. Structures: articles, prepositions, present tense, passé composé and imperfect, past perfect, conditional, direct speech and reported clause, expressing causes and time. Language of instruction: French.	
<b>Modes of Study</b>	Exercises that support communication skills. Contact lessons 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Students who have taken the course FV15A1600 French for working life are not eligible for this course because of the similar contents of the courses. Possibility for independent study: successfully completed written assignments, a written examination and an oral test required for a passing grade.	
<b>Evaluation</b>	Pass/Fail. Written examination 50%, oral test or continuous assessment 50%	

<b>Study materials</b>	Béatrice TAUZIN, Anne-Lyse DUBOIS: Objectif Express 2, units 3 - 5. Material on Blackboard.
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.

<b><i>FV15A5010</i></b>	<b><i>BUSINESS FRENCH 1</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Français de l'entreprise 1</b>	
<b>Year and Period</b>	Period 3	
<b>Teacher(s)</b>	Lecturer, M.A. David Erent	
<b>CEF Level</b>	Entry level: B1.2	
<b>Aims</b>	By the end of the course, students are expected to be able to communicate both orally and in writing in work-related situations practised during the course and to understand and apply the most important French work-related customs.	
<b>Content</b>	Communication: communication related to organising events at work, communication in meetings (both written and oral), understanding texts and interviews related to business life, reclamations and reacting to them, expressing opinions and reacting to them, communication by mail and e-mail. Structures: adverbs, structures expressing aims and consequences, past perfect, subjunctive, past tense conditional, passive, structures expressing emphasis.	
<b>Modes of Study</b>	Language of instruction: French. Exercises that support communication skills. Contact lessons 28, independent study approx. 24 hours.	
<b>Evaluation</b>	Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Students who have taken the course FV15A5000 Français de l'entreprise are not eligible for this course because of the similar contents of the courses.	
<b>Study materials</b>	0 - 5 Written examination 50%, oral test or continuous assessment 50%.	
<b>Further Information</b>	Béatrice TAUZIN, Anne-Lyse DUBOIS: Objectif Express 2, units 6 - 8. Material on Blackboard. This course has 6-10 places for open university students. More information on the web site for open university instruction.	

<b><i>FV15A5020</i></b>	<b><i>BUSINESS FRENCH 2</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Français de l'entreprise 2</b>	
<b>Year and Period</b>	Period 4	
<b>Teacher(s)</b>	Lecturer, M.A. David Erent	
<b>CEF Level</b>	Entry level: B1	
<b>Aims</b>	By the end of the course, students are expected to be able to communicate successfully both orally and in writing in work-related situations practised during the course and to understand and apply the most important French work-related customs.	
<b>Content</b>	Communication: conversations, arguments, negotiations, oral presentation and responding to it. Structures: connectors, subjunctive, gerund, futur antérieur. Language of instruction: French.	
<b>Modes of Study</b>	Exercises that support communication skills. Contact lessons 28, independent study approx. 24 hours.	
<b>Evaluation</b>	Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation.	
<b>Study materials</b>	0 - 5 Written examination 50%, oral test or continuous assessment 50%.	
<b>Further Information</b>	Béatrice TAUZIN, Anne-Lyse DUBOIS: Objectif Express 2, units 8 - 10. Material on Blackboard. This course has 6-10 places for open university students. More information on the web site for open university instruction.	

<b><i>FV15A5500</i></b>	<b><i>SUGGESTOPEDIC COURSE IN BUSINESS FRENCH</i></b>	<b><i>2 ECTS cr</i></b>
	<b>Yrityselämän ranskaa suggestopedian avulla</b>	
	<b>This course is suitable for both business and technology students. It is also suitable for students leaving for exchange.</b>	
<b>Year and Period</b>	Period 3	
<b>Teacher(s)</b>	Lecturer, M.A. Vuokko Paakkonen	
<b>CEF Level</b>	Entry level: B1.	
<b>Aims</b>	By the end of the course, students are expected to be able to communicate orally in changing and even surprising work-related situations, to understand speech on varying topics in work-related situations, to communicate orally more unreservedly and spontaneously than at the beginning of the course and to encounter new situations more boldly than before.	
<b>Content</b>	Subjects: mainly the same situations as in the courses French for Working Life and Français de l'entreprise, communicating orally using the suggestopedic method. Revising the most important structures and slightly extending the vocabulary of the above-mentioned courses. Language of instruction: French.	
<b>Modes of Study</b>	Pair and group work using role play, relaxation techniques, and exercises improving creativity. Contact lessons 28. This is a weekend course; the dates and times will be agreed upon with the students. Introductory session at the beginning of the 3rd period.	
<b>Evaluation</b>	Learning journal. Continuous assessment and the suggestopedic method require 80% attendance and active participation.	
<b>Study materials</b>	Pass/Fail.	
<b>Further Information</b>	Provided by the teacher. This course has 6-10 places for open university students. More information on the web site for open university instruction.	
<b><i>FV15A6001</i></b>	<b><i>INTERCULTURAL COURSE IN FRENCH</i></b>	<b><i>3 ECTS cr</i></b>
	<b>Cours interculturel</b>	
	<b>This course is suitable for French students, as well.</b>	
<b>Year and Period</b>	Period 4	
<b>Teacher(s)</b>	Lecturer, M.A. David Erent	
<b>CEF Level</b>	Teaching level: B1.	
<b>Aims</b>	By the end of the course, Finnish students are expected to be able to describe the Finnish people and culture to a French speaking person, paying attention to the characteristics of the French culture, and to apply the interactive skills practiced during the course when encountering a new culture. By the end of the course, French speaking students are expected to know the Finnish people and the Finnish culture in general terms and to pay attention to the characteristics of the Finnish culture when communicating with a Finn and to apply the interactive skills practiced during the course when encountering a new culture.	
<b>Content</b>	Subjects related to Finland that will be agreed upon with the students and discussed in small groups. Every task consists of the preparation phase, presenting the task and the following conversation.	
<b>Modes of Study</b>	Contact lessons 28. Independent study (incl. group work) approx. 50 hours. Approved exercises and continuous assessment, requires 75% attendance and active participation.	
<b>Evaluation</b>	Pass/Fail.	

<b>Study materials</b>	Provided by the teacher and the students.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>FV15A9301</b>	<b>FRENCH INDEPENDENT STUDY</b>	<b>1 - 4 ECTS cr</b>
	<b>Ranskan itseopiskelukurssi tekniikan ja kauppatieteiden opiskelijoille</b>	
<b>Year and Period</b>	Period 1-2, 3-4, 5	
<b>Teacher(s)</b>	Lecturer, M.A. Vuokko Paakkonen	
<b>CEF Level</b>	Entry level: B1	
<b>Aims</b>	By the end of the course, students must demonstrate having improved their independent study skills and attained the goals in their study plan for developing language and communication skills.	
<b>Content</b>	Students define the contents in their study plan in detail. Languages of instruction: French or Finnish.	
<b>Modes of Study</b>	Independent work following an individual study plan, approximately 25 - 103 hours. The course is completed in the form of tutored independent study; meetings with the teacher are discussed at the beginning of the course. The course can be integrated with business or technology studies or studies abroad. An introductory session is arranged at the beginning of the 1st, 3rd and 5th period.	
<b>Evaluation</b>	Pass/Fail based on assignments and a learning journal.	
<b>Study materials</b>	Chosen by the student.	
<b>Further Information</b>	This course has 11-15 places for open university students. More information on the web site for open university instruction.	

<b>FV16A1210</b>	<b>BASIC COURSE IN SPANISH 1</b>	<b>2 ECTS cr</b>
	<b>Espanjan peruskurssi 1</b>	
<b>Year and Period</b>	Period 1, 2, 3, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Sari Pärssinen Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	Entry level: 0	
<b>Aims</b>	By the end of the course, students are expected to be able to use simple structures and vocabulary in presentations both in studies and in the world of work and to introduce themselves both orally and in writing.	
<b>Content</b>	Introducing oneself, professions, presentations, hobbies. Structures: pronouns, nouns, adjectives and verbs in the present tense. Languages of instruction: Finnish and Spanish.	
<b>Modes of Study</b>	Exercises that support communication skills. Contact hours 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Students who have passed the course FV16A1200 Spanish 1 are not eligible for this course because of the similar contents of the courses. Possibility for independent study: a written examination and an oral test required for a passing grade.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Es español (units 1 - 3) Blackboard: "Recursos en español"	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>FV16A1220</b>	<b>BASIC COURSE IN SPANISH 2</b>	<b>2 ECTS cr</b>
	<b>Espanjan peruskurssi 2</b>	
<b>Year and Period</b>	Period 1, 2, 3, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Sari Pärssinen Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	Entry level: A1.1	
<b>Aims</b>	By the end of the course, students are expected to be able to use basic structures and vocabulary related to both studies and work, to describe a place of residence, to ask for directions, and to communicate in restaurants and shops.	
<b>Content</b>	Describing places of residence, location, going to a restaurant, food, describing things. Structures: pronouns, comparative forms of adjectives, "to be". Languages of instruction: Finnish and Spanish.	
<b>Modes of Study</b>	Exercises that support communication skills. Contact hours 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Students who have passed the course FV16A1200 Spanish 1 are not eligible for this course because of the similar contents of the courses. Possibility for independent study: a written examination and an oral test required for a passing grade.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Es español (units 4 - 6). Blackboard: "Recursos en español"	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>FV16A1251</b>	<b>ESSENTIAL SPANISH VOCABULARY</b>	<b>1 ECTS cr</b>
	<b>Espanjan kielen ydinsanasto</b>	
	<b>Independent study course. Cannot be included in compulsory language studies.</b>	
<b>Year and Period</b>	Period 3, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Sari Pärssinen	
<b>CEF Level</b>	A1 - C2	
<b>Aims</b>	By the end of the course students will be expected to know the essential Spanish vocabulary. An extended vocabulary will improve the students' performance in further Spanish courses.	
<b>Content</b>	Areas of vocabulary: essential verbs, verbs in connection with pronouns, applying for a job, presenting a company, communication both in daily and work-related situations.	
<b>Modes of Study</b>	Independent study approx. 26 hours. A written exam in the exam aquarium. Students who have passed the course FV16A1250 Basic Spanish Vocabulary are not eligible for this course because of the similar contents of the courses.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Glossary provided by the teacher. Blackboard: "Recursos en español".	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>FV16A1410</b>	<b>INTERMEDIATE COURSE IN SPANISH 1</b>	<b>2 ECTS cr</b>
	<b>Espanjan jatkokurssi 1</b>	
<b>Year and Period</b>	Period 1, 2, 3, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Sari Pärssinen Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	Entry level: A1.2	
<b>Aims</b>	By the end of the course, students are expected to be able to use structures and vocabulary needed in communication situations both at work and in everyday life and to relate events from the recent past both orally and in writing.	
<b>Content</b>	Spare time, everyday life, body parts, expressing opinions, making appointments, telling about the past. Structures: pronouns, gerund, reflexive verbs, adverbs, perfect tense. Languages of instruction: Finnish and Spanish.	
<b>Modes of Study</b>	Exercises that support communication skills. Contact lessons 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Students who have passed the course FV16A1400 Spanish 2 are not eligible for this course because of the similar contents of the courses. Possibility for independent study: a written examination and an oral test required for a passing grade.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Es español (units 7 - 9). Blackboard: "Recursos en español"	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>FV16A1420</b>	<b>INTERMEDIATE COURSE IN SPANISH 2</b>	<b>2 ECTS cr</b>
	<b>Espanjan jatkokurssi 2</b>	
<b>Year and Period</b>	Period 1, 2, 3, 4	
<b>Teacher(s)</b>	Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	Entry level: A1.2+	
<b>Aims</b>	By the end of the course, students are expected to be able to use the structures and vocabulary needed in communication situations both at work and in daily life and to describe the past both orally and in writing.	
<b>Content</b>	Describing events and situations in the past, work history, future plans. Structures: pronouns, imperfect, preterite, past perfect, relative sentences. Languages of instruction: Finnish and Spanish.	
<b>Modes of Study</b>	Exercises that support communication skills. Contact lessons 28, independent study approx. 24 hours. Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Students who have passed the course FV16A1400 Spanish 2 are eligible for this course because of the similar contents of the courses. Possibility for independent study: a written examination and an oral test required for a passing grade.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Es español (units 10 - 12). Blackboard: "Recursos en español"	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>FV16A1602</b>	<b>SPANISH FOR WORKING LIFE</b>	<b>3 ECTS cr</b>
	<b>Työelämän espanjaa</b>	
<b>Year and Period</b>	Period 1, 3	
<b>Teacher(s)</b>	Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	Entry level: A2.1	
<b>Aims</b>	By the end of the course, students are expected to be able to use the structures and vocabulary needed in work-related communication situations, to express opinions, to present companies orally and to apply for a job in writing.	
<b>Content</b>	Expressing opinions, applying for a job, invitations, meetings, presenting a company, organisational structure, corporate culture. Structures: subjunctive, conditional.	
<b>Modes of Study</b>	Languages of instruction: Finnish and Spanish. Exercises that support communication skills. Contact lessons 28, independent study approx. 50 hours.	
<b>Evaluation</b>	Written examination. Oral test or grade based on continuous assessment. Continuous assessment requires 75% attendance and active participation. Possibility for independent study: a written examination and an oral test required for a passing grade.	
<b>Study materials</b>	Pass/Fail. Socios 2 (units 1 - 5).	
<b>Prerequisites</b>	FV16A1420 Intermediate Course in Spanish 2, FV16A1400 Spanish 2 or equivalent skills.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>FV16A1702</b>	<b>UNDERSTANDING SPANISH AROUND THE WORLD</b>	<b>3 ECTS cr</b>
	<b>Entender español en el mundo</b>	
	<b>Independent study</b>	
<b>Year and Period</b>	Period 3-4	
<b>Teacher(s)</b>	Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	Entry level: A2.2	
<b>Aims</b>	By the end of the course, students are expected to understand the regular speech of native Spanish speakers (intonation, sentence structures and pace) and to have improved their listening comprehension and writing skills.	
<b>Content</b>	100 - 150 minutes of audio files, short movies and video interviews. The course includes written assignments based on the AV-material (e.g. content questions and essays).	
<b>Modes of Study</b>	Successful completion requires both written assignments and an oral interview with the teacher. Independent work approx. 78 h.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Material provided by the teacher. Blackboard: "Recursos en español".	
<b>Prerequisites</b>	Intermediate course in Spanish 2, Spanish 2 or equivalent skills.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	
<b>FV16A2203</b>	<b>FACTS ABOUT SPAIN</b>	<b>4 ECTS cr</b>
	<b>Conozca España</b>	
<b>Year and Period</b>	Period 3-4	
<b>Teacher(s)</b>	Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	Entry level: A2.2	
<b>Aims</b>	By the end of the course, students are expected to be familiar with Spain and	



<b>Content</b>	its geography, history, society and economy as well as the Spanish culture. Learning about historical events and changes in Spain from various points of view. Topics dealt with during the course include e.g. culture, society, economy, politics and current issues as well as the global presence and importance of the Spanish language. Language of instruction: Spanish.
<b>Modes of Study</b>	There are two options for completing the course: 1) Successfully completed written assignments or a written exam. Contact lessons 28 and independent work approx. 76 hours. (Not available during the academic year 2010 - 2011.) 2) During an exchange period in Spain, by completing the assignments previously agreed upon with the instructor responsible for the course.
<b>Evaluation</b>	Pass/Fail.
<b>Study materials</b>	Will be agreed upon with the teacher. Blackboard: "Recursos en español".
<b>Prerequisites</b>	Spanish for Working Life or equivalent skills.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b><i>FV16A3201</i></b>	<b><i>BUSINESS SPANISH</i></b>	<b><i>3 ECTS cr</i></b>
	<b>Español de negocios</b>	
<b>Year and Period</b>	Period 2, 4, 3-4	
<b>Teacher(s)</b>	Lecturer, M.A. Sari Pärssinen Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	Entry level: A2.2	
<b>Aims</b>	By the end of the course, students are expected to be able to communicate in Spanish in basic business situations, to understand the business culture of the Spanish speaking countries and to present and market products.	
<b>Content</b>	Business culture, products, marketing, business communication in the Spanish-speaking world. Grammar contents: conditional, advanced subjunctive, indirect speech. Also suited for technology students. Language of instruction: Spanish.	
<b>Modes of Study</b>	Exercises that support business communication. Students give a presentation on a Finnish or Spanish company. Contact lessons 28, independent work approximately 50 hours. The grade will be based either on the continuous evaluation of students or a written test plus the completion of some oral exercises. This will be agreed with the teacher at the beginning of the course. The course can also be carried out in a Spanish-speaking country by completing assignments given in advance by the teacher.	
<b>Evaluation</b>	0 - 5.	
<b>Study materials</b>	Socios 2 (units 6 - 12). Blackboard: "Recursos en español".	
<b>Prerequisites</b>	Spanish for Working Life or equivalent skills.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b><i>FV16A5202</i></b>	<b><i>INTERCULTURAL SPANISH COURSE</i></b>	<b><i>4 ECTS cr</i></b>
	<b>Curso intercultural entre Finlandia y España</b>	
<b>Year and Period</b>	Period 3	
<b>Teacher(s)</b>	Part-time Untenured Teacher, N. N.	
<b>CEF Level</b>	Entry level: B1.	
<b>Aims</b>	By the end of the course, students are expected to be able to describe Finns, Finland and the Finnish culture in Spanish, and to compare these issues to the corresponding Spanish ones.	
<b>Content</b>	The cultural characteristics of Spain and Finland. Subjects include history,	

<b>Modes of Study</b>	geography, culture and society. Students may suggest subjects of their own interest. The emphasis will be on cultural cooperation. Language of instruction: Spanish. The teacher will lead the discussion and comparison of the cultures together with Spanish exchange students. Students will give a presentation in pairs, in which they compare the Finnish and Spanish cultures.
<b>Evaluation</b>	Contact lessons 28, independent study approx. 76 hours.
<b>Study materials</b>	Continuous assessment (requires 75% attendance and active participation). Pass/Fail. Handouts in class. Blackboard: "Recursos en español".
<b>Prerequisites</b>	Spanish for Working Life or equivalent skills.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b><i>FV18A9101</i></b>	<b><i>FINNISH 1</i></b>	<b><i>2 ECTS cr</i></b>
<b>Year and Period</b>	Finnish 1 Period 1, 3	
<b>Teacher(s)</b>	Lecturer, M.A. Elina Häkkinen	
<b>CEF Level</b>	A1.1	
<b>Aims</b>	After the course students are expected to be able to understand a very simple and slow Finnish conversation about topics dealt with during the course, to tell about themselves in Finnish using very simple expressions, to use simple Finnish everyday phrases, to understand the main contents of a very simple text on concrete topics with the help of a dictionary, and to write very simple sentences on course topics with the help of a dictionary.	
<b>Content</b>	Topics: greeting people, introducing oneself, telling about one's plans and schedules, asking for the price, grocery shopping, family, telling time. Grammar: the Finnish phonetic and orthographic system, numbers, verb conjugation, negative sentences, questions, partitive, genitive, consonant gradation, i>e change.	
<b>Modes of Study</b>	The languages of instruction: Finnish and English. Individual and group work that supports learning to communicate in Finnish. Contact lessons 28, homework approximately 24 hours. A written examination.	
<b>Evaluation</b>	Pass/Fail.	
<b>Study materials</b>	Handouts given in class.	
<b>Prerequisites</b>	No previous knowledge of the Finnish language is expected.	

<b><i>FV18A9201</i></b>	<b><i>FINNISH 2</i></b>	<b><i>2 ECTS cr</i></b>
<b>Year and Period</b>	Finnish 2 Period 2, 4	
<b>Teacher(s)</b>	Lecturer, M.A. Elina Häkkinen	
<b>CEF Level</b>	A1.1	
<b>Aims</b>	By the end of the course, students are expected to be able to 1. take part in very simple conversations on topics dealt with during the course, 2. cope orally in simple everyday situations which are dealt with during the course, 3. understand directions, 4. relate what happened in the past.	
<b>Content</b>	Topics: location, travelling, shopping, clothes, weather, seasons, hobbies, asking for directions. Grammar: locative cases, postpositions, object cases, 3rd infinitive, singular imperative, past tense.	
<b>Modes of Study</b>	Languages of instruction: Finnish and English. Simple written texts and tasks will be studied both in class and as homework. In the classroom, the newly learnt language material will be practiced by	

<b>Evaluation</b>	working in pairs and groups, and through other similar activities. Contact lessons 28, homework approximately 24 hours.
<b>Study materials</b>	A written examination.
<b>Prerequisites</b>	Pass/Fail. Handouts given in class. Finnish 1 or equivalent knowledge.
<b><i>FV18A9301</i></b>	<b><i>FINNISH 3</i></b> <span style="float: right;"><b><i>2 ECTS cr</i></b></span>
<b>Year and Period</b>	<b>Finnish 3</b> Period 3-4
<b>Teacher(s)</b>	Lecturer, M.A. Elina Häkkinen
<b>CEF Level</b>	A1.2
<b>Aims</b>	By the end of the course, students are expected to be able to discuss simple issues that are dealt with during the course, talk about the past more elaborately, cope orally in a simple situation involving health care, and read simple newspaper articles on concrete topics with the help of a dictionary.
<b>Content</b>	Topics: profession and work, living-related and household issues, opinions, emotions, health, making appointments, phone conversations. Grammar: present perfect tense, translative, essive, expressing necessity, more advanced sentence types, adjective comparison.
<b>Modes of Study</b>	Languages of instruction: Finnish and English. Texts with some new vocabulary and grammatical structures will be studied in class and as homework. Different kinds of spoken situations will be practiced. There will be lectures on grammar as well as different written grammar exercises. Contact lessons 28, homework approximately 24 hours.
<b>Evaluation</b>	A written exam.
<b>Study materials</b>	Pass/Fail.
<b>Prerequisites</b>	Handouts given in class. Finnish 1 and 2 or equivalent knowledge.
<b><i>FV18A9820</i></b>	<b><i>LEARNING TOGETHER - CONVERSATION AND CULTURE IN FRENCH AND FINNISH</i></b> <span style="float: right;"><b><i>1 ECTS cr</i></b></span>
	<b>Learning Together - Conversation and Culture in French and Finnish</b>
<b>Year and Period</b>	Period 1-2, 3-4
<b>Teacher(s)</b>	Lecturer, M.A. Elina Häkkinen
<b>CEF Level</b>	A1 - C2
<b>Aims</b>	By the end of the course, students are expected to be able to show that they have improved their Finnish language skills and their cultural skills according to the aims they set for themselves at the beginning of the course.
<b>Content</b>	Language of instruction: English.
<b>Modes of Study</b>	Contact lessons 4. Work in pairs 22 hours. The course can be completed during either one or two semesters. A learning diary will be required. The teacher will announce the time of the first meeting by e-mail.
<b>Evaluation</b>	Pass/Fail.
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.

<b>FV19A1000</b>	<b>CHINESE 1</b>	<b>3 ECTS cr</b>
	<b>Chinese 1</b>	
<b>Year and Period</b>	Period 1-2, 3-4	
<b>Teacher(s)</b>	Part-time Untenured Teacher, Matina Ma	
<b>CEF Level</b>	A1.1	
<b>Aims</b>	By the end of the course students will be able to read and write Chinese phonetics, to formulate simple sentences, to produce simple everyday greetings, and to use a Chinese dictionary.	
<b>Content</b>	In the first period, students will learn Chinese phonetics through speaking and listening. In the second period, students will work on Chinese characters and develop a basic knowledge of the sentence structure. Topics include greetings, numbers and time, introduction of self and family.	
<b>Modes of Study</b>	Language of instruction: English and Chinese. 56 contact lessons, meeting twice a week. 75% attendance is required. Students who do not meet the attendance requirement but have finished all of the assignments may still receive a grade if they sit the final exam, which is an essay written in Chinese or an exam in speaking, listening and reading.	
<b>Evaluation</b>	0 - 5. Exams (60%) and continuous assessment (40%).	
<b>Study materials</b>	Provided by the teacher.	
<b>Prerequisites</b>	The course is meant for beginners.	
<b>Further Information</b>	This course has 1-5 places for open university students. More information on the web site for open university instruction.	

<b>FV19A2000</b>	<b>CHINESE 2</b>	<b>3 ECTS cr</b>
	<b>Chinese 2</b>	
<b>Year and Period</b>	Period 1-2, 3-4	
<b>Teacher(s)</b>	Part-time Untenured Teacher, Matina Ma	
<b>CEF Level</b>	A1.2	
<b>Aims</b>	By the end of the course students are expected to be able to deal with basic modern Chinese grammar, have the ability to understand and write simple passages, be able to read Chinese with satisfactory intonation, be able to understand short, slowly spoken dialogues and be able to speak about simple topics.	
<b>Content</b>	Topics include travelling and shopping in Chinese communities, personal information and employment, daily schedule, family and interests.	
<b>Modes of Study</b>	Language of instruction: English and Chinese. 56 contact lessons, meeting twice a week. 75% attendance is required. Students who do not meet the attendance requirement but have finished all of the assignments may still receive a grade if they sit the final exam, which is an essay written in Chinese or an exam in speaking, listening and reading.	
<b>Evaluation</b>	0 - 5. Exams (60%) and continuous assessment (40%).	
<b>Study materials</b>	Provided by the teacher.	
<b>Prerequisites</b>	Successful completion of FV19A1000 Chinese 1 or equivalent skills.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	

<b>FV19A3500</b>	<b>BUSINESS CHINESE</b>	<b>3 ECTS cr</b>
	<b>Business Chinese</b>	
<b>Year and Period</b>	Period 3-4	
<b>Teacher(s)</b>	Part-time Untenured Teacher, Matina Ma	
<b>CEF Level</b>	A2	
<b>Aims</b>	By the end of the course students are expected to be able to live in China, to make friends and speak in Chinese for business, have a better understanding of China's actual conditions and its ways and customs, be able to exchange ideas with native speakers on topics concerning the import and export business, sign contracts, settle disputes or resort to arbitration, provided that the speech is relatively slow and clear.	
<b>Content</b>	Topics including the opening of a bank account, commodity inspection, customs declaration, applying for a patent and taking part in a commodities fair. Language of instruction: English and Chinese.	
<b>Modes of Study</b>	56 contact lessons, meeting twice a week. 75% attendance is required. Students who do not meet the attendance requirement but have finished all of the assignments may still receive a grade if they sit the final exam, which is an essay written in Chinese or an exam in speaking, listening and reading.	
<b>Evaluation</b>	0 - 5. Exams (60%) and continuous assessment (40%).	
<b>Study materials</b>	Provided by the teacher.	
<b>Prerequisites</b>	Successful completion of FV19A2000 Chinese 2 or equivalent skills.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	

<b>FV19A5000</b>	<b>CHINESE FOR ORAL COMMUNICATION</b>	<b>3 ECTS cr</b>
	<b>Chinese for Oral Communication</b>	
<b>Year and Period</b>	Period 3-4	
<b>Teacher(s)</b>	Part-time Untenured Teacher, Matina Ma	
<b>CEF Level</b>	A2	
<b>Aims</b>	During the course, students will work on polishing their pronunciation, on improving their listening skills and on listening and speaking skills on topics dealt with in the course.	
<b>Content</b>	Topics include life in Chinese communities, traveling, accommodation, Chinese cuisine, entertainment, introduction of essential Chinese customs and Chinese festivals. Language of instruction: Chinese and English.	
<b>Modes of Study</b>	56 contact hours, meeting twice a week. 75% attendance is required. Students who do not meet the attendance requirement but have finished all of the assignments may still receive a grade if they sit the final exam, which is an essay written in Chinese or an exam in speaking, listening and reading.	
<b>Evaluation</b>	0 - 5. Exams (60%) and continuous assessment (40%).	
<b>Study materials</b>	Provided by the teacher.	
<b>Prerequisites</b>	Successful completion of FV19A2000 Chinese 2 or equivalent skills.	
<b>Further Information</b>	This course has 6-10 places for open university students. More information on the web site for open university instruction.	

## 9. Minor Subjects in English

There may be restrictions to selecting a minor subject in certain Master's degree programmes. These limitations are listed in this study guide in the section dedicated to the Master's degree programmes. Additional information is provided by the study guidance staff of each degree programme.

The minor subjects taught in English at LUT are:

### Faculty of Technology

#### Modelling of Energy Systems 21 ECTS

<i>Obligatory Studies (21 op)</i>		<i>vsk</i>	<i>per.</i>	<i>op</i>
BH40A1500	Turbulence Models	DI 2	3-4	4
BH70A0001	Numerical Methods in Heat Transfer	DI 1	1-2	6
BH70A0101	Advanced Modeling Tools For Transport Phenomena	DI 1	3-4	5
BH70A0200	Advanced Topics in Modelling of Energy Systems	DI 1	1-2	6

#### Industrial Embedded Systems, 21 ECTS

<i>Industrial Embedded Systems (21 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BL40A1000	Real-time Operating Systems and Programs	M.Sc. (Tech.) 2	1-2	5
BL40A1200	Digital Control Design	M.Sc. (Tech.) 1	1-2	4
BL40A1810	Microprocessors A	B.Sc. (Tech.) 3	3-4	6
BL50A1300	Advanced Course in Electronics	M.Sc. (Tech.) 1	3-4	6

#### Power Electronics and Electrical Drives, min 20 ECTS

<i>Select a minimum of 20 ECTS cr</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BL30A1200	Numerical Methods in Electromagnetism	M.Sc. (Tech.) 2	3	4
BL40A1100	Embedded System Programming	M.Sc. (Tech.) 1	1-2	4
BL40A1810	Microprocessors A	B.Sc. (Tech.) 3	3-4	6
BL50A0600	Electromagnetic Compatibility in Power Electronics	M.Sc. (Tech.) 1	1	2
BL50A1300	Advanced Course in Electronics	M.Sc. (Tech.) 1	3-4	6

#### Bio-Energy Technology, 22 ECTS

<i>Obligatory Studies (22 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BH50A1300	Maintenance Management	M.Sc. (Tech.) 2	1-2	4
BH50A1400	Steam Boilers	M.Sc. (Tech.) 2	1-2	6
BH50A1600	Waste Heat Recovery Techniques	M.Sc. (Tech.) 2	3-4	6
BH50A1500	Bioenergy Technology Solutions	M.Sc. (Tech.) 1	2-3	6

#### Environmental Energy Technology, 22 ECTS

<i>Obligatory Studies (22 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BH60A1600	Basic Course on Environmental Management and Economics	B.Sc. (Tech.) 2	1-2	5
BH60A2000	Emission Trading	B.Sc. (Tech.) 3	3-4	3
BH60A2101	Advanced Course in Life Cycle Assessment	M.Sc. (Tech.) 2	1-2	7
BH60A2200	Air Pollution Control	M.Sc. (Tech.) 1	3-4	3
BH60A2401	Energy Recovery from Solid Waste	M.Sc. (Tech.) 2	1-2	4

**Advanced Design Methodology, 20 ECTS**

<i>Min. 20 ECTS credits should be selected</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BJ30A0700	Computational Fluid Dynamics in Chemical Engineering	M.Sc. (Tech.) 2	1	6
BJ30A1600	Advanced Process Simulation	M.Sc. (Tech.) 1	3-4	8
BJ40A0000	Creative Design	M.Sc. (Tech.) 1	1	3
BM20A3900	Modelling Methodology in Process Engineering	M.Sc. (Tech.) 1	1-2	6

**Chemical Engineering, min 20 ECTS**

<i>Obligatory for all</i>		<i>per.</i>	<i>ECTS cr</i>
BJ20A1600 <sup>1)</sup>	Chemical Engineering Unit Operations I	1-2	4

<sup>1)</sup> Available as a book exam: Coulson&Richardson, Chemical Engineering (specified sections)

<i>Obligatory Studies, choose one course:</i>		<i>per.</i>	<i>ECTS cr</i>
BJ30A0600	Modelling of Unit Processes	3-4	6
BJ30A0700	Computational Fluid Dynamics in Chemical Engineering	1	6
BJ30A1600	Advanced Process Simulation	3-4	8
BM20A3900	Modelling Methodology in Process Engineering	1-2	6

<i>Elective Studies, choose enough courses to attain 20 ECTS cr together with the chosen obligatory courses</i>		<i>per.</i>	<i>ECTS cr</i>
BJ20A1100	Filtration and Mixing	3-4	6
BJ20A1801	Chemical Engineering Unit Operations II	1-2	5
BJ20A1901	Advanced Course in Environmental Technology and Unit Operations	3-4,1	6

**Packaging Technology, 20 ECTS**

<i>Obligatory Studies (20 ECTS cr)</i>		<i>per.</i>	<i>ECTS cr</i>
BK20A1300	Packaging Materials	1-2	4
BK20A1500	Principles of Chemistry, Paper Technology and Food Technology	1-4	5
BK50A1201	Machine Design for Packaging Technology	Intensive	4
BK50A1401	Packaging Lines and Machinery	3-4	7

**Manufacturing, 21 ECTS**

<i>Obligatory Studies (21 op)</i>		<i>per.</i>	<i>op</i>
BK20A0100	Materials Science	1-2	6
BK20A2200	Basics of Welding Technology	2	3
BK30A0500	Laser Processing	1-2	5
BK50A0700	Advanced Production Engineering	1-2	7

**Technomathematics, min 20 ECTS**

<i>Minor Studies min. 20 ECTS cr</i>		<i>per.</i>	<i>ECTS cr</i>
BM20A1300	Complex Analysis	1	3
BM20A1900	Statistics II	2	3
BM20A2000	Simulation	1	4
BM20A2102	Differential Equations	3	6
BM20A2201	Logic and Discrete Methods	1-4	4
BM20A2500	Linear Algebra and Normed Spaces	1	3
BM20A2600	Integral Transforms	4	3
BM20A2701	Numerical Methods II	4	3
BM20A2800	Nonlinear Optimization	4	4
BM20A2901	Discrete Optimization	4	5
BM20A3001	Statistical Analysis in Modelling	2	5

BM20A3101	Fuzzy Sets and Fuzzy Logic	1-2	6
BM20A3202	Fuzzy Engineering	3-4	6
BM20A3301	Stochastic Theory and Models	4	3-5
BM20A3401	Design of Experiments	4	4
BM20A3602	Fuzzy Data Analysis	3	6
BM20A3801	Advanced Mathematical Methods	1-4	3-6
BM20A3900	Modelling Methodology in Process Engineering	1-2	6
BM20A4201	Applied Functional Analysis	2-3	4-6
BM20A4500	Evolutionary Computation	2	5
BM20A5000	Principles of Technical Computing and Scientific Publishing	1-2	4

### Technical Physics, min 20 ECTS

<i>Minor Studies min. 20 ECTS cr</i>		<i>per.</i>	<i>ECTS cr</i>
BM30A0500 <sup>t</sup>	Applied Optics	2	6
BM30A1500 <sup>t</sup>	Advanced Topics in Material Science	2	6
BM30A1600 <sup>t</sup>	Microelectronics	1	6
BM30A2100	Microelectronics Processing Technology	1-2	2
BM30A2200	Semiconductor and Superconductor Physics	1-2	6

<sup>t</sup> Choose a min. of two courses.

### Bioenergy 25 ECTS, only for students of School of Business

<i>Obligatory Studies (25 ECTS cr)</i>		<i>year</i>	<i>per.</i>	<i>ECTS cr</i>
BH40A1300	Power Engines in Renewable Energy	M.Sc. (Tech.) 2	2	5
BH50A1200	Energy Systems Engineering	M.Sc. (Tech.) 1	1-2	6
BH60A1600	Basic Course on Environmental Management and Economics	B.Sc. (Tech.) 2	1-2	5
BH60A2000	Emission Trading	B.Sc. (Tech.) 3	3-4	3
BH60A2200	Air Pollution Control	M.Sc. (Tech.) 1	3-4	3
BH80G0000	Bioenergy	M.Sc. (Tech.) 1	1	3

### Faculty of Technology Management:

#### Business and Technology in Russia 20/25 op

<i>Alternative Studies, select at least 20/25 ECTS cr</i>		<i>per.</i>	<i>ECTS cr</i>
AB30A0301	International Finance and Emerging Markets	2	6
AC40A0800	Corporate Strategy for Emerging Markets	3	6
BJ40A0300	Management of Technical Information in Export of Processing Equipment to Russian Federation	4	5
BH60A2800	Energy and Environmental Challenges in Russia	3	5
CS10A0751	Enterprises and Competition in Russia	3	6
CS10A0800	The Basics of Doing Business in Russia	2	5
FV14A1200 <sup>(1)</sup>	Venäjä 1	1-2, 3-4	3
FV14A1400 <sup>(1)</sup>	Venäjä 2	1-2, 3-4	3
FV14A1801 <sup>(1)</sup>	Venäjäns sijamuodot	3-4	3
FV14A4200 <sup>(1)</sup>	Nykyvenäjän kieltä ja maantuntemusta	1-2	3

<sup>(1)</sup> Exchangeable

<sup>\*)</sup> Only one Russian language course can be included to the minor. Language courses are alternative to each other and should be selected according to the student's language skills.

The minor is intended for students from all the Master Programmes in Lappeenranta University of Technology and focuses on Russian market. The minor is organized in cooperation with all the three faculties of Lappeenranta University of Technology.

The extent of the minor for students from Faculty of Technology and Faculty of Technology Management is 20 ECTS cr, and for students from School of Business 25 ECTS cr. Student should select courses from the list below so that the required amount of ECTS credits will be fulfilled. Only one Russian language course can be included in the minor; however language course is not obligatory.



**Russia and Transitional Economies: Business Environment 20 or 25 ECTS cr**

<i>Alternative studies, select at least 20/25 ECTS cr</i>		<i>per.</i>	<i>ECTS cr</i>
CS10A0550	International Business Methods	1-2	7
CS10A0600	Doing Business in Transitional Economies	3-4	7
CS10A0651	Management of Innovations in Russia	4	5
CS10A0751	Enterprises and Competition in Russia	3	6
CS10A0800	The Basics of Doing Business in Russia	2	5
CS10A0852	European Union – Competitiveness and Enlargement	4	5

**Minor: Business Technology**

<i>Obligatory studies (min 22 ECTS cr)</i>		<i>per.</i>	<i>ECTS cr</i>
CS20A6060	Introduction to Logistics	1	5
CS35A0151	Product Lifecycle Management	4 int.	7
CT60A4101	Software Engineering Methods	1-2	5
*CT60A5000	E-Business Technologies	3-4	5

\* Lectured every other year, next 2011-2012

**Intelligent Computing. Recommended for Technomathematics Students only**

<i>Choose minimum 20 ECTS credits</i>		<i>per.</i>	<i>ECTS cr</i>
CT50A4000	Introduction to Intelligent Computing	3-4	5
CT50A5700	Introduction to Computer Graphics	2	5
CT50A6000	Pattern Recognition	3-4	7
CT50A6100	Machine Vision and Digital Image Analysis	1-2	7
CT50A6200	Computer and Robot Vision	1-2	7

**School of Business:**

Business Administration

**Business Administration 20 op**

<i>Electives, min. 20 ects credits should be selected</i>		<i>per.</i>	<i>op</i>
AB30A0301	International Finance and Emerging Markets	2	6
AB30A0550	International Financial Management	3	6
AB40A0500	Innovation and Competitiveness	4	5
AC40A0101	Cross-Cultural Marketing Strategies	2	6
AC40A0150	Integrated Marketing Communication	4	5
AC40A0202	Internationalization of the Firm and Global Marketing	2	6
AC40A0251	Sales Management and Personal Selling	3-4	6
AC50A0300	Organizational Learning and Competence Management	2	6
AC60A0400	International Accounting and Analysis	1-2	6
AC60A0750	International Marketing Management	1	6

## 10. University Administration and Professors

### University senate

The university senate is the university's highest decision-making body. The duties of the senate are defined in the Universities Act and LUT's administrative regulations. The senate members are listed on the university web site.

### Rector, vice-rectors and director of administration

The rector of the university is Professor Ilkka Pöyhönen. The rector manages the activity of the university.

The first vice-rector, Professor Hannu Rantanen, is responsible for education. The second vice-rector, Professor Veli-Matti Virolainen, is in charge of research, and the third vice-rector, Professor Minna Martikainen, of international affairs. The university's director of administration is Juha-Matti Saksa, D.Sc. (Econ. & Bus.Admin.).

### Faculties, deans and faculty councils

The university comprises three faculties headed by deans:

- Faculty of Technology, dean: Professor Esa Marttila
- Faculty of Technology Management, dean: Professor Markku Tuominen
- School of Business, dean: Professor Jaana Sandström

The highest decision-making body of a faculty is the faculty council.

The faculties are divided into departments and laboratories, which have their own directors. Degree programmes are lead by the head of the degree programme. Each faculty has a head of administration and a head of study affairs.

### University Services

University Services is responsible for university-wide services that support the university's basic tasks. The head of University Services is the director of administration.

### Professors (updated 1 June 2009)

#### FACULTY OF TECHNOLOGY

##### Faculty of Technology

D.Sc.(Tech.)	Marttila, Esa	Environmental Technology	1.1.2010	
<b>LUT Energy</b>				
D.Sc.(Tech.)	Ahola, Jero	Energy efficiency and maintenance of electrical drives	1.1.2010	31.8.2014
D.Sc.(Tech.)	Backman, Jari	Applied fluid dynamics in renewable energy systems	1.1.2010	16.12.2014
D.Sc.(Tech.)	Horttanainen, Mika	Environmental technology, esp. waste management technology and the energy recovery of waste	1.4.2010	
D.Sc.(Tech.)	Hyppänen, Timo	Modelling of energy conversion systems	1.1.2010	30.9.2012
D.Sc.(Tech.)	Kyrki-Rajamäki, Riitta	Nuclear engineering	1.1.2010	
D.Sc.(Tech.)	Larjola, Jaakko	Fluid dynamics	1.1.2010	

D.Sc.(Econ.& Bus.Adm.)	Linnanen, Lassi	Environmental technology, environmental management	1.1.2010	
D.Sc.(Tech.)	Partanen, Jarmo	Electrical engineering	1.1.2010	
D.Sc.(Tech.)	Pyrhönen, Juha	Electrical drives technology	1.1.2010	
D.Sc.(Tech.)	Pyrhönen, Olli	Wind technology	1.1.2010	
D.Sc.(Tech.)	Ranta, Tapio	Energy technology, esp. bioenergy technology	1.1.2010	31.12.2010
D.Sc.(Tech.)	Sillanpää, Mika	Green chemistry	1.5.2010	31.12.2010
D.Sc.(Tech.)	Silventoinen, Pertti	Electronics	1.1.2010	
D.Sc.(Tech.)	Soukka, Risto	Environmental technology	1.1.2010	31.12.2010
D.Sc.(Tech.)	Vakkilainen, Esa	Renewable energy systems, especially energy conversion processes of biomass, and energy efficiency	1.1.2010	30.9.2014
D.Sc.(Tech.)	Viljainen, Satu	Electrical power systems, esp. the electricity market	1.1.2010	31.7.2011

### LUT Chemistry

M.Sc.(Tech.)	Henricson, Kaj	Pulp technology	1.1.2010	30.9.2010
D.Sc.(Tech.)	Häkkinen, Antti	Solid-liquid separation	1.1.2010	30.6.2010
D.Sc.(Tech.)	Kajanto, Isko	Paper converting	1.1.2010	31.7.2012
Ph.D.	Kraslawski, Andrzej	Process engineering, esp. technology based on innovative solutions	1.1.2010	
D.Sc.(Tech.)	Louhi-Kultanen, Marjatta	Chemical unit operations, esp. separation technology	1.1.2010	16.12.2014
D.Sc.(Tech.)	Mänttari, Mika	Membrane technology	1.1.2010	31.12.2010
D.Sc.(Tech.)	Paatero, Erkki	Chemical engineering	1.1.2010	
D.Phil.	Siren, Heli	Chemistry	1.1.2010	
D.Sc.(Tech.)	Turunen, Ilkka	Design of industrial processes	1.1.2010	

### LUT Mechanical Engineering

D.Sc.(Tech.)	Björk, Timo	Steel structures	1.1.2010	31.7.2010
Ph.D.	Cameron, David	Materials technology	1.1.2010	30.6.2010
D.Sc.(Tech.)	Kujanpää, Veli	Welding technology	1.1.2010	31.12.2011
D.Sc.(Tech.)	Kärki, Timo	Wood technology	1.1.2010	30.11.2010
D.Phil.	Lindell, Henry	Flexible packaging technologies	1.1.2010	31.7.2013
D.Sc.(Tech.)	Martikainen, Jukka	Welding technology	1.1.2010	
D.Sc.(Tech.)	Mikkola, Aki	Virtual design	1.1.2010	
D.Sc.(Tech.)	Pöyhönen, Ilkka	Wood technology	1.1.2010	
D.Sc.(Tech.)	Salminen, Antti	Mechanical engineering, esp. manufacturing technology	1.1.2010	31.12.2012
D.Sc.(Tech.)	Varis, Juha P.	Production engineering	1.1.2010	

**Mathematics and Physics**

D.Sc.(Tech.)	Alatalo, Matti	Scientific computing	1.5.2010	31.12.2010
D.Phil.	Haario, Heikki	Applied mathematics	1.1.2010	
D.Phil.	Heiliö, Matti	Applied mathematics	1.1.2010	30.9.2011
D.Phil.	Lukka, Markku	Applied mathematics	1.1.2010	31.7.2010
D.Phil.	Lähderanta, Erkki	Physics	1.1.2010	
D.Phil.	Tuuva, Tuure	Physics	1.6.2010	31.12.2010

**CEID**

D.Sc.(Tech.)	Handroos, Heikki	Machine Automation	1.1.2010	
D.Sc.(Tech.)	Wu, Huapeng	Robotics	1.1.2010	

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**FACULTY OF TECHNOLOGY MANAGEMENT**
**LUT Information Technology**

D.Sc.(Tech.)	Kerttula, Esa	Telematics	1.1.2010	30.4.2012
D.Sc.(Tech.)	Kyrki, Ville	Information technology, esp. intelligent robotic systems	1.1.2010	30.9.2014
D.Sc.(Tech.)	Kälviäinen, Heikki	Information processing	1.1.2010	
D.Sc.(Tech.)	Kämäräinen, Joni	Information society technologies	1.1.2010	30.9.2013
D.Sc.(Tech.)	Porras, Jari	Communications engineering	1.1.2010	
D.Phil.	Smolander, Kari	Software engineering, esp. software architectures	1.1.2010	31.7.2011

**LUT Industrial Management**

D.Sc.(Tech.)	Harmaakorpi, Vesa	Industrial management, esp. innovation systems	1.1.2010	
D.Sc.(Econ.& Bus. Adm.)	Hilmola, Olli-Pekka	Industrial management, esp. railway logistics	1.1.2010	31.3.2013
D.Sc.(Tech.)	Huiskonen, Janne	Industrial management, esp. logistics	1.1.2010	31.7.2010
D.Sc.(Tech.)	Kärri, Timo	Industrial management, esp. management accounting in industrial enterprises	1.1.2010	31.7.2010
D.Sc.(Tech.)	Kässi, Tuomo	Engineering and technology management	1.1.2010	
D.Sc.(Tech.)	Lampela, Hannele	Industrial management, esp. knowledge management	1.1.2010	31.7.2010
D.Sc.(Econ.& Bus. Adm.)	Lehtomaa, Ahti	Industrial management, esp. technological entrepreneurship	1.1.2010	
D.Phil.	Miettinen, Asko	Industrial management, esp. technological entrepreneurship	1.1.2010	31.7.2010
D.Sc.(Tech.)	Pirttilä, Timo	Industrial management, esp. logistics	1.1.2010	
Lic.Sc.(Econ. & Bus. Adm.)	Pitkänen, Seppo	Engineering and technology management	1.1.2010	
D.Sc.(Tech.)	Rantanen, Hannu	Industrial management, esp. engineering and technology management	1.1.2010	
D.Sc.(Tech.)	Salminen, Risto	Industrial management, esp. industrial marketing	1.1.2010	
D.Sc.(Tech.)	Torkkeli, Marko	Industrial management, esp. technology and business innovations	1.1.2010	31.5.2013
D.Sc.(Tech.)	Tuominen, Markku	Industrial management, esp. management information systems	1.1.2010	
D.Sc.(Tech.)	Väätänen, Juha	Industrial management, esp. international operations and marketing in industrial enterprises	1.1.2010	31.7.2011

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**SCHOOL OF BUSINESS**
**Department of Management and International Business**

D.Sc.(Econ.& Bus.Adm.)	Aaltio, Iiris	Business administration, esp. management and organizations	1.1.2010	
D.Sc.(Tech.)	Asikainen, Sanna-Katriina	Business administration, international marketing	1.1.2010	30.9.2012
D.Sc.(Econ.& Bus.Adm.)	Blomqvist, Kirsimarja	Knowledge management	1.1.2010	31.5.2013
D.Sc.(Tech.)	Hallikas, Jukka	Supply management	1.1.2010	31.7.2010
D.Sc.(Econ.& Bus.Adm.)	Heilmann, Pia	Management and organizations	1.1.2010	31.7.2010
D.Sc.(Econ.& Bus.Adm.)	Jussila, Iiro	Management and organizations	1.1.2010	31.7.2010
D.Soc.Sc.	Juuti, Pauli	Management and organizations	1.1.2010	31.10.2011
D.Sc.(Econ.& Bus.Adm.)	Kianto, Aino	Knowledge management	1.1.2010	31.7.2010
D.Sc.(Econ.& Bus.Adm.)	Kuivalainen, Olli	International marketing	1.1.2010	30.9.2014
D.Sc.(Econ.& Bus.Adm.)	Pihkala, Timo	Management and organizations, esp. entrepreneurship and SME management	1.1.2010	
D.Sc.(Econ.& Bus.Adm.)	Saarenketo, Sami	International marketing, esp. internationalization of SMEs	1.1.2010	30.9.2012
D.Sc.(Econ.& Bus.Adm.)	Sainio, Liisa-Maija	International marketing	1.1.2010	31.12.2010
D.Sc.(Tech.)	Virolainen, Veli-Matti	Supply management	1.1.2010	

**Department of Business Economics and Law**

D.Sc.(Econ.& Bus.Adm.)	Jantunen, Ari	Strategy research	1.1.2010	31.1.2014
D.Sc.(Econ.& Bus.Adm.)	Kyläheiko, Kalevi	Business administration, esp. technology research	1.1.2010	
D.Sc.(Econ.& Bus.Adm.)	Martikainen, Minna	Finance	1.1.2010	
D.LL.	Niemi, Matti	Civil law	1.1.2010	
D.Sc.(Tech.)	Puumalainen, Kaisu	Technology research, esp. quantitative methods	1.1.2010	
D.Sc.(Econ.& Bus.Adm.)	Pätäri, Eero	Finance	1.1.2010	31.7.2010
D.Sc.(Tech.)	Sandström, Jaana	Strategic management accounting	1.1.2010	30.4.2013
D.Sc.(Econ.& Bus.Adm.)	Vaihekoski, Mika	Finance	1.1.2010	

## 11. Final thesis instructions

*Approved by the vice-rector on 9 June 2010, enter into force 1 August 2010*

### Introduction

These instructions apply mainly to Master's theses at Lappeenranta University of Technology. They may also be used, where applicable, for Bachelor's theses and written assignments. The faculties may give more detailed instructions on the preparation of theses.

The instructions start with a process description of the practical aspects of starting a thesis and of its assessment. Then, the contents of the thesis, conducting research and research methodologies are discussed. The final section deals with layout and gives practical examples of it.

The Master's thesis is the final project of the Master's degree studies. It demonstrates the student's knowledge of a scientifically and/or societally important topic related to his or her professional field. The thesis is a research assignment that requires approximately six months of full-time work and amounts to 30 ECTS credits in the degree. The student must demonstrate the ability to carry out the project independently and following a plan.

The Master's thesis is prepared in the second year of the Master's degree studies, and before applying for the approval of their thesis topic, **students must have completed their Bachelor's degree or complementary studies.**

### Final thesis process

#### Starting the work

Students who are starting their Master's thesis should read these instructions carefully and meet with the professor in charge of the field (usually a professor of the student's major subject). The student discusses the topic of the thesis with the professor to make sure it meets the scientific requirements for a Master's thesis.

The following points are discussed with the professor:

- the prerequisites for starting the Master's thesis (completed studies)
- the topic and objective of the thesis
- applying for the thesis topic
- the preliminary research plan and schedule
- funding (by the student, a grant or an employer)
- the examiners of the thesis (the first examiner is the supervising professor or a docent from the student's degree programme)
- the supervisor from the commissioning organisation
- matters to be discussed with the community providing the funding and the supervisor representing it, such as the employment relationship, responsibilities, safety, insurances, invention rights, etc.
- publicity of the thesis

#### Applying for a topic

Prerequisites for applying for the approval of the thesis topic include:

- Bachelor's degree completed (when the student has been admitted into the university for both **Bachelor's and Master's studies**)
- possible complementary studies completed (if the student has been admitted to complete only the **Master's degree**)
- possible other requirements set by the faculty

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**The student applies for the approval of the topic and the appointment of the examiners from the head of the degree programme by leaving an application with the faculty study services.**

The Master's thesis is related to the student's major subject and its topic is agreed on by the supervisor and the student together. The approval of the topic remains in force for two years from the date of approval. When the head of the degree programme approves the thesis topic, he/she also appoints the first examiner for the thesis, who is an LUT professor or docent. The first examiner must be from the student's major subject or a closely related field. The first examiner is also the supervisor of the thesis at the university. The head of the degree programme also appoints a second examiner for the thesis based on the supervisor's proposal. The second examiner must have at least a higher university degree and may be from outside of the university. If one or both of the examiners change, this must be approved by the head of the degree programme.

In addition, the thesis may have a supervisor from the commissioning organisation, who is approved by the first examiner along with the thesis topic.

Applying for Master's thesis work at a company is the student's responsibility. If the student wishes to start preparations for the thesis before the topic is officially approved, this should be discussed with the first examiner.

The topic application may be submitted when the required studies are completed and thesis work has been obtained from a company and discussed with the supervising professor. The title does not need to be finalised upon application; it may be modified during the course of the project.

The stages of the topic application process and the forms to be filled out depend on the faculty. The forms and further information on the topic application process are available on the faculty web sites.

## **Publicity of the thesis**

### **Master's theses submitted to the university for examination are normally public documents.**

This must be mentioned to the commissioner when the topic of the thesis is first discussed. If the thesis includes information which the commissioner considers confidential, the university may agree to hold the thesis **confidential for a maximum of two years**. However, it is recommended that the thesis is prepared as a public-access document.

If part of the information needs to be held confidential for longer than two years, the information must be excluded from the version submitted for examination. The work will be evaluated based on the non-confidential part.

The first examiner shall see to it that the commissioner is aware of the publicity requirements from the very beginning of the discussions.

### **Confidentiality notification**

If the thesis includes confidential information (held confidential for a maximum of two years), the commissioner of the thesis must submit a written notification of the extent of the confidential information, the reasons for confidentiality and the time the information is to be held confidential (usually in full years). The confidentiality period starts from the date the thesis is assessed. The student is responsible for submitting the confidentiality notification to the faculty no later than in connection with the assessment application. The faculty adds an indication of the possible confidentiality period after the thesis has been approved. The abstract is always public.

### **Maturity test**

Students must complete a written maturity test on the topic of their thesis. Its purpose is to verify the student's familiarity with the topic of the thesis. During the course of the studies, also the student's Finnish or Swedish skills are assessed at one point. This can be done e.g. in connection with the Bachelor's thesis. The maturity test is assessed by the first examiner of the thesis, and as needed, also a language reviser approved by the university. The maturity test is taken in the language in which the student has received his or her education in Finland. If the student has received his or her education in a language other than Finnish or Swedish, the head of the degree programme



determines the language of the maturity test. In such cases, only the contents of the maturity test is evaluated, not the language.

**If a student has demonstrated his or her language skills in connection with the Bachelor's degree or another previous university degree, the language of the maturity test will not be evaluated, only the contents. The faculties issue their own instructions on the maturity test.** Further information is available in the study guide of the LUT Language Centre.

The test should be written on a computer. For further information, please see <http://www.lut.fi/fi/lut/studies/origo/aquarium/Sivut/Default.aspx>.

The maturity test should be taken at least five weeks before graduation. The date and time for the test should be set together with the examiner and the person in charge of maturity tests in the faculty.

The examiner gives the topic of the test. The maturity test is evaluated on a scale of passed/failed.

### **Assessment of the Master's thesis**

The thesis must be reviewed by the examiners before it is printed.

The student submits the Master's thesis in its final form, i.e. bound in black covers to the examiners for assessment. Both examiners are given their own copy (Bachelor's theses are not bound in black covers). The assessment application, abstracts in Finnish and English, the possible confidentiality notification of the commissioner, and copies bound in black covers are submitted to the faculty study services. Students of foreign nationality do not need to prepare an abstract in Finnish. **The faculty decides the graduation schedule and the number of bound copies submitted, and provides instructions on the evaluation.**

The examiners prepare a written statement on the thesis and propose a grade. The title and grade of the thesis are shown in the degree certificate.

Students of Master's programmes in English will be provided a statement in English on their Master's thesis.

The faculties determine the assessment criteria for final theses. Frequently applied criteria include e.g.

- The problem-setting, objectives, definitions and delimitations of the thesis
- The relationship to previous research
- The research approach, methods and material used in the work
- The schedule of the research and time management
- The results and their analysis
- The organisation and coherence of the work
- The profoundness of the work
- The reliability of the work
- The language and layout of the work
- An independent approach and application

A Master's thesis in technology is assessed on a scale of 1-5, where 1 is satisfactory, 2 is very satisfactory, 3 is good, 4 is very good and 5 is excellent. A Master's thesis in business is assessed on the scale *improbatur* (failed), *approbatur* (lowest passing grade), *lubenter approbatur*, *non sine laude approbatur*, *cum laude approbatur*, *magna cum laude approbatur*, *eximia cum laude approbatur* *sekä laudatur* (highest grade).

If the grade of the Master's thesis in technology is 5 or in business studies at least *eximia cum laude approbatur*, and the overall grade of the degree at least 4, the student has completed his or her degree **with distinction**.

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The faculty assesses and approves the thesis after the student has submitted the bound copies and the assessment application to the faculty. **The forms and further information are available on the faculty web sites.**

If a student is not satisfied with the evaluation, he or she may leave a request for correction with the faculty council within 14 days of the day the grade was made known. The request for correction should be addressed to the faculty council in question and submitted in writing to the faculty's study affairs services. Students must submit the request in writing within 14 days of the day the grade was made known. They also have the right to find out the grounds for giving the grade.

Students who are dissatisfied with the decision may bring the matter before the degree board within 14 days of having been informed of the decision. A request addressed to the degree board in writing is to be submitted to the university Registrar's office.

## **Content of the thesis and how to conduct research**

### **Language of the thesis**

The thesis may be prepared in Finnish, Swedish or English. Permission for using other languages is granted by the head of the degree programme. The author of the thesis is responsible for the language revision of the thesis. If the commissioner of the thesis requires the use of a language other than Finnish, the commissioner is responsible for the translation or language revision of the thesis. In degree or Master's programmes in English, the thesis is prepared in English and the author is responsible for revising the language.

### **Inventions related to the thesis**

The research work for a Master's thesis may result in an invention that can be patented or otherwise protected by industrial law. An invention may be a new or improved technical device or method with industrial or commercial importance.

Inventions must be discussed with all parties involved (the student, supervisors at the university and the commissioning company). If the invention made in connection with the thesis is to be patented, the patent application must be left before the work is published. Otherwise, the thesis must be written so that the invention is not revealed.

If the invention has ensued under an employment relationship, the Act on the Right in Employee Inventions (656/1967) is applied to the company. If the employment relationship is between the student and a university or higher education institution, the act on the right in employee inventions at higher education institutions (369/2006) is applied to the school.

General patenting legislation is applied to the patenting of an invention and general copyright legislation to copyright issues unless otherwise agreed by the parties involved in the work (the commissioner, university and student).

Further information is available from the university's Research and Innovation Services.

### **Contents of the thesis**

The thesis may be composed e.g. of the following items in the following order (some apply only to the technology or the business thesis):

- Title page
- Abstract in Finnish
- Abstract in English
- Acknowledgements
- Table of contents
- List of symbols and abbreviations
- Introduction
- Discussion (theories, background and implementation of the research)

Conclusions (analysis of observations and results)

Summary (concise summary of the above)

References

Appendices

### **Title page**

The title page includes the title of the thesis. The title must be well-defined and correspond to the content of the thesis. A keyword, which expresses something essential about the thesis and has an explicit and specific meaning, is recommended as the first word. Avoid the following: some, review, method, report, study, equipment etc.

### **Abstracts in Finnish and English**

The abstract is a concise (one A4 sheet), objective, independent summary of the Master's thesis. It should be intelligible as such, without the original document. It explains the contents of the thesis: the objective, methodologies, results and conclusions. A good abstract is written in complete and concise sentences. The author does not express his or her opinions, but describes the thesis as would an outside reporter. No direct references are made to the original text.

The abstract is a public document, and therefore all confidential information must be excluded from it.

The abstract is prepared in Finnish and English. Both the Finnish and English abstracts are included in the thesis. The abstracts are also submitted to the faculty study affairs services as an annex to the assessment application of the thesis. Foreign nationals do not need to prepare an abstract in Finnish.

The author sends electronic copies of the abstracts or the entire thesis to the LUT library. More details are available from the library and its web site.

### **Acknowledgements**

Acknowledgements are a brief description of what or who had an impact on the thesis. E.g. the people who furthered the progress of the thesis may be thanked.

### **Table of contents**

The table of contents lists the headings and sub-headings and their page numbers.

### **List of symbols and abbreviations (if needed)**

Symbols, abbreviations and terms which are not common knowledge are listed in alphabetical order along with their definitions and arranged in groups: e.g. first Roman symbols, then Greek ones and finally abbreviations. The list of symbols and abbreviations is placed immediately after the table of contents.

### **Introduction**

The actual research report is opened with an introduction. The purpose of the introduction is to introduce the topic and awaken the reader's interest. The introduction briefly describes the background, material extent and aims of the thesis. The introduction relates the thesis to other research and sources and presents the research methodology applied. It also describes the key points and organisation of the research report. It does not, however, include detailed descriptions of the theory, methods or results. A good introduction is, nevertheless, significantly longer than a couple of pages, and is organised in a logical manner.

### **Discussion**

The discussion is divided into chapters with headings that depict the organisation of the thesis (in exactly the same form as in the table of contents). In this section, the author relates all of the material he or she wishes in reply to the research questions posed, as well as the conclusions based on the material. Repetition should be avoided unless it is necessary. However, the discussion must be drawn up in such a way that a professional in the field can repeat the research work e.g. to check the equations, expressions, measurements, calculations or results and conclusions.

The language of the thesis must be grammatically correct and the expression coherent, accurate and concise. The topic must be presented to the reader unequivocally, intelligibly and consistently. The style must be academic and the technical terminology established. In particular, the use of foreign words should be avoided. They should be replaced with paraphrases or expressions in the language of the thesis.

In order for the observations to be of use to others, the stages of the research work must be presented in complete and the results of the observations in their original form in e.g. tables. Long sequences of equations and programming code are appended with headings. It is not necessary to show the derivation of the equations quoted, although the author must make sure the equations are presented correctly. However, the derivation of new expressions and equations introduced in the thesis must be shown, at least in outline. The author must also explain under which conditions the calculations, formulae and equations are applicable.

### **Conclusions**

Depending on the nature and scope of the study, the report ends either with the chapter "Conclusions", or two separate chapters, e.g. "Conclusions" and "Summary". The conclusions analyse the observations and results drawn from the research. The conclusions examine and reflect on e.g. the compatibility of the theory and measurements, the reasons for possible differences, and summarise the conclusions drawn from the results. The need for further research and possible practical applications may also be argued here.

### **Summary**

The summary is a concise description of the entire work: it presents the starting point of the research, the theoretical and empirical choices, aims, results, conclusions and possible ideas for further research. No new information is introduced in the conclusions, and no direct references are made to the discussion. The importance of the summary should not be underestimated because often the reader only reads the summary or the introduction and the summary.

### **Carrying out the research**

The thesis is to be prepared according to good scientific practice. The research methods must be approved by the scientific community. The prevailing approaches and research methods in the field in question are to be applied. The student should learn about the research methodology and practices in his/her field sufficiently before preparing the thesis.

Plagiarism is absolutely forbidden. Citations and references must be made in accordance with good practice. If plagiarism takes place in an assignment, seminar report, Bachelor's thesis or Master's thesis during the supervision process, the examiner must tell the student that it is unacceptable. The thesis must be supervised so that the final version does not include references that violate good scientific practice.

If, despite the examiner's efforts, the final version in the approval process contains plagiarised material, an assignment or report is failed, and a thesis is given a failing grade. Moreover, the matter will be brought before the director of administration.

## Layout of the thesis

The presentation of the thesis is very important in terms of readability, intelligibility and reliability. A finished layout gives a good and reliable impression of both the work and its author. The thesis is written in standard language and in the passive voice. Abbreviations, such as *e.g.* or *etc.* should not be used, but instead, written out in their entirety.

### Cover, presentation and electronic version

The language of the thesis must be grammatically correct and the expression coherent, accurate and concise. It should convey the message to the reader unequivocally and intelligibly, and the organisation should be logical and coherent. Say only what is needed, avoid wordiness and run-on sentences. Buzzwords and unnecessary foreign words should be avoided in particular.

The Master's thesis is bound in black, hard covers, size A4. The university logo is not printed on the cover.

If drawings are an essential part of the thesis but need not be included in the bound copy, the originals or photocopies of them are enclosed in a separate A4-sized folder.

The student submits the abstract of his or her thesis to the electronic database (LUTPub) maintained by the university library. Also the entire thesis may be uploaded into the database, in which case it can be accessed by the general public in an open network.

### Layout of a Master's thesis in technology

On the **front cover**, printed in gold (*painokulta*), font Times, Arial or equivalent:

- MASTER'S THESIS  
(centred, bottom margin 200 mm, font size 44pt) and
- Author's name and year of publication (lower right-hand corner, bottom and right margin 30-35 mm, font size 22 pt).

On the back, printed in gold (*painokulta*), font Times, Arial or equivalent:

- MASTER'S THESIS  
(left alignment, left margin 40 mm)
- Author's name
- Year of publication (right alignment, right margin 30 mm)

The Master's thesis is bound in black, hard covers, size A4.

- The recommended font is Times 12 or Arial 11, and the spacing 1.5.
- The thesis may be printed on both sides of the paper or on one side only.
- Page margins are as follows: 35 mm at the top, 30-50 mm on the left depending on how the thesis is bound, and in one-sided printing approx. 20 mm on the right and at the bottom.
- If you print on both sides of the paper, the outer margins should be approx. 20 mm and the inner ones approx. 50 mm.
- The page numbers are placed at the top of the page either centred or in the right-hand corner. In double-faced printing page numbering is either centred or in the outer corners.
- Each paragraph is aligned to the left, there are no indentations and there is an empty line between paragraphs. The paragraphs are justified.
- Avoid long spaces between words: use hyphenation.
- The thesis should be approximately 80-100 pages, depending on its nature and contents.

## Layout of the Master's thesis in business

On the **front cover**, in gold, centred and approx. 100 mm from the top is the word Master's thesis. The author's name and the year are in the lower right-hand corner.

The text "Master's thesis", the author's name and the year are printed in gold on the spine. The text starts 80 mm from the top and the year is 30 mm from the bottom.

The Master's thesis is bound in black, hard covers, size A4.

- The recommended font is Arial 12 and spacing 1.5.
- The thesis can be printed on both sides of the paper or on one side only.
- Page margins are as follows: 35 mm at the top, approx. 50 mm on the left, and in one-sided printing approx. 20 mm on the right and at the bottom.
- Page numbering is at the top of the page, either centred or right-aligned.
- If you print on both sides of the paper, the outer margins should be approx. 20 mm and the inner ones approx. 50 mm.
- Each paragraph is aligned to the left, there are no indentations and there is an empty line between paragraphs. The paragraphs are justified.
- Avoid long spaces between words: use hyphenation.
- The thesis should be approximately 80-100 pages.

## Parts of the thesis

### Title page

The title page is the first page of the thesis – page number 1. However, the page numbers are not shown before the first page of the table of contents. **The faculty decides on the information presented on the cover page. However, the following is always printed on it:**

- university, faculty, degree programme and/or major subject
- name of author
- title of thesis
- examiners (1<sup>st</sup> and 2<sup>nd</sup>)

The points above are not to be used as headings on the title page, e.g. "University: Lappeenranta University of Technology" is incorrect, but "Lappeenranta University of Technology, Faculty of Technology" is correct. The layout of the title page should be balanced, such as in assignment reports.

### Abstracts in Finnish and English

An abstract is prepared on all Master's theses. You should favour the passive voice or the 3rd person active in case the abstract is published separately. Unestablished abbreviations, symbols or technical terms should be explained. Tables, equations etc. are used only if they are necessary for the sake of clarity. No direct references are made to the original text.

The abstract is done in both Finnish and English (equivalent contents). In the Finnish abstract, the title is in Finnish and in the English one in English. Foreign students do not need to prepare an abstract in Finnish.

The complete identification information should be included in the beginning of both the Finnish and the English abstract.

Author's name  
 Title of thesis  
 Faculty  
 Degree programme and/or major subject  
 Year of completion  
 Master's Thesis University

Number of pages, figures, tables and appendices  
 Examiners (1<sup>st</sup> and 2<sup>nd</sup>)  
 Keywords in Finnish  
 Keywords in English

The keywords must be informative and describe the contents of the thesis accurately. Concrete concepts (e.g. equipment) are in plural, abstract ones (e.g. methods) in singular. A good title should include at least some of the most important keywords. The number of keywords should be three to five.

**In addition to these general instructions, the faculties may give further guidelines on e.g. the layout of the abstract (e.g. students may need to fill out a form).**

## Acknowledgements

The acknowledgements recognise the help, guidance, advice etc. provided by others and give thanks to them. Also the commissioner of the thesis is mentioned. The acknowledgements are concluded with the author's name and the date after which no more modifications have been made to the work.

## Table of contents

The pages of the table of contents are numbered in Arabic numerals from where the text starts. **Please note that the first page (number 1) of the thesis is the title page.** Thus the table of contents may be e.g. on page 5. A separate list of figures and tables can be included at the end of the table of contents.

Decimals and indentations are used in the table of contents – as well as in the headings in the text – according to the following example (note the use of upper and lower case lettering and the indentation of sub-headings). **Please note that no more than three levels of headings are allowed.** If there is need for more detailed sub-headings, they should not be numbered. If variables need to be used in the first-level headings, they are to be written out as they are in equations. In such cases, the author and the supervising professor may decide on the most appropriate way to present the headings in order to obtain a neat and legible layout. The page numbers are aligned to the right.

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## APPENDICES

- APPENDIX 1: Statistical results
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## Discussion

Each citation in the discussion should be clearly referenced so that the reader may refer to the original source.

The nature of the work determines the formulation of the discussion. The discussion may often be divided into a theoretical part, empirical part and results:

- the theoretical background, including the literature and previous research and concepts on which the thesis is based
- observations and collection of basic material etc. In order for the observations to be scientifically valid, the research process should be described in as much detail as possible.
- the discussion on observations and presentation of the results are often closely connected. All calculations need not be shown, as long as the author explicitly explains how they are done.

Figures, tables, equations etc. make the discussion more concrete and enhance readability. They are captioned and numbered, each as their own group.

**Equations** must be written clearly, each on their own line so that they are separated from the text. They may, for instance, be indented. Equations are numbered either consecutively or by chapter. The number is written in parentheses on the right-hand side of the column. References to an equation can be made only after it has been presented, with certain exceptions. Figures and tables are captioned and numbered similarly to equations. Figures and tables have to be referred to in the text, preferably before they are introduced. **The captions of tables are placed above the table and those of figures below the figure. Figures and tables are not to include foreign words.** The variables in the figures are presented in the same way as in the text and equations.

In mathematical presentation, the author must use standard symbols if such exist and if not, other established symbols. In the absence of established symbols, the author may create new ones.

The name of a unit symbol, e.g. the electric charge  $Q$ , must be mentioned when it is first introduced in the text and repeated when needed. Standard conventions must be followed when marking variables. For instance, variables in equations, charts and figures are *written in italics*, **vectors in bold italics** (or in italics and topped with an arrow,  $\vec{E}$ ). Subscripts and superscripts or numbers are not italicised unless they refer to a variable. For example: There is a relationship between the electric field strength  $E_1$  and the electric flux density  $D_1$ , which depends on permittivity  $\varepsilon$

$$D_1 = \varepsilon E_1.$$

As in Equation (4) above, equations may be treated as elements of a sentence, which means punctuation, such as commas and periods, may also be used in connection with them.

Mathematical functions and operators are written in normal text type (sin, log, lim, etc.).

Matrices may be treated as ordinary variables, in which case their symbols may be bolded, e.g. tension matrix  $\mathbf{U}$ . Equations may be used as parts of sentences with normal punctuation. Punctuation marks are placed immediately after the equation, not its number.



Standardised graphic symbols are used in drawings and graphs. Their figures and variables are expressed in the same way as in equations.

## References

Listing references and the related ISO 690.2 and SFS 5342/1987 standards are presented in detail by Mälkiä (1994). In the commonly used name-and-year system (the Harvard system), the reference list is alphabetised according to the first author of the source. If several sources by the same author or group of authors are referenced, they are listed in order of publication starting from the oldest one. When referencing several sources published by an author within the same year, they are distinguished from each other with a lower case letter after the publication year (1999a, 1999b etc.). If the author is unknown, the abbreviation Anon. may be used instead of the author's name. Alternatively, the name of the publication may be used as the reference. Also unpublished reference material and important oral communications must be listed. The sources must be critically evaluated. The reference list must also indicate where rare and less known sources are available.

The references may not include sources that are not cited. The sources should be described in detail and in the same way.

Sources are usually referenced as follows:

**books**                      author(s), editor(s)  
    publication year  
    title  
    edition (if more than one)  
    place of publication  
    publisher (NB: not printing press! Excluding company form abbreviations)

Example of source with one author: Patton, M. Q. 1990. Qualitative evaluation and research methods. London: Sage.

Esimerkki, kun kirjoittajia on kaksi: Johnson, G. & Scholes, K. 1999. Exploring corporate strategy. 5th ed. Harlow: Prentice Hall

Sources with many volumes are presented in the same way, and the volume in question is also mentioned.

### journal papers

author(s)  
 publication year  
 title of paper  
 title of journal  
 volume (annual set)  
 issue  
 pages

Example of a source with more than one author: Santamaría, L., Neito, M.J. & Barge-Gil, A. 2009. Beyond Formal R&D: Taking Advantage of Other Sources of Innovation in Low- and Medium-Technology Industries. *Research Policy*, vol. 38, pp. 507-517.

### publication series

author(s)  
 publication year  
 title of publication  
 body in charge  
 place of publication  
 publisher  
 title and number of series

E.g.: Laiho, L. (ed.) 1984. Arctic technology research projects in Finland. Espoo: Valtion teknillinen tutkimuskeskus (VTT). Tiedotteita 331.

**final theses**

author  
 year  
 title  
 type of thesis  
 (doctoral dissertation, Master's Thesis etc.)  
 institution and department

If you reference a compilation, introduce the parent publication with the word "In:" or type it in capital letters.

For example: Rajala, T. 2000. Henkilöstö kunnan voimavarana. Rajala, T. 2000. Henkilöstö kunnan voimavarana. In: Hoikka, P. (ed.) Kunnat 2000-luvun kynnyksellä. 2nd revised ed. Tampere: Tampereen yliopisto.

**conference papers**

author  
 publication year  
 title of paper  
 name, place and date of conference  
 place of publication  
 publisher or conference organiser  
 pages

For example: Sandström, J. 2001. How to reduce the complexity when formulating cost information for design engineers? 16th International Conference on Production Research (ICPR), July 23 - August 3, Prague, Czech Republic.

**Electronic Publications**

Electronic sources are referred to according to the SFS 5831 standard. Further information: the library web site [www.lut.fi/fi/kirjasto](http://www.lut.fi/fi/kirjasto), the library's SFS standard collection and the library administrators. Electronic documents should be referenced only if no other original source exists.

Example of e-mail source:

- Bergman, S. 1996. The Iceland Teacher Training School in the field of biology, science education and development work in environmental education. [e-mail]. [stefanb@khi.is](mailto:stefanb@khi.is) 28 June 1996.

Example of Internet source:

- Denning, P. 1996. Business Designs of the New University [online document]. [Accessed 5 June 2007]. Available at <http://ene.grnu.edu/pjd/education.html>

**Referencing (citations in the text)**

Citations from books, journals, publication series and theses follow the same guidelines as the list of references. Citations include the following: **author(s), year, page(s)**. Thus referencing can be done as follows: "Williamsson (1995, 23-25) states" or (Teece et al. 1986). Mälkiä also discusses citations.

If there is more than one author, the first author's name is followed only by "et al." This is also how you should cite electronic sources, for instance (Denning 1996). Do not include the web site address – it should be indicated in the list of references. If several sources are referenced at once (e.g. two different authors cited in one paragraph), they should be separated with a semicolon and in parenthesis (:).

You should pay attention to where you place the reference. If you want the reference to include the entire preceding paragraph, place it in parenthesis after the final period. If you only want it to include the preceding sentence, place the period after the second bracket. This should also be done within a paragraph. Direct quotations should be in quotes. If you cite the same source twice in a row, the latter may simply be marked: Ibid.

The instructions above are merely guidelines, they are not binding. Referencing may be done in another commonly approved way or following the examiners' instructions. The key to referencing is consistency.

Faculties may issue their own instructions for authors to follow. Authors must also take into account the requirements set by the language of the thesis.

## Footnotes

Footnotes are only used for explanations and additional comments on the text and are numbered separately for each page. Footnotes are placed at the bottom of the page and separated from the actual text with a line approximately 5 cm long. There should be an empty row above and below the line.

1.1.

1.2.

## Appendices

Appendices may include equations, diagrams, drawings, forms, etc. that do not need to be included in the actual text but to which a reference is made. Extensive additional reports, large tables and e.g. tables that are referred to often should be appended. However, figures, equations, tables, etc., which are a key part of the text and are also interpreted, are placed in the text. The appendices should not, however, contain anything irrelevant to the thesis.

The heading of an appendix is written at the top of the page. Appendices are numbered. Appendix pages are not numbered; only the final numbered pages of the thesis are part of the table of contents. Appendices and their headings may be listed at the end of the table of contents. If the appendix consists of several pages, the pages are marked as follows:

For example: 1            Appendix I, 1  
                                 Appendix I, 2 etc.

For example: 2            Appendix 1. Heading

- (continued on page x) is written at the bottom of the page
- (Appendix 1 continued) is written in the upper right-hand corner of the following page.

## REFERENCES

ISO 690-2:1997 Information and documentation—Bibliographic references—Part 2: Electronic documents or parts thereof

Mälkiä, M. 1994. Teksti ja kirjallisuusviitteiden laatiminen. 2nd unrevised ed. Tampere: University of Tampere. Hallintotiede B 6.

SFS 5342 Bibliographic references. 2nd ed. Helsinki: Finnish Standards Association. 1992.

SFS 5831 Bibliographic references. Electronic documents or parts there of. Helsinki: Finnish Standards Association. 1998.

Hannu Rantanen  
Vice-rector

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## 12 Master's thesis instructions in Business Administration

### 1. Introduction

These instructions apply only to business students and are based on LUT's university-wide thesis instructions. These instructions will enter into force on 1 August 2010.

The instructions start with a process description of the practical aspects of starting a thesis and of its assessment. Then, the contents of the thesis, conducting research and research methodologies are discussed. The final section deals with layout and gives practical examples of it.

The Master's thesis is the final project of the Master's degree studies. It demonstrates the student's knowledge of a scientifically and/or societally important topic related to his or her professional field. The thesis is a research assignment that requires approximately six months of full-time work and amounts to 30 ECTS credits in the degree. The student must demonstrate the ability to carry out the project independently and following a plan.

The Master's thesis is prepared in the second year of the Master's degree studies. Before applying for the approval of their thesis topic, **students must have completed their Bachelor's degree or complementary studies.**

### 2. Thesis process

#### Starting the Master's thesis

Students who are starting their Master's thesis should read these instructions carefully and meet with the professor in charge of the field (usually a professor of the student's major subject). The student discusses the topic of the thesis with the professor to make sure it meets the scientific requirements for a Master's thesis.

The following points are discussed with the professor:

- the prerequisites for starting the Master's thesis (completed studies)
- the topic and objective of the thesis
- the preliminary research plan and schedule
- funding (by the student, a grant or an employer)
- the examiners of the thesis (the first examiner is the supervising professor or a docent from the student's degree programme)
- the supervisor from the company commissioning the thesis
- issues agreed on with the organisation funding the thesis and the supervisor from the organisation, such as the employment relationship, responsibilities, safety, insurances, invention rights, etc.
- public access to the thesis

#### Applying for a topic

Prerequisites for applying for the approval of the thesis topic:

- Bachelor's degree completed (when the student has been admitted into the university for both **Bachelor's and Master's studies**)
- possible complementary studies completed (if the student has been admitted to complete only the **Master's degree**)
- possible other requirements set by the faculty

**The student applies for the approval of the topic and the appointment of the examiners from the head of the degree programme by leaving an application with the faculty study coordinator.** The Master's thesis is related to the student's major subject and its topic is agreed on

by the supervisor and the student together. The approval of the topic remains in force for two years from the date of approval (decision of the vice-rector for education). When the head of the degree programme approves the thesis topic, he/she also appoints the first examiner for the thesis, who is usually an LUT professor or docent. The first examiner must be from the student's major subject or a closely related field. The first examiner is also the supervisor of the thesis at the university. The head of the degree programme also appoints a second examiner for the thesis based on the supervisor's proposal. The second examiner must have at least a higher university degree and may be from outside of the university. If one or both of the examiners change, this must be approved by the head of the degree programme.

In addition, the thesis may have a supervisor from the commissioning organisation, who is approved by the first examiner along with the thesis topic.

Applying for Master's thesis work at a company is the student's responsibility. If the student wishes to start preparations for the thesis before the topic is officially approved, this should be discussed with the supervising professor.

The topic application may be submitted when the required studies are completed and thesis work has been obtained from a company and discussed with the supervising professor. The title does not need to be finalised upon application; it may be modified during the course of the project.

**The student may obtain his/her Bachelor's degree and have the thesis topic approved within the same month.**

The forms and instructions for applying for the approval of the thesis topic are available on the web site of the School of Business: Studies -> Forms -> Application for Master's Thesis Topic (1A)

## **Public access to the thesis**

**Master's theses submitted to the university for examination are normally public documents.**

This must be mentioned to the commissioner when the topic of the thesis is first discussed. If the thesis includes information which the commissioner considers confidential, the university may agree to hold the thesis **confidential for a maximum of two years**. However, it is recommended that the thesis is prepared as a public-access document.

If part of the information needs to be held confidential for longer than two years, the information must be excluded from the version submitted for examination. The work will be evaluated based on the non-confidential part.

The first examiner shall see to it that the commissioner is aware of the publicity requirements from the very beginning of the discussions.

## **Confidentiality notification**

If the thesis includes confidential information (held confidential for a maximum of two years), the commissioner of the thesis must submit a written notification of the extent of the confidential information, the reasons for confidentiality and the time the information is to be held confidential (usually in full years). The confidentiality period starts from the date the thesis is assessed. The student is responsible for submitting the confidentiality notification to the faculty study coordinator in connection with the assessment application. The student includes the mention "Confidential" and the date the confidentiality expires in the lower right-hand corner of the title page of the thesis. The abstract is always public.

## **Maturity test**

Students must complete a written maturity test on the topic of their thesis. Its purpose is to verify the student's familiarity with the topic of the thesis. During the course of the studies, also the student's Finnish or Swedish skills are assessed at one point. This can be done e.g. in connection with the

Bachelor's thesis. The maturity test is assessed by the first examiner of the thesis, and as needed, also a language reviser approved by the university. The maturity test is taken in the language in which the student has received his or her education in Finland. If the student has received his or her education in a language other than Finnish or Swedish, the head of the degree programme determines the language of the maturity test. In such cases, only the contents of the maturity test is evaluated, not the language.

**If a student has demonstrated his or her language skills in connection with the Bachelor's degree or other previous university degree, the language of the maturity test will not be evaluated, only the contents. The faculties issue their own instructions on the maturity test.** Further information is available in the study guide of the LUT Language Centre.

The maturity test should be taken five weeks before graduation. The date and time for the test should be set together with the examiner and the person in charge of maturity tests in the faculty.

The examiner gives the topic of the test. **The maturity test is evaluated on a scale of passed/failed.**

### **Assessment of the Master's thesis**

**The thesis must be reviewed by the examiners before it is printed.**

The student submits the Master's thesis in its final form, i.e. bound in black covers to the examiners for assessment. Both examiners are given their own copy. The assessment application, abstracts in Finnish and English, the possible confidentiality notification of the commissioner, and copies bound in black covers are submitted to the faculty study coordinator no later than 14 days before the date on which the dean approves theses. Foreign students do not need to prepare an abstract in Finnish.

The examiners prepare a written statement on the thesis and propose a grade. The title and grade of the thesis are shown in the degree certificate.

A statement in English on the Master's thesis will be prepared for students in international Master's programmes and for international students.

**The student's Master's thesis may be evaluated in the same month as the student will obtain his/her Master's degree.**

### **Assessment criteria**

#### **Purpose and delimitation of the research**

- Objectives, definitions and delimitation
- Relationship to previous research

#### **Stages of the research**

- Formulation of concepts, models, hypotheses and frameworks
- Data collection
- Collection of additional material and complete analysis
- Discussion, interpretation and conclusions

#### **Management of the research area**

- Balanced organisation of the research
- Methodical and logical approach
- Comprehensive and in-depth study
- Independent, critical and profound analysis

#### **Revising the text**

- Layout and presentation
- Language and legibility

**Assessment scale**

- improbatur (fail)
- approbatur (lowest passing grade)
- lubenter approbatur
- non sine laude approbatur
- cum laude approbatur
- magna cum laude approbatur
- eximia cum laude approbatur
- laudatur (highest grade)

The student has completed his/her degree **with distinction** if the overall grade is at least 4 and the Master's thesis grade at least eximia cum laude approbatur.

The faculty assesses and approves the thesis after the student has submitted an assessment application to the faculty.

Instructions and forms are available on the web site of the School of Business: Studies -> Forms -> Assessment Application for Master's Thesis (1B)

If the student is not satisfied with the evaluation, he or she may leave a request for correction with the faculty council within 14 days of the day the grade was made known. The request for correction should be addressed to the faculty council in question and submitted in writing to the faculty's head of study affairs. Students must submit the request in writing within 14 days of the day the grade was made known. They also have the right to find out the grounds for giving the grade.

Students who are dissatisfied with the decision may bring the matter before the degree board within 14 days of having been informed of the decision. A request addressed to the degree board in writing is to be submitted to the university Registrar's office.

### **3. Contents of the Master's thesis and how to conduct research**

#### **Language of the Master's thesis**

The thesis may be prepared in Finnish, Swedish or English. Permission for using other languages is granted by the head of the degree programme. The author of the thesis is responsible for the language revision of the thesis. If the commissioner of the thesis requires the use of a language other than Finnish, the commissioner is responsible for the translation or language revision of the thesis. In degree or Master's programmes in English, the thesis is prepared in English and the author is responsible for revising the language.

#### **Inventions related to the thesis**

The research work for a Master's thesis may result in an invention that can be patented or otherwise protected by industrial law. An invention may be a new or improved technical device or method with industrial or commercial importance.

Inventions must be discussed with all parties involved (the student, supervisors at the university and the commissioning company). If the invention made in connection with the thesis is to be patented, the patent application must be left before the work is published. Otherwise, the thesis must be written so that the invention is not revealed.

If the invention has ensued under an employment relationship, the Act on the Right in Employee Inventions (656/1967) is applied to the company. If the employment relationship is between the student and a university or higher education institution, the act on the right in employee inventions at higher education institutions (369/2006) is applied to the school.

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General patenting legislation is applied to the patenting of an invention and general copyright legislation to copyright issues unless otherwise agreed by the parties involved in the work (the commissioner, university and student).

Further information is available from the university's Research and Innovation Services.

### **Contents of the thesis**

The thesis may be composed e.g. of the following items in the following order:

Title page  
Abstract in Finnish  
Abstract in English  
Acknowledgements  
Table of contents  
List of symbols and abbreviations  
Introduction  
Discussion (theories, background and implementation of the research)  
Conclusions (analysis of observations and results)  
Summary (concise summary of the above)  
References  
Appendices

### **Title page**

The title page includes the title of the thesis. The title must be well-defined and correspond to the content of the thesis. A keyword, which expresses something essential about the thesis and has an explicit and specific meaning, is recommended as the first word. Avoid the following: some, review, method, report, study, equipment etc.

### **Abstracts in Finnish and English**

The abstract is a concise (one A4 sheet), objective, independent summary of the Master's thesis. It should be intelligible as such, without the original document. It explains the contents of the thesis: the objective, methodologies, results and conclusions. A good abstract is written in complete and concise sentences. The author does not express his or her opinions, but describes the thesis as would an outside reporter. No direct references are made to the original text.

### **Acknowledgements**

Acknowledgements are a brief description of what or who had an impact on the thesis. E.g. the people who furthered the progress of the thesis may be thanked.

### **Table of contents**

The table of contents lists the headings and sub-headings and their page numbers.

### **List of symbols and abbreviations (if needed)**

Symbols, abbreviations and terms which are not common knowledge are listed in alphabetical order along with their definitions and arranged in groups: e.g. first Roman symbols, then Greek ones and finally abbreviations. The list of symbols and abbreviations is placed immediately after the table of contents.

### **Introduction**

The actual research report is opened with an introduction. The purpose of the introduction is to introduce the topic and awaken the reader's interest. The introduction briefly describes the background, material extent and aims of the thesis. The introduction relates the thesis to other research and sources and presents the research methodology applied. It also describes the key points and organisation of the research report. It does not, however, include detailed descriptions of the theory, methods or results. A good introduction is, nevertheless, significantly longer than a couple of pages, and is organised in a logical manner.



## Discussion

The discussion is divided into chapters with headings that depict the organisation of the thesis (in exactly the same form as in the table of contents). In this section, the author relates all of the material he or she wishes in reply to the research questions posed, as well as the conclusions based on the material. Repetition should be avoided unless it is necessary. However, the discussion must be drawn up in such a way that a professional in the field can repeat the research work e.g. to check the equations, expressions, measurements, calculations or results and conclusions.

The language of the thesis must be grammatically correct and the expression coherent, accurate and concise. The topic must be presented to the reader unequivocally, intelligibly and consistently. The style must be academic and the technical terminology established. In particular, the use of foreign words should be avoided. They should be replaced with paraphrases or expressions in the language of the thesis.

In order for the observations to be of use to others, the stages of the research work must be presented in complete and the results of the observations in their original form in e.g. tables. Long sequences of equations and programming code are appended with headings. It is not necessary to show the derivation of the equations quoted, although the author must make sure the equations are presented correctly. However, the derivation of new expressions and equations introduced in the thesis must be shown, at least in outline. The author must also explain under which conditions the calculations, formulae and equations are applicable.

## Conclusions

Depending on the nature and scope of the study, the report ends either with the chapter "Conclusions", or two separate chapters, e.g. "Conclusions" and "Summary". The conclusions analyse the observations and results drawn from the research. The conclusions examine and reflect on e.g. the compatibility of the theory and measurements, the reasons for possible differences, and summarise the conclusions drawn from the results. The need for further research and possible practical applications may also be argued here.

## Summary

The summary is a concise description of the entire work: it presents the starting point of the research, the theoretical and empirical choices, aims, results, conclusions and possible ideas for further research. New information is not introduced in the conclusions, and no direct references are made to the discussion. The importance of the summary should not be underestimated because often the reader only reads the summary or the introduction and the summary.

## Carrying out the research

The thesis is to be prepared according to good scientific practice. The research methods must be approved by the scientific community. The prevailing approaches and research methods in the field in question are to be applied. The student should learn about the research methodology and practices in his/her field sufficiently before preparing the thesis.

Plagiarism is absolutely forbidden. Citations and references must be made in accordance with good practice. If the student plagiarises material in his/her assignment or thesis, the supervisor must address the issue without delay. The final version of the thesis may not include references and citations that go against good scientific practice.

If, regardless of the supervisor's guidance, the final version contains plagiarised material, the failing grade *improbatum* will be proposed for the thesis. Moreover, the director of administration will be informed of the matter.

## 4 Layout and presentation of the thesis

The presentation of the thesis is very important in terms of readability, intelligibility and reliability. A finished layout gives a good and reliable impression of both the work and its author. The thesis is written in standard language and in the passive voice. Abbreviations, such as *e.g.* or *etc.* should not be used, but instead, written out in their entirety.

### Cover, presentation and electronic version

The language of the thesis must be grammatically correct and the expression coherent, accurate and concise. It should convey the message to the reader unequivocally and intelligibly, and the organisation should be logical and coherent. Say only what is needed, avoid wordiness and run-on sentences. Buzzwords and unnecessary foreign words should particularly be avoided.

The Master's thesis is bound in black, hard covers, size A4.

- The recommended font is Arial 12 and spacing 1.5.
- The thesis can be printed on both sides of the paper or on one side only.
- Page margins are as follows: 35 mm at the top, approx. 50 mm on the left, and in one-sided printing approx. 20 mm on the right and at the bottom.
- Page numbering is at the top of the page, either centred or right-aligned.
- If you print on both sides of the paper, the outer margins should be approx. 20 mm and the inner ones approx. 50 mm.
- Each paragraph is aligned to the left, there are no indentations and there is an empty line between paragraphs. The paragraphs are justified.
- Avoid long spaces between words: use hyphenation.
- The thesis should be approximately 80-100 pages.

The text "Master's thesis", the author's name and the year are printed in gold on the spine. The text starts 80 mm from the top and the year is 30 mm from the bottom.

On the front cover, in gold, centred and approx. 100 mm from the top is the word Master's thesis. The author's name and the year are in the lower right-hand corner.

If drawings are an essential part of the thesis but need not be included in the bound copy, the originals or photocopies of them are enclosed in a separate A4-sized folder.

The student submits an abstract of the thesis to the university's electronic database LUTPub, which is maintained by the library. Also the entire thesis may be uploaded into the database, in which case it can be accessed by the general public in an open network.

### Parts of the thesis

#### Title page

**The title page includes the following information:**

- University, Faculty, Major subject
- Author of the Master's thesis
- Title of the Master's thesis
- Examiners of the thesis (first and second, the supervisor is mentioned first)
- Possible period of confidentiality (lower right-hand corner)

The points above are not to be used as headings on the title page, e.g. "University: Lappeenranta University of Technology" is incorrect, but "Lappeenranta University of Technology, School of Business" is correct. The layout of the title page should be balanced, such as in assignment reports.

## Abstracts in Finnish and English

You should favour the passive voice or the 3rd person active in case the abstract is published separately. Unestablished abbreviations, symbols or technical terms should be explained. Tables, equations etc. are used only if they are necessary for the sake of clarity. No direct references are made to the original text.

The abstract is done in both Finnish and English (equivalent contents). In the Finnish abstract, the title is in Finnish and in the English one in English. Foreign students do not need to prepare an abstract in Finnish. Both the Finnish and English abstracts are attached to the thesis. They are also submitted to the study coordinator along with the assessment application.

The complete identification information should be included at the beginning of both the Finnish and the English abstract in the following order:

- Author's name
- Title of thesis
- Faculty
- Major Subject
- Year of publication
- Master's Thesis University
- Number of pages, figures, tables and appendices
- Examiners (supervisor first)
- Keywords in Finnish
- Keywords in English

An example of how to present the bibliographic information in the abstract:

Abstract:

### ABSTRACT

**Author:** Markkanen, Marja  
**Title of thesis:** Activity-based costing in a service enterprise  
**Faculty:** School of Business  
**Major Subject:** Accounting  
**Year:** 2010  
**Master's Thesis:** Lappeenranta University of Technology  
80 pages, 26 figures, 4 tables and 8 appendices  
**Examiners:** Prof. Timo Tietäväinen  
Prof. Tiina Tietäväinen  
**Keywords:** activity based costing, service enterprise, cost management

The **keywords** must be informative and describe the contents of the thesis accurately. Concrete concepts (e.g. equipment) are in plural, abstract ones (e.g. methods) in singular. A good title should include at least some of the most important keywords. The number of keywords should be three to five.

The abstract is a public document, and therefore all confidential information must be excluded from it.

The author sends electronic copies of the abstracts or the entire thesis to the LUT library. More details are available from the library and its web site.

## Acknowledgements

The acknowledgements recognise the help, guidance, advice etc. provided by others and gives thanks to them. Also the commissioner of the thesis is mentioned. The acknowledgements are concluded with the author's name and the date after which no more modifications have been made to the work.

## Table of contents

The pages are numbered in Arabic numerals from where the text starts. Please note that the first page (number 1) of the thesis is the title page. Thus the table of contents may be e.g. on page 4. The table of contents lists the headings and sub-headings and their page numbers. A separate list of figures and tables can be included at the end of the table of contents.

Decimals and indentations are used in the table of contents – as well as in the headings in the text – according to the following example (note the use of upper and lower case lettering and the indentation of sub-headings). **Please note that no more than three levels of headings are allowed.** If there is need for more detailed sub-headings, they should not be numbered. If variables need to be used in the first-level headings, they are to be written out as they are in equations. In such cases the author and the supervising professor may decide on the most appropriate way to present the headings in order to obtain a neat and legible layout. The page numbers are aligned to the right.

Decimals and indentations are used in the table of contents – as well as in the headings in the text – according to the following example (note the use of upper and lower case lettering and the indentation of sub-headings). The page numbers are aligned to the right.

### TABLE OF CONTENTS

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### Explanation of Abbreviations and Symbols

Abbreviations and variables and their explanations can be listed in alphabetical order, mathematical and other symbols as a list of their own, and identifying letters as yet another list (latin, greek etc. each separately).

### Introduction

The introduction contains an introduction to the topic, definition of the research problem, objectives, point of view, delimitation and research methodology. Different parts can be presented as separate subsections.

## Discussion

Each citation in the discussion should be clearly referenced so that the reader may refer to the original source.

The nature of the work determines the formulation of the discussion. The discussion may often be divided into a theoretical part, empirical part and results:

- the theoretical background, including the literature and previous research and concepts on which the thesis is based
- observations and collection of basic material etc In order for the observations to be scientifically valid, the research process should be described in as much detail as possible.
- the discussion on observations and presentation of the results are often closely connected. All calculations need not be shown, as long as the author explicitly explains how they are done.

Figures, tables, equations etc. make the discussion more concrete and enhance readability. They are captioned and numbered, each as their own group.

**Equations** must be written clearly, each on their own line so that they are separated from the text. They may, for instance, be indented. Equations are numbered either consecutively or by chapter. The number is written in parentheses on the right-hand side of the column. References to an equation may be made only after it has been presented, with certain exceptions. Figures and tables are captioned and numbered similarly to equations. Figures and tables have to be referred to in the text, preferably before they are introduced. **The captions of tables are placed above the table and those of figures below the figure. Figures and tables are not to include foreign words.** The variables in the figures are presented in the same way as in the text and equations.

In mathematical presentation, the author must use standard symbols if such exist, and if not, other established symbols. In the absence of established symbols, the author may create new ones. The name of a unit symbol, e.g. the electric charge  $Q$ , must be mentioned when it is first introduced in the text and repeated when needed. Standard conventions must be followed when marking variables. For instance, variables in equations, charts and figures are *written in italics*, **vectors in bold italics** (or in italics and topped with an arrow,  $\vec{E}$ ). Subscripts and superscripts or numbers are not italicised unless they refer to a variable. For example: There is a relationship between the electric field strength  $E_1$  and the electric flux density  $D_1$ , which depends on permittivity  $\epsilon$

$$D_1 = \epsilon E_1. \quad (4)$$

As in Equation (4) above, equations can be treated as elements of a sentence, which means punctuation, such as commas and periods, may also be used in connection with them.

Mathematical functions and operators are written in normal text type (sin, log, lim, etc.).

Matrices can be treated as ordinary variables, in which case their symbols may be bolded, e.g. tension matrix  $\mathbf{U}$ . Equations may be used as parts of sentences with normal punctuation. Punctuation marks are placed immediately after the equation, not its number.

Standardised graphic symbols are used in drawings and graphs. Their figures and variables are expressed in the same way as in equations.

## Conclusions and summary

The conclusions summarise the discussion: the starting point of the research, theoretical and empirical choices, objectives and results, conclusions and possible ideas for further research. You may also voice criticism. There is no need to repeat what has already been said in the discussion. Instead, a more expansive viewpoint may be adopted, explaining which questions were left unanswered etc. New information is not introduced in the conclusions, and no direct references are made to the discussion.

## References

Listing references and the related ISO 690.2 and SFS 5342/1987 standards are presented in detail by Mälkiä (1994). In the commonly used name-and-year system (the Harvard system), the reference list is alphabetised according to the first author of the source. If several sources by the same author or group of authors are referenced, they are listed in order of publication starting from the oldest one. When referencing several sources published by an author within the same year, they are distinguished from each other with a lower case letter after the publication year (1999a, 1999b etc.). If the author is unknown, the abbreviation Anon. may be used instead of the author's name. Alternatively, the name of the publication may be used as the reference. Also unpublished reference material and important oral communications must be listed. The sources must be critically evaluated. The reference list must also indicate where rare and less known sources are available.

The references may not include sources that are not cited. The sources should be described in detail and in the same way.

Sources are usually referenced as follows:

**books**                    author(s), editor(s)  
                                   publication year  
                                   title  
                                   edition (if more than one)  
                                   place of publication  
                                   publisher (NB: not printing press! Excluding company form abbreviations)

Example of source with one author: Patton, M. Q. 1990. Qualitative evaluation and research methods. London: Sage.

Example of source with two authors: Leino, A. & Leino, J. 1988. Kasvatustieteen perusteet. Jyväskylä: Gummerus.

Sources with many volumes are presented in the same way, and the volume in question is also mentioned.

**journal papers**        author(s)  
                                   publication year  
                                   title of paper  
                                   title of journal  
                                   volume (annual set)  
                                   issue  
                                   pages

Example of a source with more than one author: Porter, L. W., Steers, R. M., Mowday, R. T. & Boulian, P. V. 1974. Organizational commitment, job satisfaction, and turnover among psychiatric technicians. *Journal of Applied Psychology*, vol. 59, no. 2, pages 603-609.

**publication series**    author(s)  
                                   publication year  
                                   title of publication  
                                   body in charge  
                                   place of publication  
                                   publisher  
                                   title and number of series

E.g.: Laiho, L. (ed.) 1984. Arctic technology research projects in Finland. Espoo: Valtion teknillinen tutkimuskeskus (VTT). Tiedotteita 331.

**final theses**            author  
                                   year  
                                   title  
                                   type of thesis

(doctoral dissertation, Master's Thesis etc.)  
institution and department

If you reference a compilation, introduce the parent publication with the word "In:" or type it in capital letters.

For example: Rajala, T. 2000. Henkilöstö kunnan voimavarana. In: Hoikka, P. (ed.) Kunnat 2000-luvun kynnyksellä. 2nd revised ed. Tampere: University of Tampere.

### **conference papers**

author  
publication year  
title of paper  
name, place and date of conference  
place of publication  
publisher or conference organiser  
pages

For example: Sandström, J. 2001. How to reduce the complexity when formulating cost information for design engineers? 16th International Conference on Production Research (ICPR), July 23 - August 3, Prague, Czech Republic.

## **Electric Publications**

Electronic sources are referred to according to the SFS 5831 standard. Further information: the library web site [www.lut.fi/fi/kirjasto](http://www.lut.fi/fi/kirjasto), the library's SFS standard collection and the library administrators. Electronic documents should be referenced only if no other original source exists.

Example of e-mail source:

- Bergman, S. 1996. The Iceland Teacher Training School in the field of biology, science education and development work in environmental education. [e-mail]. [stefanb@khi.is](mailto:stefanb@khi.is) 28 June 1996.

Example of Internet source:

- Denning, P. 1996. Business Designs of the New University [online document]. [Accessed 5 June 2007]. Available at <http://ene.grnu.edu/pjd/education.html>

## **Referencing (citations in the text)**

Citations from books, journals, publication series and theses follow the same guidelines as the list of references. Citations include the following: **author(s), year, page(s)**. Thus referencing can be done as follows: "Williamsson (1995, 23-25) states" or (Teece et al. 1986). Mälkiä also discusses citations.

If there is more than one author, the first author's name is followed only by "et al.". This is also how you should cite electronic sources, for instance (Denning 1996). Do not include the web site address – it should be indicated in the list of references. If several sources are referenced at once (e.g. two different authors cited in one paragraph), they should be separated with a semicolon and in parenthesis (;).

You should pay attention to where you place the reference. If you want the reference to include the entire preceding paragraph, place it in parenthesis after the final period. If you only want it to include the preceding sentence, place the period after the second bracket. This should also be done within a paragraph. Direct quotations should be in quotes. If you cite the same source twice in a row, the latter may simply be marked: Ibid.

The instructions above are merely guidelines; they are not binding. Referencing may be done in another commonly approved way or following the examiners' instructions. The key to referencing is consistency.

**Major subjects may issue their own instructions for authors to follow. Authors must also take into account the requirements set by the language of the thesis.**

## Footnotes

Footnotes are only used for explanations and additional comments on the text and are numbered separately for each page. Footnotes placed at the bottom of the page and separated from the actual text with a line approximately 5 cm long. There should be an empty row above and below the line.

- 1.1.
- 1.2.

## Appendices

Appendices may include equations, diagrams, drawings, forms, etc. that do not need to be included in the actual text but to which a reference is made. Extensive additional reports, large tables and e.g. tables that are referred to often should be appended. However, figures, equations, tables, etc., which are a key part of the text and are also interpreted, are placed in the text. The appendices should not, however, contain anything irrelevant to the thesis.

The heading of an appendix is written at the top of the page. Appendices are numbered. Appendix pages are not numbered; only the final numbered pages of the thesis are part of the table of contents. Appendices and their headings may be listed at the end of the table of contents. If the appendix consists of several pages, the pages are marked as follows:

For example: 1                      Appendix I, 1  
    Appendix I, 2 etc.

For example: 2                      Appendix 1. Heading

- (continued on page x) is written at the bottom of the page
- (Appendix 1 continued) is written in the upper right-hand corner of the following page.

## REFERENCES

ISO 690-2:1997 Information and documentation—Bibliographic references—Part 2: Electronic documents or parts thereof

Mälkiä, M. 1994. Teksti ja kirjallisuusviitteiden laatiminen. 2nd unrevised ed. Tampere: University of Tampere. Hallintotiede B 6.

SFS 5342 Bibliographic references. 2nd ed. Helsinki: Finnish Standards Association. 1992.

SFS 5831 Bibliographic references. Electronic documents or parts there of. Helsinki: Finnish Standards Association. 1998.

Further tools in preparing a thesis:

Sirkka Hirsjärvi et al: Tutkimus ja sen raportointi, 1990.

Hirsjärvi - Remes - Sajavaara: Tutki ja kirjoita, 2004.

Mälkiä, Matti: Teksti- ja kirjallisuusviitteiden laatiminen, 1994.