

DEPARTMENT OF ARCHITECTURE

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Chairs:

Degree Programme in Architecture
 A-8 Public Building Design
 A-9 Building Technology
 A-9a Building Structures
 A-27 History of Architecture
 A-36 Urban Planning
 A-36 Urban Design
 A-52 Housing Design
 A-60 Basics and Theory of Architecture
 A-112 Wood Architecture
 Degree Programme in Landscape Architecture
 MA-94 Landscape Planning
 MA-94 Landscape Design
 MA-94 Landscape Management

(P) after the name of the course indicates postgraduate level. The course can be included in undergraduate as well as in postgraduate studies.

*) The courses marked with an asterisk * are not part of the International Architecture Program. The language of instruction is Finnish and the access of international participants is limited.

Please take note of the language of instruction

A-8 PUBLIC BUILDING DESIGN

Courses credited in ECTS

Prof. Markku Komonen, tel. 451 4423, room A212
 University teacher Pia Ilonen A 211, 451 4422

A-8.1200 Public Buildings I (10 cr)* V A
 27 + 81 (2 + 6)

Teachers: Prof Markku Komonen, university teacher Pia Ilonen
 Contents: The aim of this design course is to provide the students with basic knowledge of design processes, requirements, utility, scaling and the recent architectural development in public building.

Requirements: Lectures, examination and approved design project.

The course consists of a year-long lecture period for degree students. The autumn lecture series will be held in English, the spring lecture series (only for degree students) will be held in Finnish.

The exercise project will be accomplished as a term-long design project either during the autumn or spring term. The exercise part of the course is part of the International Architecture Program entity.

Literature: See the Department's own Study Guide.
 Only for students at the Department of Architecture.
 Language: Finnish or English.

A-8.2310 Public Buildings, studio (10 cr) V A
 16 + 54 (1 + 4) I-II, III-IV

Teachers: Prof Markku Komonen, University teacher Pia Ilonen
 Contents: An advanced design course that examines the architectural and technical problems of complex large-scale public buildings and facilities for public services.

Requirements: Approved design project.

Prerequisites: A-8.1200/A-8.200 or equivalent knowledge of building design; A-9.203 is recommended.

Only for students at the Department of Architecture.

Language: Finnish or English.

Additional: Replaces the course A-8.310

A-8.3315 Public Buildings, advanced special studio (10 cr) *
 V A 16 + 54 (1 + 4) I-II, III-IV

Teachers: Prof Markku Komonen, University teacher Pia Ilonen
 Contents: Adoption of the central functional and structural origins of public building. Developing an understanding of architectural space and form. Planning of the immediate surroundings of a public building and its importance. Presentation of the project and development of presentation skills.

Requirements: Approved design project.

Prerequisites: A-8.1200/A-8.200 or equivalent knowledge of building design; A-9.203 is recommended.

Only for students at the Department of Architecture.

A-8.3320 Architecture III, design competition (1-10 cr) * V
 Period

Teacher: Prof Markku Komonen

Contents: A classified or supervised international or national student competition in public building design.

Prerequisites: A-8.1200/A-8.200 or corresponding knowledge of building design.

Language: Finnish

Additional: Replaces the course A-8.320

A-8.3998 Public Buildings, special project (1-10 cr) * V A

Teacher: Prof Markku Komonen

Contents: An individual study project on the special aspects of public building design.

Requirements: Execution of the project (literary work, design project, video, film, exhibition etc.) to be discussed separately with the teacher.

Only for students at the Department of Architecture.

Language: Finnish

Additional: Replaces the course A-8.998

A-8.4600 Postgraduate Seminar on Public Buildings

(2-10 cr) * V P

Period

Teacher: Prof Markku Komonen

A-8.1521 Contemporary Finnish Architecture (1 cr) V

Period I-II

Teacher: Prof Markku Komonen

Contents: The lecture series offers, through guest lectures by architects, a view on contemporary Finnish architecture.

Requirements: Announced separately.

Language: English.

The course is part of the International Architecture Program entity. The lectures are organized together with the autumn lecture course A-8.1200.

Additional: Replaces the course A-8. 521

A-9 BUILDING TECHNOLOGY**Courses credited in ECTS**Prof: Antti-Matti Siikala, tel. 451 4406, room A112
University teacher Päivi Väisänen, A 310, 4541 4416**A-9.1112 Building Technology 1, basic course (9 cr) ***

27 + 108 (2 + 8) I-II

Teacher: Prof Antti-Matti Siikala

Contents: Basics of statics; the concepts of strength and sustainability. Wood, brick and concrete structures. Tensed structures. Architectural drawing standards.

Requirements: Lectures, exam, approved exercises and field trips.

Exercise projects only for students at the Department of Architecture.

Language: Finnish

Additional. Replaces the course A-9.112

A-9.1115 Building Technology 2, basic course (9 cr)

27 + 108 (2 + 8) I,IV

Teacher: Prof Antti-Matti Siikala

Contents: A design course that focuses on the basic structural and technical aspects of architecture. Steel, glass, characteristics and application. Wood as a building material. Technical and artistic design of a simple wooden building. An architect's work routines.

Requirements: Lectures, exercises, exam and excursion. Exercises only for students at the Department of Architecture.

Prerequisites: A-9.1112/A-9.112 or corresponding knowledge of building technology.

Exercise projects only for students at the Department of Architecture.

Language: Finnish

Additional: Replaces the course A-9.115

Courses credited in ocr**A-9.203 Working Drawings and Building Specifications**

(5-10 ocr)

Period I-IV

Teacher: Ville Hara

Contents: Realisation of a building project and the necessary documents; technical drawings, building element drawings and a building description.

Requirements: The course includes an opening lecture and exercises. The course is mandatory for those who have started 1994 or later and chosen building design as their main subject.

The course must be finished before the commencement of the main study subject.

Only for students at the Department of Architecture.

Language: Finnish, English when needed

A-9.210 Building Technology - course with varying content

(2-6 ocr) *V

Teacher: Prof Antti-Matti Siikala

Contents: A course with an annually changing topic. The aim is to discuss current topics.

Language: Finnish

A-9.309 Renovation of Buildings, studio (8-10 ocr) V A

27 + 54 I-III, (2 + 2) I-II, (0 + 2) III

Teachers: Prof Antti-Matti Siikala, University teacher

Päivi Väisänen, architect Antti Luutonen

Contents: Introduction to renovation of newer building stocks. In addition to lectures the course includes planning of an old building for reuse, the needed technical explanations connected to the planning.

Requirements: Exercise.

Prerequisites: A-9.1115/A-9.115, recommended A-9.203

Language: Finnish, English when needed

Only for students at the Department of Architecture.

The course is part of the International Architecture Program entity.

A-9.310 Product Design - course with varying content (6-10 ocr) V

Period I-IV

Teacher: Prof Antti-Matti Siikala, Archit. Pekka Pakkanen

Contents: A studio course that experiments with practical construction using given building materials. The studio goes deep into one material and its potentials. Designing and constructing of a small building or building component. Plenty of handwork. Excursions to industrial plants and buildings.

Requirements: Design work and construction.

Prerequisites: A-9.1115/A-9.115, A-9.203 recommended, or corresponding knowledge of design.

The course is part of the International Architecture Program entity

Language: Finnish, English when needed

A-9.998 Building Technology, special project (2-10 ocr) * V

Teacher: Assigned according to the project

Contents: An individual study project of the special aspects of public building design. The details of the project are to be negotiated with the teacher.

Language: Finnish

A-9a BUILDING STRUCTURES**Courses credited in ECTS**

Prof: Tor-Ulf Weck, tel. 451 4404, room A110

A-9.1127 Physics and Mechanics of Structures (3 cr) * V

Period I-II

Teacher: Prof Tor-Ulf Weck

Contents: Basic physics and mechanics, basis of structural design. Heat and humidity movement in structures. Connection between strength of materials and structures.

Requirements: Lectures, calculation exercises and written exam

Language: Finnish

A-9.1137 An Architect's Material Technology (3 cr) * V
Period III-IV

Teacher: Prof Tor-Ulf Weck

Contents: Basic knowledge of manufacture, technical properties and use of material in load bearing structures.

Requirements: Lectures, laboratory exercises and written exam.

Language: Finnish

A-9.1151 IT 1 Introduction to Architectural IT (1 cr) V
Period

Teacher: Aki Hiltunen, architect

Contents: Introduction of the basic elements, concepts and methods of architectural computing. TKK networks, architects' tools for communication, writing, calculation, drawing and modelling (CAD).

Requirements: Lectures, approved exercises.

Language: English

The course is part of the International Architecture Program entity

A-9.1152 IT 1 The Computer as the Architect's Tool 1 (2 cr) Period

Teacher: Tuukka Norri

Content: The study period introduces students to the school's network environment and the study services connected to it. Computer and central programme basics. Mandatory course.

Requirements: Lectures, approved exercises and exam.

Language: Finnish

Additional: Replaces the course T-106.001

A-9.1153 *IT 1 The Computer as the Architect's Tool 2 (2 cr) V
Period 1 year /II

Teacher: Tuukka Norri

Contents: Basics of computers and common word processing, calculation, graphic and design programmes. It is recommended that the course be taken during the autumn term of the first year.

Requirements: Lectures, approved exercises, exam.

Language: Finnish

Additional: Replaces the course A-9.1160

A-9.1161 IT 1 Introduction to Architectural CAD (4 cr) *
Period 2 year /III-IV

Teachers: Kimmo Kirvesmäki, architect, Iivo Vänskä

Contents: Architectural drawing and design modelling. Introduction to CAD programmes available for architectural design. The course includes the basics of ArchiCAD and AutoCAD.

Requirements: Lectures, approved exercises.

Prerequisites: A-9.1152, A-9.1153/A-9.1160/A-9.160

Language: Finnish

Addition: Replaces the course A-9.161

A-9.1162 IT 1 Introduction to Landscape Architecture Information Management (3 cr) * V

Period 2 year /III-IV

Teacher: Iivo Vänskä

Contents: Introduction to the use of digital instruments and methods in landscape architecture. The study module includes introduction to AutoCAD, the use of MicroStation-programmes and geographical data information systems.

Requirements: Lectures, approved exercises.

Prerequisites: A-9.1152, A-9.1153/A-9.1160/A-9.160

Language: Finnish

Additional: Replaces the course A-9.162

A-9.1170 IT 2 The Basics of ArchiCAD (4 cr) * V

Period 3-year and advanced students I-II

Teachers: Kimmo Kirvesmäki, architect

Contents: The basics of ArchiCAD.

Requirements: Lectures, approved exercises. Possibility to integrate the exercise with design courses.

Prerequisites: A-9.1161/A-9.161 or A-9.1162/A-9.162

Language: Finnish

Additional: Replaces the course A-9.170

A-9.1173 IT 2 The Basics of ADT (4 cr) * V

Period 3 year - advanced students /III-IV

Teacher: Marko Rajala, architect

Contents: The basics of Architectural Desktop.

Requirements: Lectures, approved exercises. Possibility to integrate the exercise with design courses.

Prerequisites: A-9.1161/A-9.161 or A-9.1162 /A-9.162

Language: Finnish

Additional: Replaces the course A-9.173

A-9.1180 IT 3 Architectural Visualization (4 cr) * V

Period advanced students /III-IV

Teachers: NN

Contents: Modern visualization tools and methods in the architectural profession. Programs to be used: AutoCad, ArchiCad, Photoshop, Illustrator, Indesign and Autodesk Viz.

Requirements: Lectures and approved accomplishment of the course work. Possibility to integrate the main exercise with design courses.

Prerequisites: A-9.1161 or A-9.1162.

Language: Finnish

Additional: Replaces the course A-9.180

A-9.1181 IT 3 Information Management for Architects (4 cr) * V

Period advanced students /I-II

Teacher: Marko Rajala, architect

Contents: Architect's data, project management and system planning by comprehensive information technology.

Requirements: Lectures, approved course work.

Prerequisites: A-9.1161 or A-9.1162.

Language: Finnish

Additional: Replaces course A-9.181

A-9.1183 IT 3 Intensified CAD (4 cr) * V

Period advanced students /I-IV

Teachers: Marko Rajala, architect

Contents: Architectural IT-project. Content to be discussed personally with the teachers.

Requirements: Approved exercise.

Prerequisites: A-9.1161/A-9.1162, A-9.1170/A-9.1173.

Language: Finnish

Additional: Replaces the course A-9.183

A-9.2251 Special Aspects in Structural Design (5 cr) P * 27 + 0 (2 + 0) I-II

Teacher: Prof Tor-Ulf Weck

Contents: Structural firmness; research institutes; the special problems of reinforced concrete structures.

Language: Finnish

Additional: Replaces the course A-9.251

A-9.2351 Building Structures, special project (2-12 cr) * V

Teacher: Prof Tor-Ulf Weck

Contents: An individual study project on the special aspects of building structures. Detailed contents to be agreed upon with the tutor.

Language: Finnish

Additional: Replaces the course A-9.351

A-27 HISTORY OF ARCHITECTURE

Courses credited in ECTS

Prof. N.N., fixed term prof: Aino Niskanen., tel. 451 4421, room A210

A-27.1111 Introduction to History of Architecture and Art (1 cr) *

27 + 0 I-II

Teachers: Prof. N.N., fixed term prof. Aino Niskanen
 Contents: Main stylistic periods and manners of expression of architecture; historical viewpoints; the building heritage of Finland; the key questions of building conservation.
 Requirements: Lectures, a small written study and a drawing exercise

Language: Finnish

Additional: Replaces the course A-27.1110

A-27.1102 History of Architecture, basic course (4-9 cr) *

54 + 90 (2 + 4) I-IV

Teachers: Architect Aaro Söderlund, architect Sari Kivimäki
 Contents: The overall development of architecture and urbanism until the beginning of the 20th century. The built environment as the outcome of historical processes. Seminar and exercises, field trips.

Requirements: Exam, approved exercises. Excursions and field exercises. Landscape architecture students may, if they wish, accomplish only the lecture part of this course (autumn + spring, together 3 cr)

Exercise projects only for students at the Department of Architecture

Language: Finnish

Additional: Replaces the course A-27.102

A-27.1200 Architecture in Finland and Scandinavia (6-15 cr)

54 + 54 (4 + 4) I-II

Teacher: Prof. N.N., fixed term prof. Aino Niskanen
 Contents: Provides basic knowledge in the historical development of architecture and urbanism that took place in Finland and in the Nordic countries between the Middle Ages and the early 20th century. Measurement task, field exercise and a small design task related to the conservation of buildings.

Requirements: Exam and approved exercises.

Exercise projects only for students at the Department of Architecture.

Language: Finnish,

Additional: Replaces the course A-27-102

A-27.1210 History of Modern Architecture (5-9 cr) *

Period III-IV (Alternate years together with A-27.2340, will be lectured in the spring 2007)

Teacher: Mona Schalin, architect

Contents: The international development of the 20th century architecture; the relationship between Finnish architecture and international trends.

Requirements: Exam based on lectures and separate list of references, possible exercise work.

Language: Finnish

Additional: Replaces the course A-27.210

A-27.2220 History of Architecture - course with a varying content (3-6 cr) * V P

54 + 0 (2 + 0) I-IV

Teachers: Prof. N.N., teachers N.N.

Contents: Yearly varying special subjects on architecture and cultural history. Can also be part of postgraduate studies.

Requirements: Exam.

Language: Finnish

Additional: Replaces the course A-27.220

A-27.1231 Art History (4 cr) *

54 + 0 (2 + 0) I-IV

Teacher: Riitta Niskanen, Ph.D.

Contents: The major stylistic periods of architecture and art.

Requirements: Exam.

Language: Finnish

Additional: Replaces the course A-27.231

A-27.1243 Renovation of Traditional Structures (6-9 cr) *

Period III-IV

Teacher: N.N., architect

Contents: Principles of restoring traditional wood and stone buildings; renovation and conservation techniques and methods. Work camps.

Requirements: Lectures, small scale working method exercises and an exam.

Language: Finnish

Additional: Replaces the course A-27.243

A-27.3302 Building Conservation, studio (9-15 cr) * V

27 + 90 (1 + 4) I-IV

Teachers: Prof. N.N., N.N., architect

Contents: An advanced design course dealing, through exercise work, with the problems of building conservation and restoration

Requirements: Seminar work and a design task.

Prerequisites: A-27.1200/A-27.200 and A-27.1243/A-27.243.

Language: Finnish

Additional: Replaces the course A-27.302

A-27.3310 History of Architecture, Research Topics, studio

(12-15 cr) P * V P

62 + 54 (2 + 2) I-IV

Teachers: Prof. N.N.

Contents: An advanced course in general history of architecture and architectural study through lectures and seminar work. The course includes a study module abroad.

Requirements: Exam and a seminar work.

Prerequisites: A-27.1200/A-27.200

Language: Finnish

Additional: Replaces the course A-27.310

A-27.2340 History of Garden Design (5 cr) *

Period Alternate years with A-27.1210

Teacher: Mona Schalin, architect

Contents: Main aspects of the history of garden design.

Requirements: Independent exam.

Literature: Announced separately.

Language: Finnish

Additional: Replaces the course A-27.340

A-27.1501 History of Wood Architecture in Finland (3-15 cr)

27 + 54 III-IV

Teachers: Sirkkaliisa Jetsonen, architect, Aimo Nissi, architect

Contents: History, conservation and renovation of wooden structures, historical wooden towns and churches in Finland. Finnish nature and traditional cultural landscape. Building types and solutions, ideology of modern wood architecture.

Requirements: Planning and designing of an enlargement or renovation of a wooden building; exam.

The course is part of the International Architecture Program entity.

Language: English

Additional: Replaces the course A-27.501

A-27.1510 History of Finnish Architecture (2-5 cr)

12 + 0 Period I-IV

Teachers: Sirkka-Liisa Jetsonen, architect

Contents: A lecture course that gives an introduction to the special features of Finnish architecture and the relationship between architecture, landscape, resources and history. The

spring term course is part of the lecture series: "Finnish Society and Culture" organised by the University of Helsinki.

Requirements: Lectures, excursions and an essay.

The course is part of the International Architecture Program entity.

Language: English

Additional: Replaces the course A-27.510

A-27.3600 Postgraduate Seminar on History of Architecture
(3-8 cr.) P *

Teacher: Fixed-term prof. Aino Niskanen.

Language: Finnish

Additional: Replaces the course A-27.600

A-27.2998 History of Architecture, special project (3-15 cr) *
V A

Teacher: Prof.N.N.

Contents: Information about the special aspects of history of architecture through studies or an exercise work. Also magazine articles, radio and tv programmes.

Only for students at the Department of Architecture.

Language: Finnish

Additional: Replaces the course A-27.998

A-36 URBAN PLANNING AND DESIGN

Courses credited in ECTS

Prof: Trevor Harris, tel. 451 4431, room A224

Prof: Kimmo Lapintie, tel. 451 4432, room A223

Prof: Peter Ache tel: 451 4095, room 310a

A-36.1000 Presentation of Studies in Urban Planning and Design (1 cr) *

Period I or IV

Teachers: Prof Kimmo Lapintie, Prof Trevor Harris, Prof Peter Ache, ass. Juhani Karanka and ass. Antti Ahlava, lecturers, representatives of the students' guild, representatives of employers.

Contents: A series of seminars where urban planning and design studies are presented as a whole. Responsibilities and demands connected to this field.

Requirements: Participation in the seminar, getting acquainted with the study material and giving feedback to the teachers.

Language: Finnish/English

A-36.1150 Introduction to Urban Planning and Design

(4 cr) *

12 + 24 (2 + 4), I

Teachers: Prof Kimmo Lapintie, Juhani Karanka, assistant

Contents: Planning and design of communities and the built environment in the Finnish society. The basic social, technical and cultural factors behind environmental changes and planning. Basic elements of planning and their application, different objectives and their integration.

Requirements: Participation in tutorials, approved completion of design assignments and a course portfolio.

Prerequisites: A-36.1000

Language: Finnish

Additional: Replaces the first part (LIGHT) of A-36.150 Urban Planning and Design, Basic Course

A-36.1151 Introduction to Urban Planning and Design, virtual course (4 cr) *

0 + 24 (0 + 4), I

Teachers: Prof Kimmo Lapintie, Juhani Karanka, assistant

Contents: Planning and designing of communities and the built environment in the Finnish society. The basic social, technical and cultural factors behind environmental changes and planning. Basic elements of planning and their application, different objectives and their integration.

Requirements: Virtual lectures and assignments. Approved completions of course portfolio and assignments.

Prerequisites: A-36.1000

Language: Finnish

Additional: Replaces the first part (LIGHT) of A-36.150 Urban Planning and Design, Basic Course. Will be organized next during the academic year 2007-2008.

A-36.1152 Basic Course in Urban Planning and Design

(5 cr) *

12 + 24 (2 + 4) II

Teachers: Prof Kimmo Lapintie, Juhani Karanka, assistant

Contents: Analysis of the built environment and basic skills in detailed planning.

Requirements: Participation in tutorials, approved completion of design assignments and course portfolio based on lectures and literature.

Prerequisites: A-36.1000, A-36.1150 or A-36.1151

Language: Finnish

Additional: Replaces the second part (PRO) of A-36.150 Urban Planning and Design, Basic Course

A-36.1154 Professional Course in Urban Planning (8 cr) *

22 + 48 (2 + 4) III-IV

Teachers: Prof Kimmo Lapintie, Juhani Karanka, assistant

Contents: Developing the draft design sketch scheme into detailed planning documents. Illustrations and official documentation used in planning. Environmental impact assessment in planning. Participation and management of the planning process and projects.

Requirements: Lectures, seminars and approved completion of planning assignments and course portfolio based on lectures and literature.

Prerequisites: A-36.1000, A-36.1150 or A-36.1151, A-36.1152.

Language: Finnish

A-36.1155 History of Town Planning (4 cr) *

26 + 0 (2 + 0) I-II

Teachers: Prof Kimmo Lapintie, Prof Trevor Harris, guest lecturers.

Contents: The development of cities and communities and the corresponding political, economical and cultural changes. The historical background of planning and design.

Requirements: Approved essay on a chosen period of the History of Urban Development and an approved course portfolio.

Language: Finnish

Additional: Replaces the course A-36.151. Not lectured in 2006-2007

A-36.1200 Drafting a Participation and Assessment Scheme

(1 cr) *

Teachers: Prof. Kimmo Lapintie, Juhani Karanka assistant

Contents: Lectures and drafting a participation and assessment scheme for a chosen training work site.

Prerequisites: A-36.1000, A-36.1150, or A-36.1151, A-36.1152

A-36.1201 Urban Space (12 cr) *

28 + 56 (2 + 4) I-II or III-IV

Teachers: Prof Trevor Harris, Antti Ahlava, assistant

Contents: Urban architectural design, analysis of urban space and its conceptualization. Design of a new built environment and understanding of the interaction between the built environment, society, nature and culture. An optional field work period in a foreign or domestic town.

Requirements: Lectures, seminars and approved design exercises.

Prerequisites: A-36.1000, A-36.1150 or A-36.1151, A-36.1152.

Language: Finnish

Additional: Replaces the course A-36.201

A-36.2320 Principles of Municipal and Regional Planning (10 cr) V

24 + 24 (2 + 2) I-II

Teachers: Prof Kimmo Lapintie, Juhani Karanka, assistant
 Contents: Basics of Master Planning, Regional Planning, and the relevant knowledge and objectives behind Comprehensive Planning. The urban and regional structure and its change. Sustainable development in Comprehensive Planning. The new framework of Comprehensive Planning.

Requirements: Lectures, tutoring, approved completion of assignments and a course portfolio based on lectures and literature.

Prerequisites: A-36.1000, A-36.1150 or A-36.1151, A-36.1152, A-36.1201/A-36.201 (for students of architecture).

Language: Finnish.

Additional: Replaces the course A-36.320

A-36.2340 The City Rejuvenated (10 cr) * V

27 + 54 (2 + 4) III-IV

Teachers: Prof Trevor Harris, Antti Ahlava, assistant

Contents: The spatial, plastic, programmatic and physical development of the existing built environment. The management of complex room programmes, facilities and processes. The theme of the course will vary annually. The course may contain a voluntary fieldwork period abroad.

Requirements: Lectures, tutoring, and approved completion of assignments

Language: Finnish

A-36.2341 Wooden Town, studio (9-14 cr) V

27 + 54 (2 + 4)

Teachers: Prof. Trevor Harris

Contents: Programmatic, spatial, plastic and physical development and planning of a modern town. An optional field study abroad is included in the course.

Requirements: Lectures, exercises and approved design assignments.

Prerequisites: A-36.1201/A-36.201 Urban Space or corresponding.

Language: Finnish.

Additional: The course is organised by the chair of Wood Architecture in conjunction with the chairs of Urban Planning and Housing Design. The course is organised every other year, the next course in the spring 2007. Replaces the course A-36.340

A-36.2998 Urban Planning and Design, special project

(1-10 cr)*V

Teachers: Prof Trevor Harris and/or Prof Kimmo Lapintie and/or Prof Peter Ache

Contents: Special individual project developing deeper understanding of the field of urban planning and design. The course can also be a foreign course or part of a foreign field trip.

Requirements: According to the project.

Language: Finnish/English.

A-36.3321 European Metropolitan Planning (5 cr) P

24 + 24 (2 + 2) III-IV

Teacher: Prof. Peter Ache

Contents: The course will address urban policy and strategies of the European Union and look at European spatial development in different member states. Conceptual issues related to space, territory, region, location and Metropolis; the differences between strategy, plan and policy; Concrete Visions; European institutional structures; examples of Metropolitan strategies; applied methods; globalization and its spatial effects.

Requirements: Lectures, approved completion of course assignments and a portfolio.

Prerequisites: A-36.1000, A-36.1150 or A-36.1151, A-36.1152, A-36.1201/A-36.201, A-36.2320

Language: English

Additional: Replaces the course A-36.3320 Local Development and Globalisation.

A-36.3326 Research Methodology (5 cr) P *

24 + 0 (2 + 0) I-II. Will be lectured for the first time during the autumn 2005

Teachers: Prof Kimmo Lapintie, Aija Staffans, D.Sc.

Contents: Basic requirements for scientific work. The nature of research, writing of a research plan, use of empirical material and literature. The nature of critical thinking and scientific world-view.

Requirements: Lectures, course portfolio based on both lectures and exercises.

Language: Finnish or English

Additional: Replaces the course A-36.3325. Will not be lectured during the academic year 2006-2007

A-36.3330 Urban Renewal Studio (10 cr) V

26 + 52 (2 + 4) I-II

Teachers: Prof Trevor Harris, assistant lecturer NN

Contents: The spatial, plastic, programmatic and physical development of the existing built environment. The management of complex room programmes, facilities and processes. The course may contain a voluntary fieldwork period in Finland

Requirements: Lectures, tutoring and approved completion of the course assignments

Prerequisites: A-36.1000, A-36.1150 or A-36.1151, A-36.1152, A-36.1201/A-36.201, A-36.2320.

Language: English, exercise sessions also in Finnish

Additional: Replaces the course A-36.330

A-36.3353 Planning Theory (5 cr) P

26 + 0 (2 + 0) I-II Will be lectured for the first time in the autumn 2006

Teacher: Prof Kimmo Lapintie

Contents: Introduction to main schools of thought in Planning Theory of the post-WW2-period. Philosophical and sociological theories behind planning theory. Contemporary issues in theoretical debates.

Requirements: Lecture and seminar attendance, virtual exam and course portfolio based on lectures and literature.

Prerequisites: A-36.1000, A-36.1150 or A-36.1151, A-36.1152, A-36.1201/A-36.201, A-36.2320

Language: Finnish or English

Additional: Replaces the course A-36.353

A-36.3360 Communicative Planning and Planning Argumentation (4 cr) P*

8 + 8 (partly virtual studies) III-IV

Teachers: Prof Kimmo Lapintie, Anu Allt, architect.

Contents: Interaction and communication in planning. Different methods of interaction and its grounds, especially in rhetoric and in argumentation. Analyzing and developing the necessary interaction and communication in conjunction with planning. The theoretical grounds for communicative planning.

Requirements: Virtual exam or course portfolio based on literature and approved design assignments.

Language: Finnish

Additional: Replaces the course A-36.360

A-36.3500 City in Crisis (10 cr) V

26 + 52 (2 + 4) I-II

Teachers: NN. architect, Henu Kjisik, architect, Veikko Vasko, architect

Contents: The reality of architecture, building and urban planning and design outside Europe, with cultural understanding as the starting point. The historical, socioeconomic and cultural development of developing nations with local vernacular principles.

Requirements: Lectures, exercises and approved completion of course assignments. The course includes a voluntary field work

period abroad. The course is part of the Department's International Architecture Program entity
Prerequisites: A-36.1000, A-36. 1150 or A-36. 1151, A-36.1152, A-36.1201/A-36.201, A-36.2320
Language: English
Additional: Replaces the course A-36. 500

A-36.3550 D-Studio (2 cr) *

Teachers: prof Kimmo Lapintie, prof Trevor Harris, prof Peter Ache, assistant Juhani Karanka and assistant Antti Ahlava.
Contents: A learning seminar intended for advanced students of Urban Design and Planning in which participants can present, ask and receive comments concerning their ongoing Master Thesis work. The Studio Seminar teachers will advise on pedagogic development, provide opportunities for practising oral and multimedia presentations and give guidance on the principles related to formulating and creating scientific knowledge
Requirements: The seminar is organised twice a term (four times a year)
Language: Finnish/English

A-36.4252 History of Town Planning, seminar period (5 cr) P *

28 + 28 (2 + 2) III-IV
Teacher: N.N.
Contents: In-depth history of town planning through various examples. The course includes seminar work.
Requirements: Exercises and a seminar study on special subjects.
Language: Finnish
Additional: Replaces the course A-36.252. Will not be lectured during the academic year 2006-2007

A-36.4300 Research Methodology for Advanced Learners

(5 cr) P *
24 + 0 (2 + 0) III-IV
Teachers: Prof Kimmo Lapintie and/or Prof Peter Ache, Aija Staffans, D.Sc.
Contents: Quantitative and qualitative methods used in scientific research. Analysis of concepts used in research. Philosophy of science behind different methods.
Requirements: Participation in lectures. Approved course portfolio based on lectures, literature and assignments. The course will not be lectured during the academic year 2006 - 2007.
Language: Finnish or English

A-36.4310 Virtual Course in Environmental Psychology (6 cr) P *

Teachers: Liisa Horelli, Docent, Ph.D., Marketta Kytta, Ph.D., Anu Allt, architect.
Contents: The aim of the course is to get familiarised with the different approaches and methods of environmental psychology which enable to recognise, assess and develop processes leading to good living environments. A theoretical option of orientation will provide insight in the theories of environmental psychology. The practical option will offer tools for the assessment and development of environments. The content comprises: 1. Historical background and core concepts 2. Methodology 3. Application of environmental psychology.
Requirements: The course will be carried out as internet-based studies during a six-month period from September 2006 to February 2007. The appropriation of the study material and learning will be checked through exams. The learning will be guided by options for specific study material and practical rehearsals which will provide opportunities for either theoretical (post graduate) or practical (supplementary) studies.
Additional: The course is primarily directed to postgraduate students. The number of students is limited. The list of references and the study material will be published during the internet-course in the autumn.
Language: Finnish

A-36.4350 Scientific Grounds for Urban and Regional Planning (5 cr) P *

24 + 0 (2 + 0) I-II
Teachers: Prof Kimmo Lapintie, Prof Peter Ache, N.N.
Contents: Introduction to one or several research fields applied to urban and regional planning.
Requirements: Virtual exam or course portfolio.
Prerequisites: A-36.1000, A-36.1150 or A-36.1151, A-36.1152, A-36.2320.
Language: Finnish
Additional: Replaces the course A-36.350

A-36.4600 Doctoral Stables, Research Seminar I (5 cr) P V* 0 + 30 I-IV

Teachers: Prof Kimmo Lapintie, Aija Staffans, D.Sc.
Contents: Meetings once a month during the terms. Students present and discuss their research projects and develop their own research plans, as well as commenting on the plans of others. Theoretical, methodological, and practical issues are addressed. The seminars also include lectures and workshops supporting the research work.
Requirements: Term paper and discourse commentary. Active participation in the seminars.
Language: Finnish/English.
Additional: Replaces one year of studies in the course A-36.600. The course will be organised next time during the academic year 2008-2009

A-36.4601 Doctoral Stables, Research Seminar II (5 cr) P V* 0 + 30 I-IV

Teachers: Prof Kimmo Lapintie, Prof Peter Ache, Aija Staffans, D.Sc.
Contents: Meetings once a month during the term. Students get acquainted with the literature in their field, as well as general literature supporting their work. During the course students present the progress of their research projects as well as comment on the projects and related theoretical, methodological and practical questions of others. The seminar is realized as a study circle.
Requirements: Presentation of a book or a collection of articles. Presentation of the progress of the individual research project. Active participation in the seminars.
Language: Finnish/English.
Additional: The course is organised during the academic year 2006 - 2007.

A-36.4602 Doctoral Stables, Research Seminar III (5 cr) P V* 0 + 30 I-IV

Teachers: Prof Kimmo Lapintie, Prof Peter Ache, Aija Staffans, D.Sc.
Contents: Meetings once a month during the terms. During the course the student's final project is processed. Based on this process a seminar lecture is held and students act as opponents to a lecture held by another student.
Requirements: Seminar lecture. Commenting of another student's lecture. Active participation in the seminars.
Language: Finnish/English.
Additional: The course will be held during the academic year 2006-2008.

A-36.4620 Summer Seminar (3 cr) P V* 3+13

Contents: The Summer Seminar is a two day event open to all Urban Planning and Design post-graduate students and researchers. The programme is founded on lectures, presentations of current research work, tutoring and possible acquaintance with local destinations.

A-52 HOUSING DESIGN

Courses credited in ECTS

Prof. NN tel. 451 4425, room A214

A-52.1200 Housing Design I (10 cr) A*

27 + 54 (2 + 4) I-II

Teacher: Prof NN

Contents: Basic principles of housing design and residential architecture; development of housing types and contemporary solutions. Lectures comprise weekly exercises and seminars.

Requirements: Lectures, exam and approved design exercises.

Literature: Kahri, Esko & Pyykönen, Hannu: Asuntoarkkitehtuuri ja suunnittelu (2nd revised edition) and other separately announced literature.

Prerequisites: A-9.1115/A-9.115 and A-60.1117 and 60.1118 or A-60.117

Only for students at the Department of Architecture.

Language: Finnish

Additional: Replaces the course A-52.200 Housing Design I

A-52.2310 Housing Design, studio (10 cr) V A

27 + 54 (2 + 4) I-II if needed also III-IV

Teachers: Prof. NN, Markku Hedman, assistant, Pirjo Sanak-senaho, assistant

Contents: An advanced design course dealing with the contemporary topics of dwelling. The exercise comprises a demanding housing object, where the development of dwelling solutions are emphasized. A broad discussion and analyses of the subject precedes the actual design work. Current topics.

Requirements: Lectures and guided exercise. Participation in mid- and final critic sessions.

Prerequisites: A-52.1200/A-52.200

Language: Finnish and English

Additional: The course is part of the International Architecture Program entity. Replaces the course A-52.310

A-52.3320 Housing Design, advanced special studio (10 cr) V

*27 + 54 (2 + 4) III-IV

Teachers: Prof NN Markku Hedman, assistant, Pirjo Sanak-senaho, assistant

Contents: The aim is to give readiness for developing new residential buildings and demanding environmental adaptation as well as look at dwelling from a research point of view. As an exercise a design assignment is made, preceded by broad discussions and analyses.

Requirements: Lectures and guided exercise. Participation in mid- and final critic sessions.

Prerequisites: A-52.2310/A-52.310. Only for students at the Department of Architecture

Language: Finnish

A-52.3330 Housing Research (2-10 cr) P A*

Will be arranged at a separately announced time

Teacher: N.N.

Contents: A course intended for degree and postgraduate students. The methods, theories, viewpoints and applications of housing research; introduction to the basics of research.

Requirements: Lectures and approved exercises (degree students).

Prerequisites: A-52.1200/A-52.200

Only for students at the Department of Architecture.

Language: Finnish

Additional: Replaces the course A-52.330

A-52.3998 Housing Design, special project (1-10 cr) *V A

Teacher: Prof NN, tutor in accordance with the student/group

Contents: An individual study project on the special aspects of housing design.

Requirements: A written study, design project, video, film, exhibition etc. Realization and time of completion to be decided upon in accordance with the student.

Only for students at the Department of Architecture.

Language: Finnish

Additional: Replaces the course A-52.998

A-52.4600 Postgraduate Seminar on Housing Design

(2-10 cr) P *V

Arranged every two or three years, date to be announced separately.

Teacher: Prof NN

Contents: A research seminar for postgraduate and other students. Introduces the development in the field and current topics.

Requirements: Lectures and a term paper.

Language: Finnish

Additional: Replaces the course A-52.600

A-60 BASICS AND THEORY OF ARCHITECTURE

Courses credited in ECTS

Prof. Simo Paavilainen, tel. 451 4408, room A114

A-60.1106 Introduction to Studies in Architecture and Landscape Architecture (2 cr) *A

Period, I, (organised before the start of the lecture period.)

Coordinator: Prof Simo Paavilainen

Contents: 1) Gives an overview on the professors' teaching at the Department of Architecture, as well as an introduction to the grounds of architecture, starting from natural phenomena. 2) Gives a general overview on computers, basics in different operating systems, TKK data network, e-mail and the use of internet. Literature: The students are supposed to acquaint themselves with architectural literature as well as fiction. The list of references is given annually during the course.

Requirements: The course is for first year students and organized before the beginning of the lecture period. Participation in the course is mandatory and completion requires approved planning exercises. The course is partly taken together with students in engineering.

Only for students at the Department of Architecture.

Language: Finnish

Additional: Replaces the course A-60.106

A-60.1107 Basics of Architecture I, autumn term (7 cr) A*

12 + 104 I-II

Teachers: Prof Simo Paavilainen, Juha Jääskeläinen, architect

Contents: Compulsory foundation course for all the students at the Department of Architecture. The objective is to give a general overview on architecture as a field of art and technology, the expressive means of architecture and aspects on the architectural profession. The aim is also to awake student's interest in other forms of art, such as literature, music and poetry.

Requirements: Lectures and tutored exercises; participation in weekly exercises, seminars and mid- and final reviews. An essay or an independent exam.

Literature: The student is expected to get familiarized with architectural literature as well as other literature. The list of references is given annually during the course.

Only for students at the Department of Architecture.

Language: Finnish

Additional: Replaces the course A-60.107

A-60.1108 Basics of Architecture I, spring term (7 cr) A*

12 + 120 III-IV

Teachers: Prof Simo Paavilainen, Juha Jääskeläinen, architect

Contents: Compulsory foundation course for all students at the Department of Architecture. The objective is to give a general overview on architecture as a field of art and technology, the expressive means of architecture and aspects on the architectural profession. The aim is also to awake student's interest in other forms of art, such as literature, music and poetry.

Requirements: Lectures and tutored exercises; essay or an independent exam. Participation in weekly exercises, seminars and mid- and final reviews.

Literature: The student is expected to get familiarized with architectural literature as well as other literature. The list of references is given annually during the course.

Language: Finnish

Additional: Only for students at the Department of Architecture. Replaces the course A-60.108

A-60.1120 Visual Arts 1 autumn (2 cr) A

52 (0 + 4) I-II

Teachers: Ipi Kärki, artist, Antti Keitilä, artist

Contents: Introduction to the basic concepts of visual expression and plastic design dimension, form and space. The educational aim is to improve the sense of proportion, rhythm and colour. Charcoal and water tasks, wood and clay carving; orientation in the methods and the use of tools used in visual art.

Requirements: Lectures and tutored exercises, participation in weekly exercises and critiques.

Only for students at the Department of Architecture. The course is part of the International Architecture Program entity, Language: Finnish, English when needed

A-60.1121 Visual Arts 1 spring (2 cr) A

60 (0 + 4) III-IV

Teachers: Ipi Kärki, artist, Antti Keitilä, artist

Contents: Introduction to the basic concepts of visual expression and plastic design dimension, form and space. The educational aim is to improve the sense of proportion, rhythm and colour. Charcoal and water colour tasks and wood and clay carving; orientation in the methods and the use of tools used in visual art.

Requirements: Lectures and tutored exercises, participation in weekly exercises and critiques. Only for students at the Department of Architecture. The course is part of the International Architecture Program entity, Language: Finnish, English when needed

A-60.1117 Architecture 2, Basic Design autumn (4 cr) *A 13+54 II

Teachers: Prof Simo Paavilainen, Juha Jääskeläinen, architect

Aaro Artto architect, NN, architect. NN architect.

Contents: Further development and experiment of the themes introduced during the 1st year basic course.

Requirements: Lectures and tutored exercises; essay or an independent exam. Participation in weekly exercises, seminars and mid- and final reviews. At the end of the course, an essay should be written based on the texts from Abacus 3.

Prerequisites: 60.1107/A-60.107 and A-60.1108/A-60.108

Only for students at the Department of Architecture.

Language: Finnish

Additional: Replaces the first part of the course A-60.117

A-60.1118 Architecture 2, Basic Design spring (5 cr) A 14 + 54 III

Teachers: Prof Simo Paavilainen, Juha Jääskeläinen, architect

Aaro Artto architect, NN, architect. NN architect.

Contents: Further development and experiment of the themes introduced during the 1st year basic course.

Requirements: Lectures and tutored exercises; essay or an independent exam. Participation in weekly exercises, seminars and mid- and final reviews. At the end of the course, an essay should be written based on the texts from Abacus 3.

Prerequisites: 60.1107/A-60.107 and A-60.1108/A-60.108

Only for students at the Department of Architecture.

Language: Finnish

Additional: Replaces the second part of the course A-60.117

A-60.1130 Visual Arts 2 autumn (2 cr) A

52 (0 + 4)

Teachers: Ipi Kärki, artist, Kari Cavén, sculptor

Contents: By means of exercises and lectures this course is an introduction to the theory of colours. The aim is to go deeper into colour-form- and space thinking and perceive both plastic and coloured entities. During the course a piece of art is studied in space, space is studied from several different angles i.e. through tone, chromatics, own experience and artistic expression.

Requirements: Lectures and tutored exercises, participation in weekly exercises and critiques.

Prerequisites: A-60.1120 and A-60.1121, or A-60.120

Only for students at the Department of Architecture. The course is part of the International Architecture Program entity,

Language: Finnish, English when needed

Additional: Replaces the course A-60.130

A-60.1131 Visual Arts 2 (2 cr) spring A

60 (0 + 4)

Teachers: Kärki, artist, Kari Cavén, sculptor

Contents: By means of exercises and lectures this course is an introduction to the theory of colours. The aim is to go deeper into colour-form- and space thinking and perceive both plastic and coloured entities. During the course a piece of art is studied in space, space is studied from several different angles i.e. through tone, cromatics, own experience and artistic expression

Requirements: Lectures, excursions and exercises.

Literature: Announced separately.

Prerequisites: A-60.1120 and A-60.1121, or A-60.120

The course is part of the International Architecture Program entity. Only for students at the Department of Architecture.

Language: Finnish, English when needed

Additional: Replaces the course A-60.130

Courses credited in ocr

A-60.239 Visual Arts 3 (3 ocr) A

period

Teachers: NN

Contents: The aim is to give students, with an interest of the special areas of artistic expression, an opportunity to go deeper into the subject. The course contains sculpture, photography, graphic art or video art.

Requirements: Lectures, seminar work. A written study about the central theme of the course.

Literature: The list of references or copies will be given during the course.

Prerequisites: A-60.1130 and A-60.1131 or A-60.130

The course is part of the International Architecture Program entity

Language: Finnish, English when needed.

Additional: Only for students at the Department of Architecture

A-60.320 Philosophy and Method, studio(2-8 ocr) P V*

Period

Teacher: Irmeli Hautamäki, Ph.D.

Contents: Analyses of the paradigms of Western philosophy especially in ethics and philosophy of society; discussions on the background philosophies of art and contemporary architecture. Central topics are, e.g., the question of the avant-garde, modernity, ethicality, power and gender. The course objective is to provide tools for critical thinking and conceptual accuracy and to practise the students' skills in writing. The autumn term course is an introductory course, the spring time course is a special course

Requirements: Lectures, seminar, discussions.

Literature: The list of references will be given at the beginning of the course.

Language: Finnish

A-60.330 Theory of Architecture, studio (2-8 ocr) P V

Teacher: Anni Vartola, architect, Lic.Sc. (Tech.)

Contents: Introduction to the central literature of architectural theory, the principles and the status of architecture, the concept of architectural quality, analyses of the different views on the architectural profession. The autumn term studio discusses historical texts from the antique to the 19th century; the spring term topic is contemporary writings of architecture.

Requirements: Lectures, seminars, exercises and project work. Limited programme for international guest students.

Literature: Hanno-Walter Kruft: A History of Architectural Theory: From Vitruvius to the Present. Princeton University Press 1994. Theorizing a New Agenda for Architecture: An Anthology of Architectural Theory 1965-1995 (ed. Kate Nesbitt). Princeton Architectural Press 1996. Architecture, Theory since 1968 (ed. K. Michael Hays). MIT Press 1998.

Language: Finnish and English

Additional: The course is part of the International Architecture Program entity. Will not be organized during the academic year 2006-2007

A-60.332 Creative Writing and Architectural Criticism

(2 ocr) P *

period

Teacher: N.N.

Contents: The objective is to improve students writing and language skills and give tools for scientific writing.

Literature: Announced at the beginning of the course

Language: Finnish

A-60.340 Architecture I, studio (8 ocr) V A

Teacher: Prof Simo Paavilainen or a visiting teacher

Contents: Interaction between architecture and other fields of art; mental, artistic and conceptual boundaries of architecture; new methods of design.

Requirements: Lectures, seminars and critiques; essay.

The course is part of the International Architecture Program entity, Only for students at the Department of Architecture.

Language: Finnish, English when needed

A-60.600 Research Seminar of the Department of Architecture

(3 ocr) P *

Period Lectured when necessary

Co-ordinator: N.N.

Contents: Discussion and critique session for postgraduate students at the Department of Architecture.

Requirements: Seminar paper.

Language: Finnish, English when needed

A-60.610 Research Basics in Architecture and Landscape Architecture (2 ocr) P *

Period

Co-ordinator: N.N.

Contents: Research plan composition, scientific argumentation, basics of scientific writing, research ethics, use of historical archives, contemporary topics of scientific discourse in the field of architecture.

Requirements: Lectures and a written individual research plan.

The course is also recommended to degree students (undergraduates) interested in architectural research or intending to do a literary Master's thesis.

Language: Finnish

A-60.998 Basics of Architecture, special project (1-10 ocr) *

Teacher: Prof. Simo Paavilainen, supervisor, to be agreed upon individually.

Contents: An individual study project on the special aspects of the basics and/or theory of architecture. The course content and requirements are decided in accordance with the student and the project.

Only for students at the Department of Architecture.

Language: Finnish

A-112 WOOD ARCHITECTURE

Prof. N.N., tel. 451 4452, room A235C

Director of Studies: Pekka Heikkinen, architect, tel. 451 4452, room A235C

A-112.2501 Wood in Architecture and Construction (3-6 cr)

24 + 24 (2 + 2) I-IV

Teachers: Pekka Heikkinen, architect, visiting lecturers

Contents: Lecture course that goes deep into the central questions of wood construction. The topics of the course include wood as a construction material, from a technical, ecological and esthetical point of view, and topical questions within wood construction.

Requirements: Lectures, excursion and exam. As a complement the following course is recommended: Puu-28.200 Introduction to Wood Properties. The course is part of the International Architecture Program entity.

Language: English

Additional: Replaces the course A-112.501

A-112.3400 Interactive Industrial Wood Construction (8 cr) P

66 + 50 III-IV

Teachers: Fixed-term prof. Matti Kairi, Ilmari Absetz architect, Pekka Heikkinen architect

Contents: Issues related to wooden industrial competitive construction are examined; architecture, construction engineering and production related processes are included.

Requirements: Lectures, exercises and seminar works, portfolio and excursions.

Literature: To be announced during the lectures

Language: Finnish or English

Additional: The course is realized in co-operation with the laboratories of Wood Technology and Building Technology and the Chair of Wood Construction.

A-112.3510 Wood Studio (12-15 cr)

54 + 54 (4 + 4) I-IV

Teachers: Pekka Heikkinen, architect, Risto Huttunen, architect, varying teachers according to the subject

Contents: An experimental building studio that goes deep into the characteristics of wood as a material. During the autumn term three small-scaled design and wood work assignments and competition of ideas for a spring project. During the spring term an experimental wooden building or construction will be designed and built. Annually changing topics.

Requirements: Designing and construction of an innovative wooden building. Supporting lectures and excursions related to the varying topic. The lecture course A-112.2501 Wood in Architecture and Construction is integrated in the study module. The course is organized alternately with the varying course of Wood Construction.

Language: English

Additional: The course is in relevant parts suitable for students in Building Structures and Wood Product Industry.

Replaces the course A-112,510

A-112.4602 Wood Construction, postgraduate course

(3-22 cr) P

Period

Teacher: Pekka Heikkinen, architect or visiting teacher

Contents: Integration of the course to postgraduate studies will be decided upon individually with the teacher.

Literature: To be decided upon individually
 Open for students at the Departments of Architecture, Civil and Environmental Engineering and Forest Products Technology.
 Language: Finnish, English when needed
 Additional: Replaces the course A-112.602

A-112.3610 Wood Program, special project (10-15 cr) P
 Period

Teachers: Pekka Heikkinen, architect, Kimmo Lylykangas
 Contents: A specializing programme, directed towards students in the Wood Program, that goes deep into the characteristics of wood and its use as a modern building material. During the autumn term three small-scaled design- and wood work assignments are realized and a competition of ideas for the spring project. During the spring term a building or construction will be designed and built, according to industrialized wood construction principles. A course diary will be made on the basis of exercises, lectures and excursions.

Requirements: Exercises, excursions and a course diary.
 As a complement the following course is recommended: Puu-28.5010 Industrial Wood Construction, arranged at the Laboratory of Wood Technology.

Open only for students from the IAP Wood Program at the Department of Architecture.

Language: English
 Additional: Replaces the course A-112.610

A-112.2700 Wood Construction - course with varying content V
 (8-10 cr)
 Period

Teachers: Pekka Heikkinen, architect, varying teachers
 Contents: In a studio like course students get acquainted with current issues within wood construction. Varying subject. The study period is realized in cooperation with other chairs of the Department of Architecture.

Requirements: A demanding design assignment, lectures, a seminar and a possible excursion. Studio like working methods. The course is organized either in the autumn or spring term alternately together with the Wood Studio.

Language: Finnish and / or English
 Additional: Open for students at the Department of Architecture, and relevant parts to students from the departments of Civil and Environmental Engineering and Forest Products Technology. The course is part of the International Architecture Program entity. Replaces the course A-112.700

A-112.2800 Wood Construction, intensive course (3-15 cr) V
 Teacher: Visiting teacher

Contents: An intensive course with varying content or a studio or workshop by a visiting teacher/professor.

Language: Finnish or English
 Additional: Replaces the course A-112.800

A-112.2998 Wood Construction, special project (3-15 cr) V

Teachers: Pekka Heikkinen, architect or visiting teachers
 Contents: Introduction to wood construction and its special issues through individual student work.

Requirements: Written work, design project, practical work, video, exhibition etc. The topic, realisation and the time for accomplishment will be agreed upon with the teacher or will be announced separately.

Open for students at the Departments of Architecture, Civil and Environmental Engineering and Forest Products Technology.

Language: Finnish, English when needed
 Additional: Replaces the course A-112.998

MA-94 LANDSCAPE PLANNING AND MANAGEMENT

Courses credited in ECTS

Prof. Maija Rautamäki, tel. 451 4456, room A130a

MA-94.1114 Basics of Landscape Architecture (4 cr) *
 27 + 54 I-II

Teachers: Prof Maija Rautamäki, university teacher Kati Susi-Wolff, visiting lecturers.

Contents: The course gives facts about the concepts, natural science basis and spatial planning in landscape architecture. Gives an overview on landscape planning and management

Requirements: Lectures, examination and exercises.

Language: Finnish
 Additional: Replaces the course MA-94.114

MA-94.1120 Field Workshop 1 (2 cr) *

Period
 Teachers: Prof Maija Rautamäki, university teacher Kati Susi-Wolff, visiting lecturers.

Contents: Introducing description, interpretation and understanding of the landscape.

Requirements: Field course, lectures and demonstrations, exercises, field diary.

Prerequisites: MA-94.1114 and MA-94.1116, MA-94.1135 and MA-94.1136

Language: Finnish

MA-94.1135 Geomorphology (3cr)
 27 + 10 I-II (will be lectured 2007-2008)

Co-ordinator: Prof Maija Rautamäki
 Contents: Introduction to the role of topography, ground and soil in the ecological whole in landscape architecture.

Requirements: Lectures, exams, demonstrations, fieldwork and excursions.

Language: Finnish
 Additional: The course is lectured alternately with MA-1137 Botany. The following courses replace the course MA-94.1132 Landscape Ecology I (6 cr); MA-94.1135 and MA-94.1136-

MA-94.1136 Hydrology and Climatology (3cr)
 27 + 10 III-IV (will be lectured 2007-2008)

Co-ordinator: Prof Maija Rautamäki
 Contents: Introduction to the role of water resources and climate in the ecological whole of the landscape.

Requirements: Lectures, exams, demonstrations, fieldwork and excursions.

Additional: The course is lectured alternately with MA-94.1138 Landscape Ecology

MA-94.1137 Botany (3cr)
 27 + 10 I-II (alternate years, lectured 2006-2007)

Co-ordinator: Prof Maija Rautamäki
 Contents: Introduction to plant ecology and natural vegetation in Finland

Requirements: Lectures, exams, demonstrations, fieldwork and excursions.

MA-94.1138 Landscape Ecology (3cr)
 27 + 10 III-IV (alternate years, lectured 2006-2007)

Co-ordinator: Prof Maija Rautamäki
 Contents: Introduction to the population, community and ecosystem ecology. Introduction to the internal species and their interaction and the man-made mutation that affect nature diversity (e.g. nature conservation ecology and urban ecology).

Requirements: Lectures, exams, demonstrations, fieldwork and excursions.

Additional: The course is lectured alternately with MA-94.1136 Hydrology and Climatology

MA-94.1139 Landscape Analysis (4cr)

28 + 52 I-II

Teacher: University teacher Kati Susi-Wolff

Contents: The course teaches inventory and analysing methods of natural science, cultural history and visual aspects of landscape and gives an overview on history and concepts of inventory methodology. Deepens the understanding and interpretation of nature basis, development, and spatial structure of landscape.

Requirements: Lectures and exercises

Additional: Replaces the course MA-94.135 Landscape Planning 1

MA-94.1240 History of Cultural Landscape (3cr)

27 + 0 (alternate years, lectured 2006-2007)

Teacher: Prof Maija Rautamäki

Contents: A general overview on the characteristics and development of the Finnish cultural landscape from the prehistoric to the contemporary era. The role of local natural elements, traditional trades and industries and the background aspects of European societies in the formation of different types of cultural landscape.

Requirements: Lectures, excursions, essay and exam.

Language: Finnish.

MA-94.1128 Fundamentals of Forestry (3cr) *

26 + 13 I (period, lectured 2006-2007)

Teacher: Olli Taskinen, M.Sc. (Agr. & For.)

Contents: Introduction to the methods of forestry and forest management. Emphasis on urban forestry.

Requirements: Lectures, exams, demonstrations, field work and excursions.

Prerequisites: MA-94.1114/MA-94.114

Language: Finnish

MA-94.1250 Laws and Administration in Landscape Planning and Management (2cr)

27 + 0 III-IV

Teacher: N.N.

Contents: Introduction to laws and administration in landscape planning and management

Requirements: Lectures, exams, and excursions.

Language: Finnish

MA-94.1251 Landscape Management (3cr)

27 + 10 (not lectured in 2006-2007)

Teacher: N.N.

Language: Finnish

Additional: The courses MA-94.1251 Landscape Management (3cr) and MA-94.1252 Landscape and Land Use (7cr) replace the course MA-94.222 Landscape Planning 2 (6 ocr)

MA-94.1252 Landscape and Land Use (7cr)

27 + 54 (not lectured in 2006-2007)

Teacher: N.N.

Language: Finnish

Additional: The courses MA-94.1251 Landscape Management (3cr) and MA-94.1252 Landscape and Land Use (7cr) replace the course MA-94.222 Landscape Planning 2 (6 ocr)

Courses credited in ocr**MA-94.152 The Basics of GIS Technology (2-6 ocr) ***

Period

Teacher: Samuli Alppi, landscape architect

Contents: Introduction to the methods and programmes of computer-aided landscape planning and GIS technology.

Requirements: Lectures and exercises.

Language: Finnish

MA-94.222 Landscape Planning 2 (6 ocr) *

56 + 84, III-IV

Teacher: Prof Maija Rautamäki

Contents: The professional role of the landscape architect in landscape planning; city, master and regional planning based on landscape ecology in the urban, rural and natural context.

Requirements: Lectures, examination and exercises.

Prerequisites: MA-94.135

Language: Finnish

MA-94.230 Open Space Planning (4 ocr) *

30 + 35 I-II

Teacher: Prof Maija Rautamäki

Contents: The meaning of green areas, urban public spaces and parks in the built environment and the planning of open spaces on different planning levels. Emphasis on understanding the natural processes in planning.

Requirements: Lectures and exercises.

Prerequisites: MA-94.135, A-36.1150 and A-36.1152 / A-36.150

Language: Finnish

MA-94.310 Landscape of Production, studio (6-8 ocr) * V P

Period III-IV (Alternate years with MA-94.312, will not be lectured in 2006-2007)

Teacher: Architect Raija Seppänen

Contents: Analysing questions about agriculture, forestry, industry and infrastructure in landscape planning and the possibilities of affecting environmental development.

Prerequisites: MA-94.222 / MA-94.1252 and MA-94.1251, MA-94.240 / MA-94.1240

Language: Finnish

MA-94.312 Environmental Impact Assessment, studio (6-8 ocr) * V P

period I-II (Alternate years, lectured in 2006-2007)

Teacher: Prof Maija Rautamäki

Contents: Methods and forms of environmental impact assessment; legislation and application in comprehensive landscape planning.

Prerequisites: MA-94.132/MA-94.1132 and MA-94.1120, MA-94.1132 and MA-94.134.

Language: Finnish

MA-94.344 Cultural Landscape Management (6-8 ocr) *V P III-IV

Teacher: Prof Maija Rautamäki

Contents: The development and prospects of the cultural landscape and historical surroundings under the influence of different pressures for change. Design exercise with emphasis on land use planning, and preservation and protection of the diversity of values through landscape management.

Requirements: Lectures, seminar paper, design and field exercises, report.

Prerequisites: MA-94.132 + MA-94.134/ MA-94.1135+ MA-94.1136+ MA-94.1137+ MA-94.1138, MA-94.240.

MA-94.390 Landscape Planning - course with varying content (2-4 ocr) * V

Teacher: N.N.

Contents: A course with an annually changing topic. The course arrangements will be announced separately.

Language: Finnish

MA-94.990 Landscape Planning, special project (1-10 ocr) V*

Teacher: According to the student/group.

Contents: An individual study project on the special aspects of landscape planning.

Requirements: Essay, design project, video, exhibition etc. The course content and requirements are decided in accordance with the students and the project.

Language: Finnish

MA-94.394 Landscape Management, course with varying content (2-4 ocr) *V

Teacher: N.N

Contents: Course with an annually changing topic with the objective to discuss current and interesting issues of landscape management.

Language: Finnish

MA-94.994 Landscape Management, special project (1-10 ocr) *V

Teacher: According to the student/group.

Contents: An individual study project on the special aspects of landscape management.

Requirements: Essay, design project, video, exhibition etc. The course content and requirements are decided in accordance with the students and the project.

Language: Finnish, English when needed

MA-94.600 Postgraduate Seminar on Landscape (2-10 ocr) P

Teachers: Prof Maija Rautamäki and Prof Jyrki Sinkkilä

Language: Finnish, English when needed

LANDSCAPE DESIGN AND CONSTRUCTION**Courses credited in ECTS (cr)**

Prof. Jyrki Sinkkilä., tel.451 4436, room A 131

MA-94.1116 Basics of Landscape Architecture, spring (5 cr)

28 + 54 IV

Teachers: Professor Jyrki Sinkkilä and assistant Emilia Weckman
Contents: Introduction to the basic concepts and components of landscape architectural design. The use of landform, water, vegetation and structures in small-scale landscape compositions. Landscape architecture as a form of art.

Requirements: Lectures, exam and design exercises.

Language: Finnish

Additional: Replaces the course MA-94.116 Basics of Landscape Design (4 ocr) and MA-94.1116 Basics of Landscape Architecture B (5 cr)

MA-94.1121 Field Course 2 (2 cr)

5+30 I (summer session in 2007)

Teacher: NN

Contents: Landscape construction in urban environment.

Requirements: excursions, study diary

Prerequisites: MA-94.1161 Housing Environment, MA-94.1170 Landscape Construction, MA-94.1140 Plants in Design 1 and MA-94.1141 Plants in Design 2 or corresponding skills.

MA-94.1140 Plants in Design 1 (3 cr)

27+0 I-II

Teachers: Pentti Alanko, M.Sc. (Agr. & For.)

Contents: Introduction to the basic range of native and cultivated plant species and their use. Botanical nomenclature, hardiness zones and provenience of plant material.

Requirements: Lectures, exam and field trips.

Language: Finnish

Additional: Replaces the course MA-94.1150 Plants in Design 1A (3 cr)

MA-94.1141 Plants in Design 2 (3 cr)

8+27 III-IV

Teachers: Jussi Luomanen and Emilia Weckman, landscape architects

Contents: Planting and management plans. The selection, grouping and maintenance of vegetation.

Requirements: Lectures, seminars and design exercises.

Language: Finnish

Additional: Replaces a part of the course MA-94.150 Plants in design 1 (3 ocr)

MA-94.1161 Housing Environment (9 cr)

28+90 I-IV, study sessions

Teachers: Meri Mannerla-Magnusson, architect and Emilia Weckman, landscape architect

Contents: Functional and spatial design of urban housing environment and its detailed treatment. General understanding of the 20th century landscape architecture and the development of contemporary housing environments.

Requirements: Lectures, seminars and design exercises.

Prerequisites: MA-94.1116 Basics of Landscape Architecture B/ Basics of Landscape Architecture, spring

Language: Finnish

Additional information: Recommended parallel courses: MA-94.1141 Plants in Design 2 and MA-94.1170 Landscape Construction. Replaces the course MA-94.161 Parks and Gardens 1 (5 ocr)

MA-94.1170 Landscape Construction (6 cr)

54+21 I,III-IV

Teacher: Meri Mannerla-Magnusson, architect and Emilia Weckman, landscape architect

Contents: Basics of construction techniques used in garden and park design. Appreciation of technically functional solutions in landscape architecture. Emphasis on the soil and ground structures of green areas.

Requirements: Lectures, exercises, exam and visits to construction sites.

Prerequisites: MA-94.1116 Basics of Landscape Architecture, spring

Language: Finnish

Additional: Recommended parallel courses: MA-94.1161 Housing Environment and MA-94.1141 Plants in Design 2.

Replaces the course MA-94.2170 Landscape Construction 2 (3 ocr)

MA-94.1216 Public Open Space (8 cr)

28+90 I-II

Teachers: Krista Muurinen and Emilia Weckman, landscape architects

Contents: The landscape architecture and detailed design of public environments in urban areas. Introduction to recent trends in landscape architectural design.

Requirements: Lectures, seminars, exercises and design exercises.

Prerequisites: MA-94.1161 Housing Environment, MA-94.1170 Landscape Construction, MA-94.1140 Plants in Design 1 and MA-94.1141 Plants in design 2 or corresponding skills.

Language: Finnish

Additional: Replaces the course MA-94.216 Parks and Gardens 2 (5 ocr)

MA-94.1221 Plants in Design 3 (3 cr)

27+0 I-II

Teacher: Pentti Alanko, M.Sc. (Agr. & For.)

Contents: Furthering appreciation of plants in urban or rural landscapes. Topics: plants and environmental factors, winter dendrology, plant diseases and pests, establishing and management of woody plants; visual and structural characteristics of plants.

Requirements: Lectures and exam.

Prerequisites: MA-94.1140 Plants in Design 1 and MA-94.1141 Plants in Design 2

Language: Finnish

Additional: A preliminary assignment, to be realised the previous year, is included in the course. The assignment are delivered by the landscape architecture office.

Replaces the course MA-94.221 Plants in Design 2 (2 ocr).

LANDSCAPE ARCHITECTURE DEGREE

MA-94.3142 Design of Special Environments, studio (9-12 cr)
28+54 **III-IV**, spring 2007
Teachers: Prof Jyrki Sinkkilä
Contents: The course develops further design skills in landscape architecture by introducing the problems of an architecturally, functionally or technically demanding landscape site.
In 2006-07 the course concentrates on the design of cemeteries.
Requirements: Lectures, studies, design exercises, exam
Language: Finnish
Additional: Replaces the course MA-94.320 Parks and Gardens 3 (6-8 ocr)

MA-94.2324 Streets and Squares, studio (9-12 cr)
28+54 **I-II**, autumn 2006
Teachers: Prof Jyrki Sinkkilä
Contents: The course develops further the understanding of the public open spaces and design skills in creating urban sites and detailing their constructions.
Requirements: Lectures, seminars, design exercises.
Prerequisites: A-36.1201 Urban Space
Language: Finnish
Additional: Replaces the course Streets and Squares, studio (6-8 ocr)

MA-94.2392 Landscape Design, course with varying content (3-6 cr)
14+0 **I-II**
Teacher: Eeva Ruoff, Ph.D.
Contents: Course with an annually changing topic with the objective to discuss current and interesting issues of landscape design. Subject in the autumn 2006: Public Parks in Finland in the 19th and 20th Century.
Language: English
Additional: Course is a part of the International Architecture Program. Replaces the course MA-94.392 Landscape Design, course with varying content (2-4 ocr).

MA-94.2400 Readings in Landscape Architecture(4-6 cr)
0+40 **I-II, III-IV**
Teacher: Prof Jyrki Sinkkilä
Contents: The course gives an introduction to the topical writings that relate to contemporary landscape architecture.
Requirements: Seminar work and papers.
Prerequisites: A-27.2340 History of Garden Design or corresponding skills.
Language: Finnish
Additional: Replaces the course MA-94.400 Readings in Landscape Architecture (4 ocr)

MA-94.2992 Landscape Design, special project (1-15 cr)
Teacher: According to the student/group.
Contents: An individual study project on the special aspects of landscape design and construction.
Requirements: Essay, design project, video, exhibition etc. The course content and requirements are decided in accordance with the students and the project.
Language: Finnish
Additional: Replaces the course MA-94.992 Landscape Design, special project (1-10 ocr)

MA-94.3143 Architecture and Landscape, studio (9-12 cr)
28+54 **III-IV**, spring 2008
Teacher: Prof Jyrki Sinkkilä
Contents: Interplay of architecture and landscape in different cultural contexts. Relations between building, landscape and nature, art and gardening.

Requirements: Lectures, literary and graphic studies, excursions.
Language: Finnish
Additional: Replaces the course MA-94.322 Architecture of Gardens, studio (6-8 ocr)

MA-94.2144 Project Management in Landscape Architecture (6-9 cr)
40+27 **III-IV**, spring 2007
Teacher: Prof Jyrki Sinkkilä
Contents: Preparation for landscape professional practice in various design, construction and development projects.
Requirements: Lectures, seminars, exam.
Prerequisites: MA-94.1170 Landscape Construction, MA-94.1140 Plants in design 1 and MA-94.1141 Plants in Design 2 or corresponding skills.
Language: Finnish

MA-94.3145 Advanced Course in Landscape Design, studio (9-12 cr)
28+54 **I-II**, autumn 2007
Teacher: Prof Jyrki Sinkkilä
Contents: The course develops further the appreciation of techniques in landscape construction. Varying themes and topics introduce the acquisition, production and application of technical information in landscape design practice.
Requirements: Lectures, studies, design exercise, exam.
Prerequisites: MA-94.1170 Landscape Construction, MA-94.1140 Plants in Design 1 and MA-94.1141 Plants in Design 2 or corresponding skills.
Language: Finnish

MA-94.2244 History of Landscape Architecture in Finland (4 cr)
27+0 **I-II**, autumn 2007
Teacher: Eeva Ruoff, Ph.D.
Contents: The history of landscape architecture and horticulture in Finland from the late Middle Ages to the 1960's; general background, ideological traits, ideals, styles and literature.
Requirements: Lectures, exam and excursions.
Language: English
Additional: The course is a part of the International Architecture Program.
Replaces the course MA-94.244 History of Landscape Architecture in Finland (2 ocr).

MA-94.3342 Conservation of Parks and Gardens, studio (9-12 cr)
V L Period + summer sessions (spring 2008)
Teacher: Eeva Ruoff, Ph.D.
Contents: Inventory of old parks and gardens; the methods of archaeological research, interpretation of inventory findings and the use of literature sources; emphasis on making conservation plans for gardens.
Requirements: Lectures, inventory exercise, restoration plan project with seminars and exercises.
Prerequisites: A-27.2340 History of Garden Design, MA-94.1221 Plants in Design 3.
Language: Finnish
Additional: Recommended parallel courses: A27.1200 Architecture in Finland and Scandinavia and A-27.1243 Renovation of Traditional Structures.
Replaces the course MA-94.342 Restoration of Parks and Gardens, studio (6-8 ocr).

MA-94.2346 Plants in Cultural Landscape and Old Gardens (3 cr)
0+27 **IV,I** (started in the spring 2006)
Teachers: Eeva Ruoff, Ph.D., Pentti Alanko, M.Sc. (Agr. & For.)
Contents: Characteristic plants of various areas of the Finnish cultural landscape; the most important ornamental and useful plants; traditions of plant use and factors of plant prevalence.

Requirements: Lectures, seminar exercises, excursions and exam.

Prerequisites: MA-94.1221 Plants in Design 3 or corresponding skills

Language: Finnish

Additional: Replaces the course MA-94.346 Plants in Cultural Landscape and Old Gardens (2 ocr)

MA-94.2348 Field Research - Parks and Gardens, studio (3 cr)

0+27 Summer sessions

Teacher: Eeva Ruoff, Ph.D.

Contents: A pragmatic field work session with the objective to give the basic instruments of inventory technique; emphasis on structural analysis of a project garden or park, the course also includes botanical identification and plant assessment.

Requirements: Measurement, drawing, photography and other documentation exercises during the fieldwork session, report.

Prerequisites: MA-94.1221 Plants in Design 3 and MA-94.2244 History of Landscape Architecture in Finland.

Language: Finnish

Additional: Replaces the course MA-94.348 Inventory of Parks and Gardens (2ocr).

DEPARTMENT OF AUTOMATION AND SYSTEMS TECHNOLOGY

Head of department: Prof Aarne Halme, tel. 451 3300
 Administrative manager: Paula Enström, tel. 451 3921
 Planning officer (Study Affairs): Johanna Lindström, tel. 451 5152
 International study adviser: tel. 451 5471
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 Department office: Otaniementie 17, 451 4878,
 fax 451 4873

Chairs:
 AS-74 Control Engineering
 AS-75 Media Technology
 AS-84 Automation Technology
 AS-116 Information Technology in Automation

Please pay attention to the language of instruction

AS-0 Departments courses

Courses credited in ECTS

AS-0.1101 Basic Course in C- programming (4 cr)
 Spring III-IV
 Teacher: Aki Hiisilä, M.Sc.(Tech.)
 Contents: Basic concepts of high standard programming languages, adjustment model and implementation techniques. Basics of programming C. Exercises, which consist of programming in C.
 Requirements: Exercises and exam.
 Prerequisites: T-106.1203/T-106.1206.
 Additional information: Replaces the course AS-0.101.
 Language: Lectures in Finnish, exercises and exam in English.

AS-0.1102 C/C++- programming (4 cr)
 Autumn I-II
 Teacher: Aki Hiisilä, M.Sc.(Tech.)
 Contents: Basic concepts of high standard programming languages, adjustment model and implementation techniques, programming tools, programming as group work. Assignments consist of programming in C and C++ in Unix environments.
 Requirements: Assignments and exam.
 Literature: Announced later.
 Prerequisites: AS-0.1101
 Language: Lectures in Finnish, assignments and exam in English.

AS-0.1110 XML- Based Description Languages (3 cr)
 Autumn I-II
 Teacher: N.N.
 Contents: The course deals with description languages and especially XML (eXtensible Mark-Up Language) -family's description languages.
 Requirements: Examination and exercise work.
 Literature: The textbook will be announced later. In addition, lecture notes and other material.
 Prerequisites: T-106.1003/T-106.003 and T-106.1203/T-106.213 or T-106.1206/T-106.216.
 Additional information: Replaces the course AS-0.110.
 Language: Finnish. Individual study in English possible.

AS-0.1400 Automation and Media Technology at Work (1 cr)
 Autumn II
 Teacher: Prof Kari Koskinen
 Contents: The course is meant for the first year students. Automation technology, systems technology and media technology are introduced and discussed from the viewpoint of working life. Activity branches in private and public sectors with strong emphasis on automation, systems and media technology are introduced.
 Requirements: The course consists of five lectures and an excursion. Active participation in the lectures and the excursion is required for passing the course.
 Language: Finnish

AS-0.2230 Laboratory Exercises in Control and Automation Engineering (2-6 cr)
 Autumn & Spring I-II, III-IV
 Teacher: Mikael Maasalo, M.Sc. (Tech.)
 Contents: Functions and use of basic components in industrial automation. Control of real processes, and computer simulation. Fuzzy control, optimal control, controller tuning, stability checking, identification etc.
 Requirement: Pre-reports, laboratory work is completed in groups of 3-4 persons. 3 tasks/credit under guidance of an assistant, post reports. Final exam.
 Prerequisites: Basic knowledge of automation and control engineering.
 Additional information: Replaces the course AS-74.230.
 Language: Finnish.

AS-74 CONTROL ENGINEERING

Prof: Heikki Koivo, tel. 451 5200, room 3571
 Prof: Heikki Hyötyniemi, tel. 451 5205, room 3553

Courses credited in ECTS

AS-74.1101 Computer Simulation (3 cr)
 Autumn I-II
 Teacher: Prof Heikki Koivo
 Contents: Computer simulation of dynamic systems. Difficulties in digital simulation: time delay, tables, discontinuity, stiff systems. Linearization, optimisation in simulation, examples of technical and ecological system simulation. Examples of commercial simulation software. Lectures and tutorials are held in microcomputer class. Simulation tool: Matlab/Simulink.

Literature: Lecture notes.

Prerequisites: Basic courses in physics and mathematics.
Additional information: Replaces the course AS-74.101.
Language: Finnish. Individual study in English possible.

AS-74.1102 Basic Mathematics for Control Theory (2 cr)
Autumn I

Teacher: Kai Zenger, D.Sc. (Tech.)
Contents: Matrix algebra, Laplace transformations and transfer functions. Excitations and responses. State-space presentation, differential equations, Z-transforms.
Literature: Virkkunen: Sääntötekniikan matematiikka, Otatieto 1995, lecture notes.
Prerequisites: Basic courses in mathematics.
Additional information: Replaces the course AS-74.102.
Language: Finnish.

AS-74.1106 Introduction to Matlab Software I (1 cr)
Autumn & spring I, III

Teacher: Lasse Eriksson, M.Sc.(Tech.)
Contents: The course provides a basic knowledge of Matlab software to be used as a computing tool especially in automation and control engineering applications. Basic calculations, functions, plots, Matlab programming. The course is intended primarily for students who have never used Matlab.
Requirements: Exercises
Literature: Parts of William J. Palm III: Introduction to Matlab 6 for engineers, 2001.
Prerequisites: No prerequisites
Replaces the course AS-74.106.
Language: Finnish

AS-74.1107 Introduction to Matlab Software 2 (1 cr)
Autumn & spring II, IV

Teacher: Lasse Eriksson, M.Sc.(Tech.)
Contents: Efficient use of Matlab software in automation and control engineering applications. Versatile use of data structures, plots, Matlab programming, examples of Matlab functions and use of toolboxes. The course is intended for students who have a basic knowledge of Matlab. The objective of the course is to gain a deeper understanding of Matlab.
Requirements: Exercises
Literature: Parts of William J. Palm III: Introduction to Matlab 6 for engineers, 2001.
Prerequisites: AS-74.1106/106 or corresponding background knowledge of Matlab
Additional information: Replaces the course AS-74.107.
Language: Finnish

AS-74.1118 Process Control (4 cr)
Autumn I-II

Teacher: prof. Heikki Koivo
Contents: The course is a part of the Linkage program. Introduction to feedback control, modelling and simulation of typical processes. The most common control tasks in industrial paper mills are covered. Consistency control, head-box control, CD control.
Requirements: Overlaps parts of AS-84.1132.
Literature: Lecture notes and articles.
Prerequisites: Sufficient knowledge of basic mathematics and physics.
This course is part of Linkage Programme 1
Replaces the course AS-74.118.

AS-74.2111 Analogue Control (3 cr)
Autumn I-II

Teacher: Jean-Peter Ylén, D.Sc. (Tech.)
Contents: Fundamentals of analogue control. Dynamical systems. Frequency domain models. State space models. Design and analysis of control systems. In tutorial Matlab/Control System Toolbox is used.

Literature: P.H. Lewis, C. Yang: Basic Control Systems Engineering, Prentice-Hall 1997. Handouts.
Prerequisites: A basic course in automation and control. Recommended AS-74.101/1101, AS-74.102/1102.

Additional information: From the beginning of the year 2007 the course is lectured once in a year in spring during study periods III-IV. In 2006 the course is lectured for the last time during periods I-II. Replaces the course AS-74.111.
Language: Finnish. Individual study in English possible.

AS-74.2112 Digital Control (3 cr)

Spring III-IV
Teacher: Kai Zenger, D.Sc. (Tech.)
Contents: Fundamentals of digital control. Theory of sampling. Connections between continuous and discrete models. Discrete control algorithms. Discrete PID control. Disturbances and their compensation.
Literature: Lecture notes, courses homepages and internet-course.
Prerequisites: AS-74.111/2111. Recommended AS-74.101/1101, AS-74.102/1102.

Additional information: In the year 2007 the course is lectured in spring (periods III-IV) and in autumn (periods I-II). From there on the course is lectured in periods I-II only. Replaces the course AS-74.112.
Language: Finnish. Course material available in English.

AS-74.2400 System Dynamics (4 cr)
Autumn I-II

Teacher: Jean-Peter Ylén, D.Sc. (Tech.)
Contents: The objective of the course is to give the knowledge needed to identify, model and understand different economical, social and technical systems. The basics of analysis, modeling and control of dynamic systems are treated. Validating dynamic models are further discussed and application examples presented.
Requirements: Examination and project work.
Literature: John. D. Sterman: Business Dynamics -Systems Thinking and Modeling for a Complex World, McGraw-Hill.
Prerequisites: Basic courses in mathematics.
Additional information: Replaces the course AS-74.400.
Language: Finnish. Individual study in English possible.

AS-74.3100 Dynamic Systems (3 cr)

Autumn I-II
Teacher: Robert Tenno, D. Sc. (Tech.)
Contents: Basics of dynamic modelling. Physical analogies, mechanical systems. Model transforms and approximations. Partial differential equation systems. Simulation and basics of identification methods.
Literature: Lecture notes.
Prerequisites: Basic courses in physics and mathematics.
Additional information: Replaces the course AS-74.100.
Language: Finnish. Individual study in English possible.

AS-74.3114 Computer Modelling (5 cr) P
Spring III-IV

Teacher: Jean-Peter Ylén, D.Sc. (Tech.)
Contents: Basics of modelling and identification, modelling of discrete systems in time and frequency domains, recursive identification. A large part of the course is reserved for computer exercises during which identification methods are applied to practice.
Requirements: Final exam
Literature: Lecture notes
Prerequisites: Basics of automation and control engineering.
Additional information: Replaces the course AS-74.114.
Language: Finnish, English on demand.

AS-74.3115 Neural Nets and Fuzzy Computing in Automation (3 cr) P

Spring III-IV

Teacher: Prof Heikki Koivo

Contents: Basics of neural computing and fuzzy logic. Fuzzy control. Industrial applications of fuzzy logic and neural networks.

Neuro-fuzzy computing. Matlab/Fuzzy Logic Toolbox and neural Network Toolbox are used in tutorials.

Requirements: Exam and assignments.

Literature: Lecture notes.

Prerequisites: AS-74.111/2111, AS-74.112/2112.

Additional information: Replaces the course AS-74.115.

Language: Finnish, English on demand.

AS-74.3123 Model-based Control Systems (4 cr) P

Autumn I-II

Teacher: Kai Zenger, D.Sc.(Tech.)

Contents: Model-based control methods: multivariable control, optimal control, nonlinear control, robust control.

Requirements: Assignment and exam.

Literature: Glad, Ljung. 2000. Control Theory, Multivariable and Nonlinear Methods. Taylor and Francis.

Prerequisites: AS-74.111/2111, AS-74.112/2112.

Additional information: Replaces the course AS-74.123.

Language: Finnish, English on demand.

AS-74.3135 Servomechanisms (3 cr)

Spring III-IV

Teacher: Prof Heikki Koivo

Contents: DC and AC servomechanisms and their combinations. Electro hydraulic servomechanisms. Use of computers and probes in servomechanics. Different control algorithms. Basics of microsystems.

Literature: Lecture notes

Requirement: Exercises

Prerequisites: Basic course in control engineering.

Additional information: Replaces the course AS-74.135.

Language: Finnish.

AS-74.3136 Introduction to Microsystems (3 cr)

Spring III-IV

Teacher: Prof Heikki Koivo

Contents: Microsystem components. Microsystems. Modelling, simulation and control of microsystems. Examples of microsystems.

Requirements: Final exam and seminar presentation, possibly individual project work.

Literature: Lecture notes, parts of book Fatikow, S., Rembold, U.: Microsystem Technology and Microrobotics, Springer 1997.

Additional information: Replaces the course AS-74.136.

Language: English

AS-74.3176 Computer-aided Control System Design (3 cr)

Spring III-IV

Teacher: Robert Tenno, D. Sc. (Tech.)

Contents: Commercial CAD software for design and analysis of control systems.

Requirements: Final exam.

Literature: Additional material.

Prerequisites: AS-74.111/2111, AS-74.112/2112.

Additional information: Replaces the course AS-74.176.

Language: Finnish.

AS-74.3180 Automation Technology in Buildings (3 cr)

Spring III-IV, will be lectured every other year, for the first time in academic year 2006 - 2007.

Teacher: Janne Peltonen, M.Sc. (Tech.)

Contents: Handling of building automation technology, application fields, functions, implementation techniques, calculations of profitability. Energy management, fire and security systems.

Requirements: Course consist seminar

Literature: Lecture notes.

Prerequisites: Basic course in control engineering.

Additional information: Replaces the course AS-74.180.

Language: Finnish.

AS-74.3198 System Engineering in Wireless Communication (4 cr) P

Spring III-IV, lectured alternate years, not lectured in Spring 2007.

Teacher: Prof. Heikki Koivo

Contents: Radio propagation. Fundamentals of RF communication. Principles of wideband CDMA (WCDMA). Power control, handoff, admission and load control. Optimization of radio resources. Speech signal analysis and modelling. Linear predictive coding. Coding strategies. System application aspects.

Examination: Homework exercises, seminar presentations and examination

Literature: Lecture notes

Prerequisites: Basic control and optimization courses. Courses on estimation are helpful.

Additional information: Replaces the course AS-74.198.

Language: English

AS-74.3220 Individual Project in Control Engineering A (2-6 cr) V

Autumn + spring I, II, III, IV

Teachers: Prof Heikki Koivo, Prof Heikki Hyötyniemi and Kai Zenger, D.Sc.(Tech.)

Contents: Individual work on a suitable project. Literature study, laboratory work, or a design project.

Prerequisites: Basic course in control engineering.

Additional information: Replaces the course AS-74.220.

Language: Finnish or English.

AS-74.3345 Seminar on Control Engineering (3 cr)

Autumn I-II

Teacher: Prof Heikki Koivo, Prof Heikki Hyötyniemi

Contents: New technological and methodological trends in control engineering. Students prepare reports and give seminar presentations about selected topics, which can be method or application oriented. During and after each presentation the topic is analysed through active discussion.

Requirements: Preparation and presentation of the seminar work, and active participation in discussions.

Additional information: Replaces the course AS-74.345.

Language: Finnish

AS-74.4191 Multivariate Regression Methods (4 cr) P

Autumn I-II

Teacher: Prof Heikki Hyötyniemi

Contents: The modern multivariate statistical methods (linear regression, principal component analysis and regression, partial least-squares regression, canonical correlation analysis and regression, and independent component analysis and regression) are studied and applied to modelling dynamic systems (subspace identification). The goal is to understand the principles that the different methods are based on as well as recognising the underlying similarities.

Requirements: Examination and special assignment.

Literature: Lecture notes

Prerequisites: Basic knowledge of linear algebra and matrix calculus.

Additional information: Replaces the course AS-74.191.

Language: Finnish. Course material available in English.

AS-74.4192 Elementary Cybernetics (3 cr) P

Spring III-IV

Teacher: Prof Heikki Hyötyniemi, visiting lecturers

Contents: Systemic, holistic approaches to modelling of complex systems. Interactions of local actors, dynamic structures

caused by feedback loops, and the emergent higher-level phenomena. Analogues in neural, cognitive, biological and ecological systems, examples in complex social and economical dynamics, and applications in complex industrial processes.

Requirements: Assignment and exam.

Additional information: Replaces the course AS-74.192.

Literature: Finnish. Course material available in English.

AS-74.4330 Postgraduate Course in Control Engineering (4-8 cr) P V

Autumn + spring I-II, III-IV

Teacher: Prof Heikki Koivo

Contents: Control methods and theory for research and practical applications. The contents vary from year to year.

Requirements: Seminar presentation and assignments

Literature: to be announced later

Additional information: Replaces the course AS-74.330.

Language: Finnish, English on demand.

AS-74.4340 Special Course in Control Engineering (1-8 cr) P V

Autumn + spring I, II, III, IV

Teacher: Prof Heikki Koivo, Prof Heikki Hyötyniemi and Kai Zenger, D.Sc.(Tech.)

Contents: The course is meant for postgraduate students. It consists of e.g. examinations based on books on different topics of control theory.

Additional information: Replaces the course AS-74.340.

Language: Finnish or English.

AS-75 MEDIA TECHNOLOGY

Prof. Pirkko Oittinen, tel. 451 3341, room 3540; prof. Eero Hyvönen, tel. 451 3362, room 2540.

Courses credited in ECTS

AS-75.1101 Media Genres (3 cr)

Spring III-IV

Teacher: Stina Westman, M.Sc. (Tech.)

Contents: Media genres; messages, media and media effects.

Requirements: Examination and exercise work.

Literature: To be announced later.

Prerequisites: -

Additional information: Replaces the course AS-75.120.

Language: Finnish. Individual study in English possible.

AS-75.1102 Basics of Publication Technology (3 cr)

Autumn + spring, I-II, III-IV

Teacher: Prof Eero Hyvönen

Contents: The course deals with the technical principles related to page make-up, web page design, multimedia documents and document coding.

Requirements: Based on individual practical assignments.

Literature: Handouts and other material.

Prerequisites: T-106.1003/T-106.003

Additional information: Replaces the course AS-75.102.

Language: Finnish. Individual study in English possible.

AS-75.1124 Basics of Imaging Technology (4 -5 cr)

Autumn I-II

Teacher: N.N.

Contents: Modelling of imaging systems using transfer system and information theories. Light, radiometry, photometry. Optics, lenses. Detection, generation, coding, characterisation and processing of image signals. Colour vision, colorimetry and colour coordinate systems, spatial vision.

Requirements: Exercise work and examination.

Literature: Saarelma Hannu: Kuvatekniikan perusteet, Otatiето 601

Prerequisites: -

Additional information: Replaces the course AS-75.124.

Language: Finnish. Individual study in English possible.

AS-75.2121 Basics of Media Technology (4 cr)

Spring III-IV

Teacher: Mikael Malanin, M.Sc. (Tech.) and prof Pirkko Oittinen

Contents: The course deals with the technical aspects and processes of media signals and devices, and subjective and objective measurement connected to them.

Requirements: Exercise work and two partial examinations or one final examination.

Literature: Lecture notes and other material.

Prerequisites: AS-75.1124/AS75.124.

Additional information: Replaces the course AS-75.121.

Language: Finnish. Individual study in English possible.

AS-75.2128 Imaging and Display Technology (5 cr) P

Autumn I-II

Teacher: Mikko Nuutinen, M.Sc. (Tech.)

Contents: Imaging, display and printing technologies and their performance.

Requirements: Lectures, 1-2 exercise works and examination.

Literature: Consists of articles, exact content to be announced later.

Prerequisites: AS-75.2121/AS-75.121, AS-75.1124/AS-75.124.

Additional information: Replaces the course AS-75.128.

Language: Finnish. Individual study in English possible.

AS-75.2300 Information Networks: Studio 2 (2 cr)

Spring (Period I or II, to be announced later)

Teacher: Prof Eero Hyvönen

Contents: The course focuses on electronic publishing. The PBL (Problem-Based Learning) method is used as an educational method in dealing with the technical issues of electronic publishing.

Requirements: PBL-cases and articles. Exercise work guided by the assistants.

Prerequisites: -

Additional information: Replaces the course AS-75.300. The course is only meant for the students in the Degree Programme of Information Networks.

AS-75.2500 Semantic Web (4 cr) P

Spring III-IV

Teacher: Prof Eero Hyvönen

Contents: The core content of the course consists of Semantic Web technologies and standards such as Resource Description Framework (RDF) and Web Ontology Language (OWL). Rule systems, ontology techniques and Semantic Web tools and applications will also be covered. The theoretical part of the course will be complemented by exercise work.

Requirements: Examination and exercise work.

Literature: G. Antoniou, F. van Harmelen, A Semantic Web Primer. MIT Press, 2004. Lecture notes and other material.

Prerequisites: AS-0.1110/AS-0.110, T-106.1223/T-106.253 (recommendation).

Additional information: Replaces the course AS-75.105.

Language: Finnish. Individual study in English possible.

AS-75.3118 Graphic Media Technology (5-6 cr) P

Autumn & spring II-IV

Teacher: Prof Pirkko Oittinen

Contents: The course deals with the graphic media process from the viewpoint of production, products and technologies. Additional themes include the standards and solutions of digital workflow, colour management and changing information and personalization. The course consists of several modules.

Requirements: Active attendance, seminar work, exercise work and examination.

Literature: Oittinen, P., Graafinen viestintäteknikka (lecture notes) and other material.

Prerequisites: AS-75.2121/AS-75.121.

Additional information: Replaces the course AS-75.118.

Language: Finnish. Individual study in English possible.

AS-75.3130 Visual Media (5-6 cr) P

Autumn & spring I-IV

Teacher: Mari Laine, M.Sc. (Tech.) and Pirkko Oittinen, prof.

Contents: the course deals with the objective and subjective quality of visual media applications as well as the measurement of quality. Subjective quality will mainly be approached from the viewpoints of visual perception and user experience. Optional fields of study include still images, broadcast video, displays and print quality.

Requirements: Examination and exercise work in small groups. The six-credit version of the course includes an additional individual assignment.

Literature: Consists of articles, exact content to be announced later.

Prerequisites: AS-75.2121/AS-75.121.

Additional information: Replaces the course AS-75.130.

Language: Finnish. Individual study in English possible.

AS-75.3132 Systems in Media Communication (5-6 cr) P

Autumn & spring I-IV

Teacher: Jan Kallenbach, M. Sc. (Tech.) and Pirkko Oittinen, prof.

Contents: The course deals with the hardware, software, systems and channels used in activities of media companies. The course is carried out as a project in which the topic is explored top-down from the global level down to media companies.

Requirements: Examination and exercise work in small groups. The six-credit version of the course includes an additional individual assignment.

Literature: To be announced later.

Prerequisites: AS-75.2121/AS-75.121.

Additional information: Replaces the course AS-75.132.

Language: English and Finnish.

AS-75.3206 Laboratory Course in Media Technology (3-9 cr) V

Autumn + spring I, II, III, IV

Teacher: Tuuli Nurminen, M.Sc. (Tech.)

Contents: Individual assignments on topics related to visual media, media technology, publication technology or graphic arts technology. The assignments typically include literature research and an experimental study which can include for example planning, modelling, testing or measurement.

Requirements: 1 or 2 individual assignments.

Prerequisites: AS-75.2121/AS-75.121.

Additional information: Replaces the course AS-75.206.

Language: Finnish or English.

AS-75.3300 Project Course in Visual Media (2-8 cr) P V

Autumn + spring I, II, III, IV

Teacher: Mikko Nuutinen, M.Sc. (Tech)

Contents: The purpose of the course is to exercise the students' independent problem-solving skills with individual research projects from different fields of visual media.

Requirements: One or two individual projects.

Prerequisites: AS-75.1124/AS-75.124, AS-75.2121/AS-75.121.

Additional information: Replaces the courses AS-75.135, AS-75.196 and AS-75.202.

Language: Finnish or English.

AS-75.3400 Project Course in Knowledge media (2-8 cr) P V

Autumn + spring I, II, III, IV

Teacher: Prof Eero Hyvönen

Contents: A knowledge media -related project conducted individually or in a small group. The specific content of the project will be agreed on with the teacher.

Requirements: To be agreed on a case by case basis.

Literature: To be chosen according to the topic of the project.

Prerequisites: Media technology modules A1 and A2 or equivalent knowledge.

Language: Finnish or English.

AS-75.3600 Semantic Web Services (4 cr) P

Autumn I-II

Teacher: Prof Eero Hyvönen and Tuukka Ruotsalo, M.Sc.(Econ.& Bus.Adm.)

Contents: The basic Web Service tools and standards (e.g. SOAP, WSDL and UDDI), the representation of functional services with choreography languages, the semantic description systems of the services (e.g. OWL-S and WSMF), and the tools and applications of the area. The theory will be complemented by exercise work.

Requirements: Examination and exercise work.

Literature: The textbook will be announced later. Lecture notes and other material.

Prerequisites: AS-0.1110/AS-0.110, AS-75.2500/AS-75.105 (recommended).

Additional information: Replaces the course AS-75.108.

Language: Finnish. Individual study in English possible.

AS-75.3700 Research Seminar on Media Technology (3 cr)

Autumn I-II

Teacher: Prof Pirkko Oittinen and Prof Eero Hyvönen

Contents: New media technology research results will be discussed in relation to the topics of the participants' Master's Theses.

Requirements: Active participation in the seminar.

Literature: Research articles, books, standards, software etc.

Prerequisites: Qualifications for Master's Thesis work.

Language: Finnish or English.

AS-75.4146 Postgraduate Course on Visual Media (3-9 cr) P V

Spring III-IV

Teacher: Prof Pirkko Oittinen

Contents: Individual and group assignments concerning current themes for research on visual information and its application technologies and applications.

Requirements: To be agreed on case by case.

Prerequisites: M.Sc. (Tech.) degree

Additional information: In addition to the spring term, the course may be organized at varying times (e.g. during the summer).

Replaces the course AS-75.146.

Language: Finnish or English.

AS-75.4210 Advanced Laboratory Course in Media Technology (2-8 cr) P V

Autumn + spring I, II, III, IV

Teacher: Prof Pirkko Oittinen and Prof Eero Hyvönen

Contents: The purpose of the course is to exercise the students' independent problem-solving skills with individual research projects on topics related to publication and media technology.

Requirements: 1-2 individual research assignments.

Prerequisites: AS-75.3206/AS-75.206.

Additional information: Replaces the courses AS-75.113, AS-75.135 and AS-75.210.

Language: Finnish or English.

AS-75.4700 Postgraduate Seminar on Knowledge media (3-9 cr) P V

Autumn I-II

Teacher: Prof Eero Hyvönen

Contents: Will be agreed on annually. The topic for the Autumn of 2005 is "Semantic Web Ontologies".

Requirements: To be agreed on case by case.
 Literature: Research articles, books, standards, software etc.
 Prerequisites: M.Sc. (Tech.) degree or equivalent knowledge.
 Additional information: The course is an optional replacement for AS-75.146.
 Language: Finnish or English.

AS-84 AUTOMATION TECHNOLOGY

Prof. Aarne Halme, tel. 451 3300, room 2565.
 Prof. Arto Visala, tel. 451 3306, room 2564.

Courses credited in ECTS

AS-84.1128 Fundamentals of Automation and Control Technology (3 cr)
 Spring III-IV

Teacher: Prof Arto Visala

Contents: Automation in factories, machines, vehicles, and in other machines and devices. Measurements and actuators in the controlled process/ machine. Automation system architecture and functions, hardware and software. Binary and fuzzy logic control. Modelling of dynamic systems. Feedback control. Exercises.

Requirements: Final exam.

Literature: G. Olsson, D. Piani, 1992. Computer Systems for Automation and Control. Prentice-Hall.

Language: Finnish. Individual study in English possible.

AS-84.1132 Automation and Control Technology (5 cr)
 Autumn I-II

Teacher: Prof Aarne Halme

Contents: Automation in factories, machines, vehicles, and in other machines and devices. Measurements and actuators in the controlled process/ machine. Automation system architecture and functions, hardware and software. Binary and fuzzy logic control. Modelling of dynamic systems. Feedback control. Exercises and laboratory work.

Requirements: Final exam and laboratory works.

Literature: G. Olsson, D. Piani, 1992. Computer Systems for Automation and Control. Prentice-Hall.; lecture notes.

Language: Finnish. Individual study in English possible.

AS-84.1137 Robotics (3 cr)

Spring III-IV

Teacher: Pekka Forsman, D.Sc. (Tech.)

Contents: Basics in robotics. Industrial robots and mobile robots. Subsystems and physical components of robots. Basic kinematics and motion control principles. Examples of various practical applications of robotics.

Requirements: Final exam and a robot programming exercise.

Literature: Craig J.J.: Introduction to robotics. Third Edition, Prentice Hall, 2005 (partly); lecture notes.

Prerequisites: Basic knowledge of automation and control engineering.

Language: Finnish. Individual study in English possible.

AS-84.1168 Automation Systems (3 cr)

Autumn I-II

Teacher: Panu Harmo, M.Sc. (Tech.)

Contents: Basic functions and architecture of industrial automation systems. Communications and networks in automation. Operating systems and automation application programming. Hardware and software systems for automation. Automation project implementation. Practical examples. Excursions and exercises.

Literature: Lecture notes.

Prerequisites: Basic knowledge of automation and control engineering.

Language: Finnish

AS-84.2161 Signal Processing Methods in Automation (5 cr)
 Spring III-IV

Teachers: Prof Aarne Halme, Prof Arto Visala

Contents: Sampling. Digital filtering, 2D filtering. Dynamic machine vision. Estimators and Kalman-type filters. Digital servo controllers. Fuzzy control. Fault detection and analysis. Sensor fusion. Assignment work.

Literature: Lecture notes; parts of the following book: Franklin, Powell & Workman: Digital Control of Dynamic Systems. 3rd Edition. Addison-Wesley, 1998. E. Trucco & A. Verri: Introductory techniques for 3-D computer vision. Prentice Hall, 1998.

Language: Finnish. Course material available in English.

AS-84.3125 Estimation and Sensor Fusion Methods (3 cr) P
 Autumn I

Teachers: Prof Arto Visala, Jorma Selkänaho, D.Sc. (Tech.)

Contents: State estimation methods in automation and control engineering. Linear estimation in static systems. State estimation in discrete dynamical systems. Computational aspects. Continuous state estimation. States estimation in non-linear systems. Adaptive estimation. Parameter estimation. The goal is to be able to plan and implement estimation algorithms in practice.

Requirements: Final exam.

Literature: Lecture notes; Bar-Shalom, Y. & Li X-R., 1998. Estimation and tracking. principles, techniques and software.

Language: Finnish, English on demand.

AS-84.3126 Machine Perception (3 cr) P

Autumn II

Teacher: Prof Arto Visala

Contents: Widens ability to apply signal processing in automation. Particularly, perception processing methods in robots and autonomous machines. Dynamic machine vision, signal processing in connection with laser scanners. Overview of biological sensor-motor mechanisms.

Literature: E. Trucco & A. Verri: Introductory techniques for 3-D computer vision. Prentice-Hall (1998); lecture notes.

Language: Finnish, English on demand.

AS-84.3127 Positioning and Navigation Methods (3 cr) P

Spring III

Teachers: Jorma Selkänaho, D.Sc. (Tech.), Pekka Forsman, D.Sc. (Tech.)

Contents: Methods of positioning of mobile objects. Dead reckoning. Methods based on fixed beacons. Feature based positioning. Simultaneous mapping and positioning. Generic RF-methods, GPS, utilisation of wireless mobile communication networks. Estimation methods of focusing position.

Literature: Lecture notes.

Language: Finnish. Individual study in English possible.

AS-84.3134 Automation in Energy Technology (3 cr)

Autumn I-II, alternate years, not lectured autumn 2006

Teacher: Prof Arto Visala, Matias Halinen, M.Sc. (Tech.)

Contents: Instrumentation and control of power plants. Advanced control on power plants. Upper layer control systems. Automation of distributed energy production. Control of fuel cells.

Literature: Lecture notes

Prerequisites: Basic knowledge of automation and control engineering.

Language: Finnish

AS-84.3138 Introduction to Robot Kinematics (3 op)

Autumn I

Teacher: D.Sc. (Tech.) Peter Jakubik

Contents: The course covers the introduction to the space robot algorithms, their applications and examples from space robotics. Topics discussed: coordinate transformations, frames, operations with frames, forward kinematics, inverse kinematics, differential relationships, static forces, redundant robots, singularities, veloc-

ity control, trajectory generation, path planning, mobile robots, walking, rolling, omnidirectional rolling, swarm formation, obstacle avoidance with manipulators and vehicles, examples from space robotics.

Requirements: Final examination and calculation exercises.

Literature: Craig, J.J. Introduction to Robotics: Mechanics and control. 3. ed. and handouts.

Prerequisites: Basic knowledge of automation and control engineering.

Additional: The course is for SpaceMaster students only.

Language: English

AS-84.3139 SpaceMaster Project in Automation Technology (4 op)

Autumn I-II

Teacher: M.Sc. (Tech.) Tomi Ylikorpi, M.Sc. (Tech.) Seppo Heikkilä, Lic. (Tech.) Ilkka Seppänen

Contents: Guided "learning by doing" project which is done individually or in teams of 2-3 students. Students on one's own initiative search, learn, develop and apply suitable methods to solve, implement and test given tasks. The tasks comprise of different robotics and automation problems in frame of mechanical systems and electronics and software required for control, measurement and communications systems. The topics for the research are selected to form the basis for the final SpaceMaster Thesis work. The schedule and contents for the work is agreed in advance. Laboratory staff assists in procurement of needed hardware, students perform the needed assembly-work themselves.

Requirements: Pre-reports, final report and project presentation.

Prerequisites: Basic knowledge of automation and control engineering.

Additional: The course is for SpaceMaster students only.

Language: English

AS-84.3145 Field and Service Robotics (4 cr)

Autumn I-II

Teachers: Prof Aarne Halme, Jussi Suomela, D.Sc. (Tech.)

Contents: Mobile intelligent machines and robots. Functional subsystems: motion and energy, piloting, sensor and perception, navigation, control and supervising, work task management system. Technical solutions of subsystems. Locomotion theory, particularly walking. Assignment work.

Literature: Everett, H.R., 1995. Sensors for mobile robots. A.K. Peters Ltd.; lecture notes.

Prerequisites: AS-84.137, basic knowledge of automation and control engineering.

Language: Finnish, English on demand.

AS-84.3146 Behaviour-based Robotics (3 cr) P

Autumn I

Teacher: Mika Vainio, D.Sc. (Tech.)

Contents: Planning and use of behaviour-based robots. Generic design principles through study of existing robot systems. Overview of biological perception and learning, corresponding technical solutions. Control architectures. Distributed robot systems. New paradigms in robotics.

Literature: Murphy, Robin. R. Introduction to AI robotics.; lecture notes.

Prerequisites: AS-84.137, basic knowledge of automation and control engineering.

Language: Finnish, English on demand.

AS-84.3147 Man-machine Interfaces in Automation (3 cr) P

Spring IV

Teacher: Jussi Suomela, D.Sc. (Tech.)

Contents: Basic functions and operational layers in Man-Machine-Interfaces (MMI). Communication between man and machine, means and methods for MM communication. Dynamics of MM interactions. Ergonomics of human senses in MMI. MMIs for teleoperation. Cognitive level MMIs. Applications. Assignment work with research machines.

Literature: lecture notes.

Prerequisites: AS-84.137, basic knowledge of automation and control engineering.

Language: Finnish. Course material available in English.

AS-84.3148 Kinematics and Motion Planning (3 cr) P

Autumn II

Teacher: Sami Ylönen, Lic.Sc. (Tech.)

Contents: Advanced kinematic modelling. Introduction to robot dynamics. Modelling of mobile robots. Motion planning, collision free paths. Force control. Applications. Exercises.

Literature: Craig, J.J.: Introduction to robotics. Third Edition, Prentice Hall, 2005. Robot motion planning. Kluwer; lecture notes.

Prerequisites: AS-84.137, basic knowledge of automation and control engineering.

Language: Finnish. Individual study in English possible.

AS-84.3149 Bionics (3 cr)

Spring IV

Teacher: N.N.

Contents: Utilization of biological principles and mechanisms developed in the evolution process in planning of manufactured machines and their control, e.g.: light and solid structures, energy conversion principles and systems, locomotion systems, perception and navigation systems, simple and flexible reasoning and inference methods, swarm intelligence, superior adaptation mechanisms. Assignment work.

Literature: Lecture notes.

Prerequisites: AS-84.137

Language: Finnish, English on demand.

AS-84.3165 Automation in Biotechnical Processes (3 cr)

Spring III-IV, alternate years, not lectured spring 2007.

Teacher: Anja Appelqvist, M.Sc. (Chem.Eng.)

Contents: Modelling, measurements and control of biotechnical fermentation processes. Control and monitoring of batch, fed-batch, and continuous fermentation processes. Specific requirements and implementation of automation system. Sensor technology.

Literature: Pons (ed), 1992. Bioprocess Monitoring and Control, Hanser Publishers.

Prerequisites: Basic knowledge of automation and control engineering.

Language: English

AS-84.3169 Networked Automation (3 cr) P

Spring IV

Teacher: Prof Arto Visala

Contents: Open fieldbuses in industry, vehicle networks. Configuration and management of controls, monitoring and fault diagnosis over the network. Design and implementation of "field controls".

Literature: Lecture notes.

Language: Finnish. Individual study in English possible.

AS-84.3180 Mechatronics for Small-scale Autonomic Devices (3 cr)

Spring III

Teachers: Pekka Appelqvist, D.Sc. (Tech.), Anja Appelqvist, M.Sc. (Chem. Eng.)

Contents: Structures and subsystems of small-scale autonomous mechatronics devices. Electronic components, sensors and actuators, integration to mechanics. Development of embedded software. Miniaturization. MEMS-components. Microreactors and micro process technology. Application examples. Essay writing and exam.

Literature: Lecture notes

Prerequisites: AS-84.168, basic knowledge of automation and control engineering, AS-84.136 helpful.

Language: Finnish. Course material available in English.

AS-84.3190 Nonlinear Modeling and Control (3 cr) P

Spring III, alternate years, not lectured spring 2007

Teacher: Prof Arto Visala, Janne Paanajarvi, M.Sc. (Tech.)

Contents: Modelling of nonlinear dynamic systems with artificial neural networks and Wiener state space models. Introduction to nonlinear control: analysis, controller synthesis, nonlinear model predictive and optimal control.

Literature: Lecture notes and T. Glad & L. Ljung: Control Theory, Taylor & Francis (2000), part III Nonlinear methods, 11-19. Prerequisites: AS-74.111, AS-74.112 (AS-74.123 useful).

Language: Finnish. Course material available in English.

AS-84.3268 Project in Automation Systems (3 cr)

Spring III-IV

Teacher: Panu Harmo, M.Sc. (Tech.)

Contents: Continuation project of AS-84.168 Automation Systems. Students connect sensors and actuators of laboratory processes to a commercial automation systems and program the system to control the process. The students will get acquainted with process instrumentation, fieldbuses, automation systems structures, hardware and software, programming and operation in practice. The work is done in groups.

Requirements: Pre-reports, final report, and project presentation.

Prerequisites: AS-84.1168.

Other: Combined with the lecture course AS-84.1168.

Language: Finnish, English on demand.

AS-84.3270 Real-time Programming (3 cr)

Spring IV

Teachers: Teemu Ronkka, M.Sc (Tech.)

Contents: Basics of planning of embedded systems and real time programming. The programming of embedded systems in C-language, basics of digital control and electronics of embedded systems. Teaching consists of lectures (20 hours) and programming exercises. ATMEL's AVR-micro controllers are used as evaluation equipment. At the end of the course instead of an examination students build a small electronic device and attach it to the micro controller.

Prerequisites: -

Language: Finnish

AS-84.3284 Project in Automation Technology (2-9 cr) V

Autumn + spring I-II, III-IV

Teacher: Ilkka Leppänen, M.Sc. (Tech.)

Contents: Variable size guided "learning by doing" project which is done individually or usually in teams of 2-3 students. Students apply suitable methods to solve, implement, and test given tasks. The titles are given and guided by research and teaching staff. The schedule for the work is agreed in advance.

Requirements: Pre-reports, final report, and project presentation.

Prerequisites: Basic knowledge of automation and control engineering.

Additional information: Replaces the course AS-84.284.

Language: Finnish, English on demand.

AS-84.3400 Seminar on Automation Technology (3 cr)

Spring III-IV

Teacher: Prof Aarne Halme

Contents: New technological trends in automation. Students prepare reports and give seminar presentations about selected topics, which can be method or application oriented. During and after each presentation the topic is analyzed through active discussion.

Requirements: Preparation and presentation of the seminar work, and active discussions.

Additional information: Replaces the course AS-84.400.

Language: Finnish, seminar presentations may be done in English.

AS-84.4340 Postgraduate Course in Automation Technology (4-8 cr) P V

Autumn + spring I-II, III-IV

Teacher: Prof Aarne Halme, Prof Arto Visala

Contents: One semester seminar for postgraduate students. The subjects vary yearly according to the actual interests in different technologies and methods of automation engineering and control theory.

Requirements: Seminar type requirements.

Additional information: Replaces the course AS-84.340.

Language: English

AS-116 INFORMATION TECHNOLOGY IN AUTOMATION

Prof: Kari Koskinen, tel. 451 5461, room 1553.

Courses credited in ECTS**AS-116.1100 Manufacturing Automation (4 cr)**

Autumn I-II

Teacher: Prof Kari Koskinen

Contents: Control and control systems of machines and production equipment in manufacturing industry. Sensors, identification techniques and data acquisition systems. Programmable logic controllers, fieldbuses and SCADA-systems. Control systems of machines, production cells, FM-systems and production lines. System integration and program interfaces. Use of simulation in the design of production systems. Applications of industrial robots. Assignment work.

Literature: Lecture notes.

Prerequisites: Basic knowledge of automation and control engineering.

Additional information: Replaces the course AS-116.100.

Language: Finnish

AS-116.2120 Information Technology Applications in Automation (5 cr)

Autumn I-II

Teacher: Pekka Aarnio, Lic.Sc. (Tech.)

Contents: Operating systems and buses used in machine and equipment control (for example CAN-bus). Application of microcontrollers and FPGA-chips. Design and realization methods with proper tools supporting real-time, embedded control programs (for example UML-method with its real-time extension). Assignment work.

Literature: Lecture notes.

Prerequisites: Basic knowledge of automation and control engineering. Basic knowledge of computer sciences.

Additional information: Replaces the course AS-116.120.

Language: Finnish and English

AS-116.3110 Information Systems in Manufacturing Industries (4 cr)

Spring III-IV

Teacher: Ilkka Seilonen, Lic.Sc (Tech.)

Contents: Networking of production organisations between and inside companies. Business process view and modelling of business processes. Control and information systems supporting networked production. Integration of systems: production management and control systems, product design and product data management systems, manufacturing execution systems, etc. Communication buses and networks and software technologies needed in integration. Specification of the information technological infrastructure and design of its implementation. Assignment work.

Literature: Lecture notes.

Prerequisites: Recommendation: AS-116.100/1100 Manufacturing automation.

Additional information: Replaces the course AS-116.111.

Language: Finnish

AS-116.3130 Project Work Exercises on Information Technology Applications in Automation (2-9 cr) V

Autumn + spring I-II, III-IV

Teacher: Jukka Peltola, Lic.Sc. (Tech.)

Contents: Small-scale research, realization projects or clearing up some matter concerning laboratory fields of interest. The goal is to learn through practical work done. The project can be done individually or in groups of two according to the time schedule made.

Requirements: Pre-reports, final report and project presentation. Prerequisites: Basic knowledge of automation and control engineering. Basic knowledge of computer sciences.

Additional information: Replaces the course AS-116.130.

Language: Finnish, English on demand. Individual study in English possible.

AS-116.3150 Seminar on Information Technology in Automation (3 cr) V

Autumn I-II

Teacher: Prof Kari Koskinen

Contents: New technological trends and issues in information technology applied to automation. Students prepare reports and give seminar presentations on selected topics, which can be method or application oriented. A presented topic is analysed through active discussion.

Requirements: Preparation and presentation of the seminar work and active participation in seminar sessions.

Additional information: Replaces the course AS-116.150.

Language: Finnish. Study in English possible.

AS-116.3160 Discrete Event Simulation (3 cr) P

Autumn I-II

Lecturer: Pekka Korpiharju, Lic.Sc. (Tech.)

Contents: Use of discrete event simulation and operation principles. Simulation of production systems, logistics chains and service systems. Steps of simulation project. Data acquisition and modelling. Modelling, generating and using random numbers. Verification and validation. Analysis of simulation results. Simulation programs. Virtual prototyping. Future of simulation techniques. Course work.

Literature: Handouts

Prerequisites: Basic knowledge of statistics.

Additional information: Replaces the course AS-116.160.

Language: Finnish. Course material available in English. Individual study in English possible.

AS-116.3170 Software Components in Automation (3 cr) P

Spring IV

Teacher: Seppo Kuikka, D.Sc. (Tech.)

Contents: The objective of the course is to familiarise students with deployment and development of software components. Several of the latest automation and information systems are based on software component technologies. The themes of the course include: software components and component models. Deployment of software components within applications. Development of components. Component architectures of new automation systems. How to integrate a component off the shelf within an automation application. The domain-specific component standards in automation. Software component business issues. Assignment: Development of a small component based application or a literature survey on a specific component technology area.

Literature: Handouts

Prerequisites: Basic knowledge of object oriented programming and C++.

Additional information: Replaces the course AS-116.170.

Language: Finnish

AS-116.3180 Dependability of programmable control systems (3 cr) P

Autumn I

Teacher: Hannu Harju, Lic.Sc. (Tech.)

Contents: Software dependability is very important for the functional behaviour of control systems. Dependability is a property of a system that justifies placing one's reliance on it. Therefore, a basic understanding of the nature of dependable software is important for all working with control software. The course introduces basic reliability theory, and covers most essential techniques for designing and assessing dependability of software based control systems.

Literature: Handouts

Prerequisites: basic knowledge of automation systems and program systems.

Additional information: Replaces the course AS-116.180.

Language: Finnish.

AS-116.3190 Information Technology for Extended Products (4 cr) P

Spring III-IV

Teacher: Prof Kari Koskinen

Contents: Extended product comprises the physical product itself and the related support services for the end user during the whole life cycle of the product. The following topics are discussed: The concept of the extended product, integration of products and services. The development and management of an extended product viewed as a business process of an enterprise. The information and systems technologies needed for the realisation of an extended product: Internet technologies, information security technologies, remote operations support systems, intelligent fault diagnosis, methodologies for product description and documentation. Industrial case-examples. Assignment work.

Literature: Handouts.

Prerequisites: Recommendation: AS-116.100/1100 AS-116.111/3110.

Additional information: Replaces the course AS-116.190.

Language: Finnish.

AS-116.3200 Modelling of Real-time Systems with Object Oriented Modelling Language (3 cr) P

Spring III

Teacher: Pekka Aarnio, Lic.Sc (Tech.)

Contents: Modeling real-time software and embedded systems in automation domain using object oriented UML-notation (Unified Modeling Language). Real-time extensions and profiles of UML (e.g. real-time profile, RT-Corba profile). Design Patterns and their applications in architecture and detailed design of real-time systems. Automatic executable code generation from UML-model.

Literature: Lecture notes

Requirements: Examination and exercises.

Prerequisites: UML basics, AS-116.120/2120.

Additional information: Replaces the course AS-116.200.

Language: Finnish. Course material available in English. Individual study in English possible.

AS-116.4140 Postgraduate Seminar on Information Technology in Automation (4-8 cr) V P

Autumn + spring I-II, III-IV

Teacher: Prof Kari Koskinen

Contents: Different kinds of technological and methodological subjects of current interest will be studied. Topics vary yearly.

Requirements: Students prepare reports and give seminar presentations about selected topics. Active participation in the seminar lectures and working as an opponent is necessary. Assignment work, making and solving exercises.

Literature: will be announced later.

Additional information: Replaces the course AS-116.140.

Language: Finnish, English on demand.

DEPARTMENT OF CHEMICAL TECHNOLOGY

Head of the Department: Professor Matti Leisola, tel. 451 2546
 Administrative Manager: Marjukka Petänen, tel. 451 2912
 Planning Officer (Study Affairs): Eija Zitting, tel. 451 2607, fax: 451 2742
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Chairs:

Kem-4 Organic Chemistry
 Kem-30 Biochemistry and Microbiology
 Kem-31 Physical Chemistry
 Kem-35 Inorganic and Analytical Chemistry
 Kem-40 Industrial Chemistry
 Kem-42 Chemical Engineering
 Kem-70 Bioprocess Engineering
 Kem-90 Process Control
 Kem-100 Polymer Technology
 Kem-107 Plant Design
 (P) after the name of the course indicates postgraduate level.

Please pay attention to the language of the instruction

Kem-4 ORGANIC CHEMISTRY

Courses credited in ECTS

Prof. Ari Koskinen, tel. 451 2538
 Prof. Reija Jokela, tel. 451 2538

KE-4.1100 Organic chemistry I (4 cr)

Autumn
 Lecturer: Petri Pihko, teaching researcher
 Contents: Presentation of organic structures and reactions, and introduction to the analysis of organic structures. Course deals in basics of organic chemistry: molecular orbital theory, structure and reactivity, physical chemistry and reaction mechanisms.
 Literature: Clayden, Greeves, Warren, Wothers: Organic Chemistry, Oxford University Press, Oxford, 2001
 Language: Finnish

KE-4.2100 Organic Chemistry II (3 cr)

Autumn (Period II)
 Lecturer: Prof Reija Jokela
 Contents: Presentation of organic structures and reactions, and introduction to the analysis of organic structures. Course deals in basics of organic chemistry: molecular orbital theory, structure and reactivity, physical chemistry and reaction mechanisms.
 Literature: Clayden, Greeves, Warren, Wothers: Organic Chemistry, Oxford University Press, Oxford, 2001
 Language: Finnish

KE-4.2110 Organic chemistry, laboratory course I (3 cr)

Autumn
 Lecturer: Petri Pihko, teaching researcher
 Contents: The aim of the course is to introduce modern laboratory practices in organic chemistry. Topics: analytical methods on organic chemistry, planning of synthetic operations.
 Requirements: Laboratory work and written report.

Literature: Compendium. Also recommended: Leonard, Lygo & Procter (1998): Advanced Practical Organic Chemistry, 2nd ed., Stanley Thomas Publishers Ltd.
 Prerequisites: KE-4.1100

KE-4.2500 Organic Chemistry III (4 cr)

Spring (period IV)
 Lecturer: Prof Reija Jokela
 Contents: Enolate and alkene chemistry, radical reactions; the chemistry of life: mechanisms in biological chemistry, natural products and polymerization.
 Examination: Seminar and a take-home exam with a target molecule given by the lecturer.
 Literature: Clayden, Greeves, Warren, Wothers: Organic Chemistry, Oxford University Press, Oxford, 2001
 Prerequisites: KE-4.2100.
 Language: Finnish

KE-4.2510 Organic Chemistry, laboratory course 2 (3 cr)

Spring (Period IV)
 Instructors: Petri Pihko, teaching researcher
 Contents: The aim of the course is to introduce modern laboratory practices in organic chemistry. Topics: analytical methods on organic chemistry, planning of synthetic operations.
 Requirements: Laboratory work and written report.
 Literature: Compendium. Also recommended: Leonard, Lygo & Procter (1998): Advanced Practical Organic Chemistry, 2nd ed., Stanley Thomas Publishers Ltd.
 Prerequisites: KE-4.2110
 Language: Finnish

KE-4.3100 Organic Chemistry IV (5 cr)

Autumn (period I), lectured for the first time academic year 2007-2008
 Instructors: Prof Ari Koskinen

Courses credited in ocr

Kem-4.251 Organic Instrumental Analysis (4.5 ocr)
 Spring, lectured for the last time academic year 2006-2007
 Lecturer: Jari Koivisto, teaching researcher

Contents: Identification of organic compounds by UV-, IR-, ¹H-NMR-, ¹³C-NMR- and mass spectrometric methods.

Examination: Approved home exercises, final exam

Literature: Compendium, L.M. Harwood, T.D.W. Claridge: Introduction to Organic Spectroscopy, Oxford University Press, Oxford 2004.

Prerequisites: Kem-4.202. Especially students with organic chemistry as major subject are recommended to do this course before Kem-4.300.

Language: Finnish

Kem-4.300 Organic Chemistry II (4.5 ocr)

Autumn, lectured for the last time academic year 2006-2007

Lecturer: Prof Reija Jokela

Contents: Conformational analysis, enolate chemistry, chemo- and diastereoselectivity, pericyclic reactions, rearrangement reactions, heterocyclic compounds.

Literature: Clayden, Greeves, Warren, Wothers: Organic Chemistry, Oxford University Press, Oxford (2001). Recommended also: Carey & Sundberg (2001): Advanced Organic Chemistry, Part A: Structure and Mechanisms, 4th ed. Kluwer Academic/Plenum Publishers, Amsterdam.

Prerequisites: Kem-4.202, Kem-4.252

Language: Finnish

Kem-4.302 Organic Chemistry, laboratory course 2 (4 ocr)

Spring (period IV), lectured for the last time academic year 2006-2007

Instructors: Petri Pihko, teaching researcher

Contents: The aim of the course is to introduce modern laboratory practices in organic chemistry. Topics: analytical methods on organic chemistry, planning of synthetic operations. Requirements: Laboratory work and written report.

Literature: Compendium. Also recommended: Leonard, Lygo & Procter (1998): Advanced Practical Organic Chemistry, 2nd ed., Stanley Thomas Publishers Ltd.

Prerequisites: Kem-4.202

Language: Finnish

Kem-4.350 Modern Synthetic Organic Chemistry (5 ocr)

Spring

Lecturer: Prof Ari Koskinen

Contents: Synthesis design and types of strategies. Transition state theory. Alkene synthesis. Introduction to organometallic reactions. Oxidation and reduction, protecting group strategies. Diastereoselectivity. Pericyclic reactions. Stereoelectronic control. Radical chemistry. Combinatorial chemistry.

Literature: Lecture notes and Nicolaou, K.C., Sorensen, E.J.: Classics in Total Synthesis, VCH, Weinheim, 1996 (in part).

Prerequisites: Kem-4.300. The course is recommended to be done simultaneously with Kem-4.251.

Language: Finnish

Kem-4.400 Physical Organic Chemistry (2 ocr)

Autumn

Lecturer: Petri Pihko, teaching researcher

Contents: The aim of the course is to deepen the student's understanding of the basis of organic reactivity. Determination of reaction mechanisms, isotope effects, substituent effects. Acid-base catalysis. Solvent effects. The topics will be covered mainly through real-life synthesis examples. The course is a good base for courses Kem-4.450 and Kem-4.406.

Requirements: Problem based seminars and an examination.

Literature: Compendium and Carey & Sundberg, 2001. Advanced Organic Chemistry, Part A: Structure and Mechanisms, 4th ed., Kluwer Academic/Plenum Publishers, Amsterdam (in part).

Prerequisites: Kem-4.300

Language: Finnish

Kem-4.401 Research Project in Organic Chemistry (5 ocr)

Autumn/spring

Lecturer: Prof Ari Koskinen

Requirements: Report of the project.

Prerequisites: Kem-4.350 and Kem-4.351

Language: Finnish

Kem-4.402 Research Seminar in Organic Chemistry I (2 ocr)

Autumn & spring

Lecturer: Prof Ari Koskinen

Contents: Active participation in a series of seminars in organic chemistry. All students have their own seminar presentation.

Prerequisites: Kem-4.350. The course is done together with Kem-4.401.

Language: Finnish

Kem-4.405 Medicinal Chemistry (2 ocr)

Autumn (period), even years

Lecturer: Prof Tomi Järvinen

Literature: Compendium

Prerequisites: Kem-4.300

Language: Finnish

Kem-4.450 Asymmetric Synthesis (2 ocr)

Spring, odd years (web course)

Lecturer: Prof Ari Koskinen

Contents: Introduction to asymmetric synthesis. Asymmetric induction. Reactions of the carbonyl group.

Literature: Lecture notes and Koskinen, A.: Asymmetric Synthesis of Natural Products, John Wiley & Sons, Chichester, 1993

Prerequisites: Kem-4.350

Language: Finnish

Kem-4.450 Industrial Organic Fine Chemistry (2 ocr)

Spring (period IV)

Lecturer: D. Sc. (Tech.) Elias Suokas

Contents: Course deals with the industrial chemical process development of organic fine chemicals. The approach is the viewpoint of product development chemist. The course illustrates the phenomena occurring when a laboratory method have to develop suitable to an industrial production, limitations for the process, how to compare different process alternatives, how to fit a process to an existing plant, and the plant and business environment. The course contains lectures, examples, exercises, and seminar work (= examination).

Prerequisites: Good knowledge on organic chemistry and experience in laboratory syntheses.

Language: Finnish

Kem-4.601 Research Seminar in Organic Chemistry II (2 ocr)

P

Autumn & spring

Lecturer: Prof Ari Koskinen

Contents: Active participation in a series of seminars in organic chemistry. All students have their own seminar presentation.

Language: Finnish

Kem-30 BIOCHEMISTRY AND MICROBIOLOGY

Courses credited in ECTS

Prof. Simo Laakso, tel. 451 2550

Prof. Katrina Nordström, tel. 451 2549

KE-30.1600 Microbiology I (2 cr)

Spring (Period IV)

Lecturer: Prof Katrina Nordström

Contents: Microbial cells (bacteria, microfungi, viruses), structure and function. Applications of micro-organisms in the process, food and pharmaceutical industries and aspects of environmental applications.

Literature: Course material package and additional literature to be announced.

Language: Finnish

KE-30.2100 Biochemistry I (4 cr)

Autumn (Period I)

Lecturer: Prof Simo Laakso, special lecturers

Contents: Structure and function of proteins, nucleic acids, carbohydrates and lipids. Role of biomolecules in living materials. Examples of biotechnological applications of biopolymers. Enzyme catalysis, principles of enzyme kinetics and analytical methods for enzymatic reactions. Bioenergetics and the living cell.

Literature: Course material package and additional literature to be announced.

Prerequisites: KE-4.1100

Language: Finnish

KE-30.2110 Microbiology II (5 cr)

Autumn (Period II)

Lecturer: Prof Katrina Nordström

Contents: Taxonomy, growth and culture of microorganisms. Influence of environment/process parameters on microbial physiology and adaptation. Microbial genetics and regulation of gene expression, molecular basis of pathogenesis. Control of microbial ecology in the process industry.

Literature: Course material package and Madigan et al., Brock Biology of Microorganisms, 11th ed., 2006

Prerequisites: KE-30.1600

Language: Finnish

KE-30.2500 Biochemistry II (5 cr)

Spring (Period III)

Lecturer: Prof Simo Laakso

Contents: Isolation and purification methods for proteins and nucleic acids. The genetic code, gene expression and protein synthesis. Structure, function and biosynthesis of antibodies. Metabolism of carbohydrates, nitrogen compounds and lipids in the cell and the biochemistry of the most critical metabolic routes and reactions. Regulation of metabolism at the molecular and genetic level for applications in biotechnology.

Literature: Course material package and additional literature to be announced.

Prerequisites: KE-30.2100

Language: Finnish

KE-30.2510 Biochemistry and Microbiology, Laboratory Course (5 cr)

Spring (Period IV)

Lecturer: Senior assistant Marjatta Vahvaselkä

Contents: A practical demonstration of the influence of processing on the structure-function of biological materials and control of such changes. An introduction into use of practical level analytical methodology in the handling of biological materials. The emphasis is on the most important materials and processes within the food industry as well as on microbial methodology and applications thereof. The number of participants may be limited.

Requirements: Laboratory demonstrations/practical work, written reports, lectures, home exercises, exam.

Literature: To be announced.

Prerequisites: KE-30. 2100, KE-30.2500

Language: Finnish

KE-30.3100 Microbiology III (3 cr)

Autumn (Period I), lectured first time academic year 2007-2008

Lecturer: Senior assistant Marjatta Vahvaselkä

Contents: Spoilage and producer organisms in the food industry. Physical, chemical and biological control methods of food preservation. Process and product hygiene, HACCP analysis, and hygiene and production safety management systems within the food industry. Hygienic design of food production equipment and processes.

Literature: Course material package and additional literature to be announced.

Prerequisites: KE-30.2110

Language: Finnish

KE-30.3110 Biochemistry III (3 cr)

Autumn (Period II), lectured for the first time academic year 2007-2008

Lecturer: Prof Simo Laakso

Contents: Biochemistry of nutrition and the role of functional components in metabolism. Structure of food materials at the molecular-, nano- and macro level. Application of enzymes and cells in food processing. Functionality of foods, nutritional compounds and ingredients. An introduction to food product development combined with a project work.

Literature: Course material package and additional literature to be announced.

Prerequisites: KE-30.2500

Language: Finnish

KE-30.4100 Industrial Microbiology (4 cr)

Autumn (Period I), even years, first time academic year 2008-2009

Lecturer: Prof Katrina Nordström

Contents: Production chain microbial ecology from raw materials to waste. Sources and control of contamination in e.g. the chemical, forest, bio- and pharmaceutical industries. Regulatory issues relevant to production, GMP, GLP, biological quality and safety and monitoring of production with respect to genetic modification. Project work and seminars.

Literature: Course material and literature to be announced.

Prerequisites: KE-30.3100

Language: Finnish

KE-30.4110 Microbiological Production Processes (3 cr)

Autumn (Period I), odd years, first time academic year 2007-2008

Lecturer: Prof Katrina Nordström

Contents: Special course in advanced microbiology with focus on different aspects of human-microbe interactions, immunology and microbial risk management of emerging health- and wellness technologies. Diagnostic methods based on serology and molecular biology, microbial resistance and epidemiology.

Literature: Course material and literature to be announced.

Prerequisites: KE-30.3100

Language: Finnish

KE-30.4120 Food Materials (6 cr)

Autum, first time academic year 2008-2009

Lecturer: Research fellow D.Sc. (Tech.) Pekka Lehtinen, Prof Simo Laakso

Contents: The course deals with applying the special characteristics of living material for the development of new food products. Also covered are chemical and physical changes in food materials during processing and their effects on quality, nutritional value, safety and shelf life of food. New methods for food quality analysis are covered.

Requirements: Lectures and exam.

Literature: Berlitz and Grosch: Food Chemistry, Springer, and Mazza, G.: Functional Foods, Technomic and course material.

Prerequisites: KE-30.3110

Language: Finnish

KE-30.4130 Food Production Technologies (4 cr)

Autum (Period II), first time academic year 2008-2009

Lecturer: D.Sc. (Tech.) Ilkka Virkajärvi

Contents: The course covers practical examples on how unit operations can be integrated into cost effective production chains. Use of modern biotechnological, microbiological and technological solutions for the development and production of nutritionally beneficial and safe foods. An introduction to tools for the evaluation of feasibility, control of environmental factors and the utilization of side streams.

Requirements: Lectures and exam.

Literature: Fellows: Food processing technology, Woodhead and course material

Prerequisites: KE-30.3100, KE-30.3110

Language: Finnish

KE-30.4500 Fermentation Processes (3 cr)

Spring (Period IV), lectured odd years, first time academic year 2008-2009

Lecturer: Prof Simo Laakso

Contents: Theory and bioenergetics of fermentation processes. Main fermentation types, calculation of balance of fermentation substrates and products and yield of biomass. Application of fermentation processes to novel and emerging technologies.

Literature: To be announced.

Prerequisites: KE-30.3100, KE-30.3110

Language: Finnish

KE-30.4510 Process Biochemistry (4 cr)

Spring (Period IV), even years, first time academic year 2007-2008

Lecturer: Prof Simo Laakso

Contents: Biochemical and physical reactions and surface and colloid phenomena of selected biopolymers. Case-examples of application of multidisciplinary approaches to development of new materials, biotechnological processes and unit operations thereof. At the end of the course, students will form an innovation team, where the information gained during the course will be applied to practicing of problem solving.

Literature: To be announced.

Prerequisites: KE-30.3110

Language: Finnish

KE-30.4520 Food Product Development (4 cr)

Spring (Period III), first time academic year 2008-2009

Lecturer: Research fellow D.Sc. (Tech.) Pekka Lehtinen, Prof Katrina Nordström, senior assistant Marjatta Vahvaselkä

Contents: The emphasis of the course is on requirements for food product safety, nutritional factors and consumer aspects of product development. Aspects and importance of quality control systems, management safety systems and risk analysis for product safety. Legislation and regulatory requirements for new foods with health benefits and of foods produced by using novel technologies are discussed with reference to bringing products onto markets.

Requirements: Lectures and exam.

Literature: Course material and literature to be announced.

Prerequisites: KE-30.3100, KE-30.3110

Language: Finnish

KE-30.5000 Practical Course in Food Development (6 cr)

Autum/Spring, first time academic year 2008-2009

Lecturer: Research fellow D.Sc. (Tech.) Pekka Lehtinen, D.Sc (Tech.) Ilkka Virkajärvi

Contents: An advanced planning and research project with emphasis on problem-solving within food product development.

Requirements: Compact project is carried out during one period.

Prerequisites: KE-30.4120, KE-30.4130, KE-30.4520

Language: Finnish

KE-30.5100 Practical Course in Biochemistry and Microbiology (6 cr)

Autum, first time academic year 2008-2009

Lecturer: Senior assistant Marjatta Vahvaselkä

Contents: A broad research project in applied biochemistry and microbiology.

Requirements: Problem based research project, project reports and seminar. The course is a prerequisite for the master's thesis in biochemistry and microbiology.

Prerequisites: KE-30.2510, KE-70.3200

Language: Finnish

Courses credited in ocr**Kem-30.300 Technical Biochemistry and Food Technology, Laboratory Course I (4 ocr)**

Autum, last time academic year 2006-2007

Instructors: Senior assistant Marjatta Vahvaselkä (Kem-30) and assistants

Contents: Introductory microbiology and food hygiene, aseptic technique, sterilization and microscopy.

Requirements: Participation in laboratory practical work and written examination.

Attending must be confirmed by May 15 via webTopi the spring prior to the commencing autumn Laboratory course I.

Prerequisites: Kem-4.252, KE-30.1600, Kem-30.104 (recommended)

Language: Finnish

Kem-30.315 Process Biochemistry (4.5 ocr)

Spring (Period IV), last time academic year 2006-2007

Lecturer: Prof Simo Laakso

Contents: Dynamics of biological materials in industrial production processes. Selected application oriented individual or teamwork is included.

Literature: Course material and Berg, M., Tymoczko, J. L., Stryer, L. Biochemistry (2002), 5th ed.

Prerequisites: Kem-30.300 and for students of the Technical Biochemistry Option also Kem-70.410. Other students must negotiate with the lecturer as to the most suitable time for taking the course (recommended for 4th-5th year students).

Language: Finnish

Kem-30.320 Practical Course in Biochemistry (4.5 ocr)

Spring & autumn, in study groups according to agreement, last time academic year 2007-2008

Instructors: Prof Simo Laakso and senior assistant

Contents: A broad research project on selected topics. Written report and seminar required.

Requirements: The coursework is performed as a project work or by participation in research. The course is a prerequisite for the M.Sc. (Tech) thesis. Course requirements for students with applied biochemistry as minor studies will be separately agreed on. Attendance at the spring course must be confirmed by November 30 via webTopi.

Prerequisites: Kem-30.300, for students of the Technical Biochemistry Option also Kem-70.410

Language: Finnish

Kem-30.331 Microbiological Production Methods (4.5 ocr)

Spring (III), last time academic year 2006-2007

Lecturer: Prof Katrina Nordström

Contents: Use of micro-organisms in the biotechnology industry. Products, production GMP (Good Manufacturing Practice), GLP (Good Laboratory Practice), GCP (Good Clinical Practice). Microbial ecology in production processes and as sources of contamination from pilot- to production scale processing.

Literature: Course material and other literature to be announced.

Prerequisites: Kem-30.300, Kem-30.325 and for students of the Technical Biochemistry Option Kem-70.410 and Kem-30.351.
Language: Finnish

Kem-30.335 Practical Course in Microbiology (4.5 ocr)

Spring & autumn, in study groups according to agreement, last time academic year 2007-2008

Instructors: Prof Katrina Nordström and senior assistant

Contents: A broad research project on microbial physiology with reference to food- or biotechnology. Written report and project meetings required.

Requirements: The coursework is performed as a project work or by participation in research. The course is a prerequisite for the M.Sc. (Tech) thesis. Course requirements for students with applied biochemistry as minor studies will be separately agreed on. Attendance at the spring course must be confirmed by November 30.

Prerequisites: Kem-30.325, Kem-30.300 and for students of the Technical Biochemistry Option Kem-70.410.

Language: Finnish

Kem-30.341 Fermentation Processes (3 ocr)

Spring (period IV), odd years, last time academic year 2006-2007

Lecturer: Prof Simo Laakso

Contents: Theory and bioenergetics of fermentation processes. Main fermentation types, calculation of balance of fermentation substrates and products and yield of biomass.

Literature: Laakso, S. Fermentation Processes, Applied Biochemistry and Microbiology Report, 4/97.

Prerequisites: Kem-30.104.

Language: Finnish

Kem-30.351 Microbial Genetics (3 ocr)

Autumn, lectured for the last time academic year 2006-2007

Lecturer: Prof Katrina Nordström

Contents: Gene technology, methods and r-DNA. Examples of development of biopharmaceuticals, food raw materials and plant biotechnology. Seminar or research report.

Literature: Course material, compendium and literature to be announced.

Prerequisites: Kem-30.104; Kem-30.325.

Language: Finnish

Kem-30.400 Special Course in Biochemistry and Microbiology (1 - 2 ocr) P

To be announced

Lecturer: Prof Simo Laakso, prof Katrina Nordström, special lecturers

Contents: A postgraduate course on selected topics.

Prerequisites: M.Sc (Tech.) degree

Language: Finnish

Kem-30.404 Postgraduate Course on Technical Biochemistry (4 ocr) P

To be announced

Lecturers: Prof Simo Laakso and Prof Katrina Nordström

Contents: As Kem-30.405 but including a seminar presentation.

Prerequisites: M.Sc. (Tech) degree

Language: Finnish

Kem-30.405 Biobusiness (2 ocr) P

To be announced

Lecturers: Prof Simo Laakso and Prof Katrina Nordström

Contents: Supervised project directed at problem-based learning of selected applications. Written report included. The topic is selected from current issues. Written project report included.

Prerequisites: M.Sc. (Tech) degree

Language: Finnish

Kem-30.407 Postgraduate Course on Technical Biochemistry (7 ocr) P

To be announced

Lecturers: Prof Simo Laakso and Prof Katrina Nordström

Contents: As Kem-30.404 including a written examination based on literature selected according to the topic of the course.

Prerequisites: M.Sc. (Tech) degree

Language: Finnish

Kem-31 PHYSICAL CHEMISTRY

Courses credited in ECTS

Prof: Kyösti Kontturi, tel. 451 2570

KE-31.1800 Physical Chemistry I (3 cr)

Spring (Period IV)

Lecturer: Gunilla Fabricius, lecturer

Contents: Basic principles of thermodynamics: the equations of state of gases, the principal laws of thermodynamics, phase equilibria in one-component systems, phase equilibria in ideal and real solutions, chemical equilibrium.

Requirements: A written exam with problem solving and theoretical questions combined.

Literature: Engel, Reid, Thermodynamics, Statistical Thermodynamics & Kinetics, Pearson Education, Benjamin Cummings, San Francisco 2005 or Engel, Reid, Physical Chemistry, Pearson Education, Benjamin Cummings, San Francisco 2005. Fabricius, Liukkonen, Sundholm, Fysikaalisen kemian taulukoita, Otatiето 548, 1999

Prerequisites: Recommended: Mat-1.1410, Mat-1.1420, Tfy-3.1241, Tfy-3.1242

Language: Finnish

KE-31.2100 Physical Chemistry II (3 cr)

Autumn (Period I)

Lecturer: Gunilla Fabricius, lecturer

Contents: Electrochemical cells. Transport processes (conductivity, diffusion). Chemical kinetics and reaction mechanisms.

Requirements: A written exam with problem solving and theoretical questions combined.

Literature: Engel, Reid, Thermodynamics, Statistical Thermodynamics & Kinetics, Pearson Education, Benjamin Cummings, San Francisco 2005 or Engel, Reid, Physical Chemistry, Pearson Education, Benjamin Cummings, San Francisco 2005. Fabricius, Liukkonen, Sundholm, Fysikaalisen kemian taulukoita, Otatiето 548, 1999

Prerequisites: Recommended: Mat-1.1410, Mat-1.1420, Tfy-3.1241, Tfy-3.1242, KE-31.1800

Language: Finnish

KE-31.2110 Physical Chemistry Laboratory I (3 cr)

Autumn

Lecturer: Gunilla Fabricius, lecturer

Contents: Lab experiments to illustrate physico-chemical principles and experimental methods and to develop skills in report writing and in data analysis. The experiments are related to the topics of courses KE-31.1800 and KE-31.2100.

Requirements: 6 laboratory experiments (5 h each) including reports, a written exam.

Literature: Laboratory instructions

Prerequisites: KE-31.1800, KE-35.1210, KE-35.1700

Language: Finnish

KE-31.2120 Physical Chemistry III (3 cr)

Autumn (Period II)

Lecturer: Lasse Murtomäki, teaching researcher

Contents: Kinetic theory of gases. Basic statistical thermodynamics. Basic surface chemistry. Activated complex theory.

Requirements: A written exam with problem solving and theoretical questions combined.

Literature: Engel, Reid, Thermodynamics, Statistical Thermodynamics & Kinetics, Pearson Education, Benjamin Cummings, San Francisco 2005 or Engel, Reid, Physical Chemistry, Pearson Education, Benjamin Cummings, San Francisco 2005. Fabricius, Liukkonen, Sundholm, Fysikaalisen kemian taulukoita, Otatiето 548, 1999

Prerequisites: KE-31.1800, KE-31.2100

Language: Finnish

KE-31.2500 Physical Chemistry Laboratory II (2 cr)

Spring (Period III)

Lecturer: Gunilla Fabricius, lecturer

Contents: Lab experiments in surface chemistry. The experiments are related to the topics of the course KE-31.2120

Requirements: 4 laboratory experiments (5 h each) including reports.

Literature: Laboratory instructions

Prerequisites: KE-31.2110, KE-31.2120

Language: Finnish

KE-31.3100 Physical Chemistry IV (3 cr)

Autumn (Period I)

Lecturer: Lasse Murtomäki, teaching researcher

Contents: Basic quantum chemistry and spectroscopy.

Requirements: A written exam with problem solving and theoretical questions combined.

Literature: Engel, Reid, Thermodynamics, Statistical Thermodynamics & Kinetics, Pearson Education, Benjamin Cummings, San Francisco 2005 or Engel, Reid, Physical Chemistry, Pearson Education, Benjamin Cummings, San Francisco 2005. Fabricius, Liukkonen, Sundholm, Fysikaalisen kemian taulukoita, Otatiето 548, 1999

Prerequisites: Recommended: Mat-1.1410, Mat-1.1420, Tfy-3.1241, Tfy-3.1242, Tfy-3.1253

Language: Finnish

KE-31.3110 The Computational Methods of Physical Chemistry (2 cr)

Autumn (Period II)

Lecturer: N.N.

Contents: The course deals with computational solutions for different physicochemical systems, for example Monte Carlo simulation and molecule dynamics.

Requirements: Written exam and exercises

Literature: Material is distributed during the lectures.

Prerequisites: KE-31.3100

Language: Finnish

KE-31.3120 Special Project in Physical Chemistry (5 cr)

Autumn (Period II), will be lectured for the first time during the academic year 2007-2008

Lecturer: Prof Kyösti Kontturi

Contents: A theoretical and/or experimental work in physical chemistry.

Requirements: Written report and oral presentation

Literature: As agreed

Prerequisites: KE-31.1800, KE-31.2100, KE-31.2110, KE-31.2120, KE-31.2500, KE-31.3100

Language: Finnish

KE-31.4100 Basic Electrochemistry (3 cr)

Autumn (Period II), will be lectured for the first time during the academic year 2007-2008

Lecturer: Prof Kyösti Kontturi

Contents: Thermodynamics of electrolyte solutions. The aim of the course is to introduce the utilization of electrochemistry in industrial applications and research, for instance, processing of metals, fuel cells and biomembranes.

Requirements: Homework problems and/or seminar, written or oral examination.

Literature: As agreed

Prerequisites: KE-31.1800, KE-31.2100, KE-31.2120, KE-31.3100

Language: Finnish/English as agreed

KE-31.4110 Electrochemical Kinetics (3 cr)

Autumn (Period II), will be lectured for the first time during the academic year 2007-2008

Lecturer: Prof Kyösti Kontturi

Contents: The course deals with kinetics of electrochemical reactions, electric double layer and modern experimental methods as well as the electrochemistry of liquid-liquid interfaces and of membranes.

Requirements: Homework problems and/or seminar, written or oral examination.

Literature: As agreed

Prerequisites: KE-31.4100

Language: Finnish/English as agreed

KE-31.4500 Electrochemistry Laboratory (3 cr)

Spring (Period III), will be lectured for the first time during the academic year 2008-2009

Lecturer: Prof Kyösti Kontturi

Contents: 1-2 larger research type laboratory practicals.

Requirements: Written report

Literature: As agreed

Prerequisites: KE-31.4100, KE-31.4110

Language: Finnish/English as agreed

KE-31.4510 Transport Processes at Electrodes and Membranes (4 cr)

Spring (Period III), even years

Lecturer: Prof Kyösti Kontturi

Contents: The nature of transport, the theoretical basis of transport equations, transport to electrodes, transport in different types of membranes (ion exchange, neutral and liquid membranes), concentration polarisation.

Requirements: Weekly homework problems, oral examination

Literature: Compendium

Prerequisites: KE-31.1800, KE-31.2100, KE-31.2120, KE-31.3100, KE-31.4100, KE-31.4110

Language: Finnish/English as agreed

KE-31.4520 Impedance Spectroscopy (2 cr)

Spring (Period III), odd years

Lecturer: Lasse Murtomäki, teaching researcher

Contents: The theory and practice of alternating current signal analysis. The course includes a laboratory experiment.

Prerequisites: KE-31.4100, KE-31.4110

Language: Finnish/English as agreed

KE-31.4530 Special Topics in Electrochemistry (3 op) P

Spring (period IV)

Lecturer: prof. Kyösti Kontturi

Contents: According to need, in spring 2004 the topic was scanning electrochemical microscopy (SECM).

Requirements: Oral examination together with home work.

Literature: As agreed.

Prerequisites: KE-31.4100, KE-31.4110

KE-31.5100 Polyelectrolytes (2 cr)

Autumn (Period I), odd years

Lecturer: Anna-Kaisa Kontturi, Docent

Contents: Physical-chemical characterization of synthetic and bioelectrolytes, effective charge number, conformation, transport properties, electrokinetic properties, polyelectrolyte theories.

Requirements: Written examination and seminar presentation

Literature: Material is distributed during the lectures

Prerequisites: KE-31.1800, KE-31.2100, KE-31.2120, KE-31.3100

Language: Finnish

KE-31.5110 Dynamics of the Chemical State (2 cr)

Autumn (period II), odd years

Lecturer: Pertti Koukkari, Docent

Contents: Modelling of chemical-thermodynamic multiphase systems using advanced models based on state variables; the computing software are FACTSage and Chemsheet.

Prerequisites: KE-31.1800, KE-31.2100, KE-31.2120, KE-31.3100.

KE-31.5500 Theoretical Chemistry and Molecular Modelling (3 cr)

Spring (Period III), even years

Lecturer: Tapani Pakkanen, Docent

Contents: Basic quantum chemistry, molecular mechanics, molecular orbital theory, molecular modelling and applications. Demonstrations.

Requirements: Written examination

Literature: Material handed out at the lectures, literature references

Prerequisites: KE-31.3100

Language: Finnish/English as agreed

Courses credited in ocr

Kem-31.109 Physical Chemistry Laboratory (P, MT, for students of the degree programme of Forest Products Technology and Materials Science and Rock Engineering) (3.5 ocr)

Autumn & spring, lectured for the last time academic year 2006-2007

Instructors: Gunilla Fabricius, lecturer and Prof Kyösti Kontturi
Contents: Practical training in physical chemistry laboratory technique. The exercises are related to the topics of courses Kem-31.102 and Kem-31.105.

Requirements: 9 laboratory exercises (6 h each) including reports, followed by an examination. Grading: pass/fail

Literature: Laboratory instructions

Prerequisites: Kem-35.106 or Kem-35.211

Language: Finnish

Kem-31.151 Postgraduate Seminar on Physical Chemistry (1-8 ocr) P V

Autumn

Instructors: Prof Kyösti Kontturi

Contents: Seminars deal with special topics of physical chemistry concerning the degree requirements of post-graduate students. The research methods of physical chemistry are also introduced by guest lecturers. Seminar presentations and homework.

Literature: As agreed

Prerequisites: Kem-31.122/Kem-31.124 and/or Kem-31.142

Language: Finnish/English as agreed

Kem-31.154 Research Seminar in Physical Chemistry (0-3 ocr) P V

Autumn / spring as agreed

Instructors: Prof Kyösti Kontturi

Contents: Seminars concerning topics of current interest in electrochemistry, membrane electrochemistry or thermodynamics. In particular, these seminars focus on topics related to the ongoing research themes in our laboratory as well as other universities and industry. Recommended in particular for graduate students and final year undergraduates.

Requirements: Seminar presentation.

Literature: As agreed.

Prerequisites: Kem-31.122/Kem-31.124 and/or Kem-31.142 (compulsory)

Language: Finnish/English as agreed

Kem-35 INORGANIC AND ANALYTICAL CHEMISTRY

Courses credited in ECTS

Prof (Inorganic Chemistry): Maarit Karppinen, tel. 451 2602

Prof (Inorganic Chemistry): Lauri Niinistö, tel. 451 2600

Prof (Analytical Chemistry): Sakari Kulmala, tel. 451 2601

KE-35.1200 Inorganic Chemistry I (4 cr)

Autumn

Lecturer: Tuula Leskelä, lecturer

The goal of the course is to give broad basics of inorganic and general chemistry and elements of main groups.

Contents: The course deals with the main principles of inorganic and general chemistry and technical applications. The chemistry of elements is examined as groups according to the periodic table, mainly the elements of main groups.

Requirements: Two exams or final exam. The course contains home exercises.

Literature: Zumdahl, Zumdahl: Chemistry, Houghton Mifflin Company and compendium.

Language: Finnish

KE-35.1210 Inorganic Chemistry, laboratory course (4 cr)

Autumn

Lecturer: Minna Nieminen, lecturer and assistants

Contents: Inorganic reaction chemistry, chemicals and their handling, safe working practices.

Requirements: Exam

Literature: Antila, Koskentalo, Toivonen, Yliruokanen: Analyttisen kemian harjoitustyöt: Ionien reaktioita, Otatieto 849; compendium.

Prerequisites: Safety in the laboratory - course lectured in the beginning of autumn term.

Language: Finnish

KE-35.1500 Analytical Chemistry I; (KE, P, also for students of the degree programme of Forest Products Technology) (3 cr)

Spring (Period III)

Lecturer: Prof Sakari Kulmala

Contents: Theory and uses of ordinary quantitative analysis methods. Equilibrium constants, titrimetry, some electrochemical analysis methods, spectrophotometry, atomic absorption / atomic emission spectrometry, chromatographic techniques and capillary electrophoresis.

Requirements: Final exam.

Literature: Harris: Quantitative Chemical Analysis, W. H. Freeman and Company; compendium.

Language: Finnish, individual study in English possible

KE-35.1700 Analytical Chemistry Laboratory course I (3 cr)

Spring

Instructors: Johanna Suomi, teaching researcher and Sirje Liukko, assistant

Contents: Quantitative analysis using classical methods (titration, gravimetry etc.) and the most common instrumental methods. In the instrumental methods the students will use electrochemical analysis methods, spectrophotometry, AAS and gas chromatography. All in all the course contains 10 individual analyses and 4 group works.

Requirements: Final exam.

Literature: Toivonen, Yliruokanen: Analyttisen kemian harjoitustyöt: Kvantitatiivinen analyysi, Otatieto 834 (Note: available

only in Finnish) as well as two work instructions available in Finnish from the course home page.

Prerequisites: Safety in laboratory exam passed before starting the course.

Language: Examination available also in English, but teaching is given in Finnish

KE-35.2100 Inorganic Chemistry II (3 cr)

Autumn (period II)

Instructor: Prof Maarit Karppinen

Contents: An overview of descriptive inorganic chemistry. Special emphasis is placed on the chemistry of transition metals.

Requirements: Final examination

Literature: Compendium, recommended: Rayner-Canham, Overton: Descriptive Inorganic Chemistry; W. H. Freeman and Company

Prerequisites: KE-35.1200, KE-35.1500, KE-35.1210, KE-35.1700

Language: Finnish

KE-35.2500 Inorganic Chemistry III (5 cr)

Spring (period III)

Instructor: Prof Maarit Karppinen

Contents: The main concepts and theories of inorganic chemistry and their impact using practical examples. Special emphasis is placed on inorganic materials and their applications.

Requirements: Final examination and home works

Literature: Compendium

Prerequisites: KE-35.2100

Language: Finnish

KE-35.2510 Inorganic Instrumental Analysis (7 cr)

Spring

Instructor: Minna Nieminen, lecturer, and assistants

Contents: The aim of the course is to give an overview of the instrumental methods for inorganic analysis. The lectures will focus on theoretical basis of the methods, different instrumental solutions and applications to the analysis of various types of samples and elements. In addition, knowledge of the use and sources or errors of different methods will be discussed.

Requirements: 6 laboratory exercises including reports, followed by an examination

Literature: Skoog, Holler, Nieman: Principles of Instrumental Analysis, Saunders College Publishing; compendium.

Prerequisites: KE-35.1200, KE-35.1500, KE-35.1210, KE-35.1700

Language: Finnish

KE-35.3500 Inorganic Chemistry II, laboratory course (5 cr)

Spring, arranged for the first time academic year 2007-2008

Lecturer: Tuula Leskelä, lecturer

Contents: The goal of the laboratory course is to get acquainted with the methods of inorganic synthetic chemistry, characterisation of the synthetic products and different research methods used in inorganic chemistry. The syntheses utilise reactions in aqueous solutions and in the solid state; higher pressure and temperature are also employed.

Requirements: Reports

Literature: Leskelä, Leskelä: Laboratoriotyömoniste

Prerequisites: KE-35.1210, KE-35.1700, KE-35.2100, KE-35.2500, KE-35.2510

KE-35.4000 Evaluation of an analysis method (1 cr)

I, II, III, IV

Lecturer: Prof Sakari Kulmala and Johanna Suomi, teaching researcher

Contents: The student will present an essay on an analytical method showing the pro's con's and the suitability of the method. The essay is to be based on a relatively recent scientific article and the method should preferably be so new that it has

not yet been incorporated into the course literature. (The supervisors will provide suitable articles to the students).

KE-35.4100 Inorganic Chemistry IV (6 cr)

Autumn (period II), lectured for the first time academic year 2008-2009

Instructor: Prof Maarit Karppinen

Contents: The most important research techniques in inorganic chemistry emphasizing inorganic compounds in the solid state and determination of their structures by diffraction and spectroscopic methods.

Requirements: Final examination and seminar presentation

Literature: Compendium

Prerequisites: KE-35.2500

Language: Finnish/English as agreed.

KE-35.4310 Atomic Spectrometry, special topics (3 cr) P

Autumn (Period II), odd years

Lecturer: Hannu Revitzer, researcher

Contents: Theory and practical applications of atomic absorption spectrometry and ICP emission spectrometry. The course contains laboratory work and a seminar presentation made by each student.

Requirements: Final examination and the seminar presentation

Literature: Lajunen: Spectrochemical Analysis by Atomic Absorption and Emission, RSC

Language: Finnish

KE-35.4320 Analytical Methods in Environmental Chemistry (4 cr)

Autumn (Period II), even years

Lecturer: Asta Ekman and Timo Lukkarinen, specialist teachers

Contents: The aim of the course is to achieve command on elemental distributions in water, air and biological systems and monitoring of pollutants in the environment.

Requirements: Essay and examination.

Literature: Compendium

Language: Finnish

KE-35.4330 Advanced Analytical Chemistry (4 cr) P

Autumn (Period II), lectured for the first time academic year 2007-2008

Lecturer: Prof Sakari Kulmala, assistant

Contents: The aim of the course is to deepen analytical knowledge in general, and provide further information on sampling, chemometry, on-line analysis, quality systems and modern sources of analytical information and basic knowledge in planning of analytical methods and instruments.

Requirements: Examination and exercises

Literature: Compendium

Prerequisites: KE-35.1500, KE-35.2510

Language: Finnish

KE-35.4340 Laboratory Quality Systems, Quality Assurance and Validation of Analytical Methods (2 cr)

Autumn (Period II)

Lecturer: Prof Sakari Kulmala

Contents: The fundamentals of laboratory quality systems (Accreditation, Good Laboratory Practice and ISO 9000-series standards) and quality assurance within the systems and in general. Development of analytical methods and their validation is also discussed.

Requirements: Examination

Literature: Compendium

Language: Finnish, individual study in English possible

KE-35.4500 Functional Oxide Materials (3 cr)

Spring (period III), lectured for the first time academic year 2008-2009

Instructor: Prof Maarit Karppinen

Contents: Introduction to synthesis and properties of various important functional oxide materials employed in spintronics, nanotechnology and other topical application fields. The focus is on new materials. Moreover, the course provides the students with a short introduction to thin-film technologies of inorganic materials.

Requirements: Final examination

Literature: Lecture handouts

Prerequisites: KE-35.2500

Language: Finnish, individual study in English possible.

KE-35.4510 Thermoanalytical Methods and Applications (3 cr)

Spring (period IV), lectured even years, for the first time academic year 2007-2008

Lecturer: Tuula Leskelä, lecturer, and assistants

Contents: The goal of the course is for the participants to become acquainted with the principles, instrumentation and data analysis of thermoanalytical methods (TG, DTA, DSC and TG-MS). The applications discussed as examples cover various fields of chemistry and materials research, especially inorganic chemistry.

Requirements: Final examination and 4 laboratory exercises including reports.

Literature: Niinistö L.: Thermal Analysis, in book: Kellner et al.: Analytical Chemistry, 2nd ed., Wiley-VCH, 2004

Language: Finnish

KE-35.4610 Chromatographic and Capillary Electromigration Techniques (5 cr) P

Spring (Period III)

Lecturer: Johanna Suomi, teaching researcher

Contents: The aim is to introduce the most widely used modern separation techniques: gas chromatography, liquid chromatography and capillary electrophoresis. The basics of separation, the factors affecting the analysis, the most common detectors and some practical applications are studied for all these techniques. Sample pretreatment for these techniques is also shortly described.

Requirements: The course contains laboratory exercises with reports and a home essay. There is also an examination.

Literature: Riekkola, Hyötyläinen: Kolonnikromatografia ja kapillaarielektromigraatiotekniikat or Skoog, Holler, Nieman: Principles of Instrumental Analysis, Saunders College Publishing, USA

Language: Finnish, individual study in English possible. The laboratory exercises in Finnish or English as agreed.

KE-35.4810 Sample pretreatment (3 cr) P

Spring (Period IV)

Lecturer: Johanna Suomi, teaching researcher and Sirje Liukko, assistant

Contents: Sample pretreatment methods and the basics of reliable sampling. The course also contains laboratory exercises.

Requirements: Examination, reports on the laboratory exercises.

Literature: Compendium

Language: Finnish, individual study in English possible

KE-35.5000 Seminar on Chemical Analysis Technique (4 cr) P

Autumn & Spring, even years

Lecturer: Prof Sakari Kulmala

Contents: Seminars on modern analytical methods.

Requirements: Active participation and oral presentation.

Prerequisites: As agreed

Language: English or Finnish (preferably English)

KE-35.5010 Special Work in Analytical Chemistry I (3 cr) P

Autumn & Spring

Lecturer: Prof Sakari Kulmala, assistants

Contents: Laboratory work on chromatographic techniques or fluorescence studies.

Requirements: Work report

Prerequisites: KE-35.4810

KE-35.5020 Special Work in Analytical Chemistry II (3 cr) P

Autumn & Spring

Lecturer: Prof Sakari Kulmala, assistants

Contents: Laboratory work on chemiluminescent studies.

Requirements: Work report

Prerequisites: As agreed

Language: Finnish or English as agreed.

KE-35.5100 Research Project in Inorganic Chemistry (8 cr)

Autumn, lectured for the first time academic year 2009-2010

Lecturer: Minna Nieminen, lecturer, assistants and researchers

Contents: The course introduces its participants to research methods in inorganic chemistry and to ongoing research projects of the laboratory. It includes also laboratory work, which is connected to the research projects and is initiated by doing a literature survey on the same or a related topic. The laboratory work is reported in written form as well as by giving a seminar lecture.

Prerequisites: KE-35.4100

Language: Finnish/English as agreed.

KE-35.5110 Chemical Instrumentation and Electroanalytical Methods (5 cr) P

Autumn (Period I)

Lecturer: Prof Sakari Kulmala, assistant

Contents: The most important analog and digital electronic components and their function in analytical instruments are considered. The principles, analytical performance and instrumentation for each established electroanalytical method are studied (mainly voltammetry, stripping analysis, coulometry and potentiometry).

Requirements: Final examination and laboratory exercises with reports

Literature: Skoog, Holler, Nieman: Principles of Instrumental Analysis, Saunders College Publishing, Orlando, USA, 5th ed., 1998 and Rubinson: Contemporary Instrumental Analysis, Prentice Hall, 2000

Prerequisites: KE-35.1500 or corresponding knowledge of analytical chemistry

Language: Finnish, individual study in English possible

KE-35.6000 Research Study on Analysis Technique (6 cr) P

Autumn & Spring

Lecturer: Prof Sakari Kulmala

Contents: Literature survey of a current analytical technique or specific laboratory work on an agreed analytical subject.

Requirements: Report

Prerequisites: As agreed

Language: English or Finnish as agreed

KE-35.6100 Postgraduate Research Seminar on Inorganic Chemistry (2 - 3 cr) P V

Autumn

Lecturer: Matti Putkonen, D.Sc (Tech.)

Contents: A seminar course where the annually changing topics cover recent developments in inorganic chemistry. The goal is to give an overview of new research results and trends.

Requirements: Attendance and exam (2 cr) and seminar presentation (3 cr).

Prerequisites: KE-35.4100

Language: Finnish/English as agreed.

KE-35.6500 Systematic Material Design (2 cr) P

Spring (period IV), odd years, lectured for the first time academic year 2008-2009

Lecturer: Prof Maarit Karppinen

Contents: Students are provided with insights into modern approaches and tools such as combinatorial chemistry, statistical multivariate analysis and layer-by-layer engineering for new-

material design, precision synthesis and on-demand tailoring of (multi)functional materials.

Requirements: Active participation and an essay on a topical theme.

Literature: Handouts

Prerequisites: KE-35.2500

KE-35.6510 Licentiate Seminar on Inorganic Chemistry (12 cr) P

Spring (period III), even years

Lecturer: Prof Maarit Karppinen

Contents: The goal of the course is to deepen knowledge of descriptive chemistry and selected key topics in inorganic chemistry. The course consists of lectures and seminars and is recommended for postgraduate students.

Requirements: Final examination and seminar presentations.

Literature: Greenwood, Earnshaw: Chemistry of the Elements, Butterworth-Heinemann, Oxford

Prerequisites: Degree (M.Sc. (Tech.))

Language: Finnish/English as agreed.

KE-35.9200 General and Inorganic Chemistry (P, MT for students of the degree programmes of Forest Products Technology and Materials Science and Engineering) (5 cr)

Autumn

Lecturer: Minna Nieminen, lecturer

Contents: Principles of general and inorganic chemistry, chemistry and technical applications of the most important elements and inorganic compounds.

Requirements: Two exams or final exam.

Literature: Antila, Karppinen, Leskelä, Mölsä, Pohjakallio: Tekniikan kemia, Edita, and compendium.

Language: Finnish

KE-35.9210 Analytical Chemistry Laboratory course; (P, for students of the degree programme of Forest Products Technology) (3 cr)

Autumn, not organized academic year 2006-2007

Instructors: Johanna Suomi, teaching researcher and Sirje Liukko, assistant

Contents: Quantitative analysis using classical methods (titration, gravimetry etc.) and the most common instrumental methods. In the instrumental methods the students will use electrochemical analysis methods, spectrophotometry, AAS and gas chromatography. All in all the course contains 10 individual analyses and 4 group works. There is also an examination.

Literature: Toivonen, Ylirokanen: Analyttisen kemian harjoitustyöt: Kvantitatiivinen analyysi, Otatieto 834 (Note: available only in Finnish) as well as two work instructions available in Finnish from the course home page.

Prerequisites: Safety in laboratory exam passed before starting the course.

Language: Examination available also in English, but teaching is given in Finnish

KE-35.9220 Principles of Chemistry; (R, for students of the degree programme of Civil and Environmental Engineering) (5 cr)

Autumn

Lecturer: Tuula Leskelä, lecturer

Contents: The goal of the course is to give basic knowledge on general and inorganic chemistry and to give an overview of organic chemistry. The chemistry of elements is examined as groups according to the periodic table, mainly the elements of main groups. In addition to basic principles, emphasis is placed on technical applications.

Requirements: Two exams or final exam.

Literature: Antila, Karppinen, Leskelä, Mölsä, Pohjakallio: Tekniikan kemia, Edita and compendium.

Language: Finnish

KE-35.9600 Principles of Inorganic Instrumental Analysis; (MT, for students of the degree programme of Materials Science and Engineering) (5 cr)

Spring (Period III)

Lecturer: Prof Sakari Kulmala, assistant

Contents: Principles of analytical chemistry and the most important methods of instrumental analysis. The course contains laboratory exercises. An examination on safety in laboratory must be passed before the beginning of the exercises.

Requirements: Exam and laboratory exercises.

Literature: Harris: Quantitative Chemical Analysis, Freeman; Skoog, Holler, Nieman: Principles of Instrumental Analysis 5th ed., compendium

Prerequisites: KE-35.9200 or KE-35.9220

Language: Finnish

KE-35.9610 Chromatographic and Capillary Electromigration Techniques (P for students of the degree programme of Forest Products Technology) (4 cr) P

Spring (Period III)

Lecturer: Johanna Suomi, senior lecturer

Contents: The aim is to introduce the most widely used modern separation techniques: gas chromatography, liquid chromatography and capillary electrophoresis. The basics of separation, the factors affecting the analysis, the most common detectors and some practical applications are studied for all these techniques. Sample pretreatment for these techniques is also shortly described.

Requirements: Final examination, laboratory exercises with reports.

Literature: Riekkola, Hyötyläinen: Kolonokromatografia ja kapillaarielektromigraatiotekniikat or Skoog, Holler, Nieman: Principles of Instrumental Analysis, Saunders College Publishing, USA

Language: Finnish, individual study in English possible. The laboratory exercises in Finnish or English as agreed.

KE-35.9700 Principles of Chemistry; (K, TU, AUT, for students of the degree programmes of Mechanical Engineering, Industrial Engineering and Management, and Automation and Systems Technology) (5 cr)

Spring

Lecturer: Tuula Leskelä, lecturer

Contents: The goal of the course is to give basic knowledge on general and inorganic chemistry and to give an overview of organic chemistry. The chemistry of elements is examined as groups according to the periodic table, mainly the elements of main groups. In addition to basic principles, emphasis is placed on technical applications.

Requirements: Two exams or final exam.

Literature: Antila, Karppinen, Leskelä, Mölsä, Pohjakallio: Tekniikan kemia, Edita and compendium.

Language: Finnish

Courses credited in ocr

Kem-35.115 Inorganic Chemistry II, laboratory course (2 ocr)

Spring

Lecturer: Tuula Leskelä, lecturer

Contents: The goal of the laboratory course is to get acquainted with the methods of inorganic synthetic chemistry, characterisation of the synthetic products and different research methods used in inorganic chemistry. The syntheses utilise reactions in aqueous solutions and in the solid state; higher pressure and temperature are also employed.

Requirements: Reports

Literature: Leskelä, Leskelä: Laboratoriotyömoniste.

Prerequisites: KE-35.1210 and KE-35.1700.

Language: Finnish

Kem-35.123 Inorganic Chemistry III (3 ocr)

Spring

Lecturer: Prof Maarit Karppinen

Contents: The most important research techniques in inorganic chemistry emphasizing inorganic compounds in the solid state and determination of structures by diffraction and spectroscopic methods. Moreover, the course provides the student with a short introduction to novel functional inorganic materials and thin-film technologies.

Requirements: Final examination

Literature: Compendium, recommended: Ebsworth, Rankin, Cradock: Structural Methods in Inorganic Chemistry, Blackwell Sci. Publ.

Prerequisites: Kem-35.114, Kem-35.115, Kem-35.220.

Language: Finnish/English as agreed

Kem-35.124 Research Project in Inorganic Chemistry (5 ocr)

Spring

Lecturer: Minna Nieminen, lecturer, assistants and researchers

Contents: The course introduces its participants to research methods in inorganic chemistry and to ongoing research projects of the laboratory. It includes also laboratory work, which is connected to the research projects and is initiated by doing a literature survey on the same or a related topic. The laboratory work is reported in written form as well as by giving a seminar lecture.

Prerequisites: Kem-35.114, Kem-35.115 and Kem-35.220.

Language: Finnish/English as agreed

Kem-35.149 Advanced Analytical Chemistry (2 ocr) P

Spring (Period IV)

Lecturer: Prof Sakari Kulmala, assistant

Contents: The aim of the course is to deepen analytical knowledge in general, and provide further information on sampling, chemometry, on-line analysis, quality systems and modern sources of analytical information and basic knowledge in planning of analytical methods and instruments.

Literature: Compendium

Prerequisites: Kem-35.144, Kem-35.115 and Kem-35.220

Language: Finnish

Kem-35.175 Thermoanalytical Methods and Applications (2.5 ocr)

Autumn (Period II), even years

Lecturer: Prof Lauri Niinistö and assistants

Contents: The goal of the course is for the participants to become acquainted with the principles, instrumentation and data analysis of thermoanalytical methods (TG, DTA, DSC and TG-MS). The applications discussed as examples cover various fields of chemistry and materials research, especially inorganic chemistry.

Requirements: Final examination.

Literature: Niinistö, L.: Thermal Analysis, in book: Kellner et al. Analytical Chemistry, 2nd ed. Wiley, VCH 2004, handouts

Prerequisites: Kem-35.220.

Language: Finnish/English as agreed.

Kem-40 INDUSTRIAL CHEMISTRY**Courses credited in ECTS**

Prof: Outi Krause

Updated personnel contact information can be found at <http://teke.tkk.fi/english/hkunta/index.html>

KE-40.1600 Introduction to the processes (2 cr)

Spring (Period III)

Lecturer: Prof Outi Krause

Contents: Basic principles of chemical processes: conversion, yield, selectivity and reaction rate as well as material and mole

balances. Calculation examples related to stoichiometry and mole balances. Home exercises and visiting lecturers.

Requirements: Home exercise and exam.

Literature: Compendium.

Language: Finnish

KE-40.1800 Ideal reactors (3 cr)

Spring (Period IV)

Lecturer: Prof Outi Krause

Contents: Fundamentals of chemical reaction engineering. Design of ideal reactors.

Requirements: Exam and home exercises.

Literature: Compendium; Scott Fogler: Elements of Chemical Reaction Engineering, 4th ed., chapt. 1-7.

Prerequisites: KE-40.1600.

Language: Finnish

KE-40.2500 Basics in Process Technology (5 cr)

Spring (Period III)

Lecturer: Prof Outi Krause

Contents: Mass- and energy balances in chemical processes. Thermodynamic equilibrium. Most common chemical processes will be presented.

Requirements: Homeworks and exam.

Literature: Compendium.

Prerequisites: KE-40.1600, basic knowledge on thermodynamics, (KE-40.1800 recommended) or corresponding courses.

Language: Finnish

KE-40.2510 Seminar on Finnish Chemical Industry (2 cr)

Spring

Lecturer: Prof Outi Krause

Contents: Series of seminar presentations about the Finnish chemical industry. Compulsory lectures and individual reports about the lectures.

Requirements: Compulsory lectures and approved reports about the lectures

Literature: As agreed

Prerequisites: KE-40.1600 or corresponding course.

Language: Finnish

KE-40.4000 Research Project in Industrial Chemistry (7 cr)

Autumn/Spring (period)

Lecturer: Prof Outi Krause

Contents: Experimental Project work in industrial chemistry or reaction engineering. The project will be based on a literature review, which will be done first.

Requirements: Approved literature review and report of the results

Prerequisites: KE-40.2500, KE-40.4100 and KE-40.4110 or corresponding courses

Language: Finnish/English as agreed

KE-40.4010 Special Course in Catalysis (6 cr)

Autumn/Spring (period)

Lecturer: Prof Outi Krause

Contents: Experimental work related to catalysis. The project will be based on a literature review, which will be done first.

Requirements: Approved literature review and report of the results

Prerequisites: KE-40.4110 or corresponding course.

Language: Finnish/English as agreed

KE-40.4100 Industrial Chemistry, laboratory course (4 cr)

Autumn

Lecturer: Prof Outi Krause

Contents: 2-4 experimental tasks in the field of industrial chemistry and reaction engineering.

Requirements: Approved report of the results.

Language: Finnish/English as agreed

KE-40.4120 Kinetics of Catalytic Reactions (5 cr)

Autumn (Period I)
 Lecturer: Prof Outi Krause
 Contents: Kinetics and mass transfer in the heterogeneously catalysed system. Catalyst deactivation. Rate equations and design of reactors.
 Requirements: Home exercises, seminar presentation and exam.
 Literature: Scott Fogler: Elements of Chemical Reaction Engineering, 4th ed., chapt. 10-12
 Prerequisites: KE-40.1800 or corresponding course.
 Language: English (individual study)

KE-40.4130 Two and Three Phase Reactors (5 cr)

Autumn (Period II), odd years, will be lectured for the first time academic year 2007-2008
 Lecturer: Prof Outi Krause
 Contents: Non-ideal flow and design models of non-ideal reactors. Kinetics and mass transfer of gas-liquid-, liquid-liquid- and gas-solid reactions. Most important reactors and their design. Home exercises.
 Requirements: Exam and home works.
 Literature: Scott Fogler: Elements of Chemical Reaction Engineering, 4th ed., chapt. 12.8-14; Levenspiel: Chemical Reaction Engineering, 3rd ed., chapt. 23-26
 Prerequisites: KE-40.4110 or corresponding course.
 Language: Finnish, individual study in English possible

KE-40.4140 Environmental Catalysis (5 cr)

Autumn (Period II), even years
 Lecturer: Prof Outi Krause and visiting lecturers
 Contents: Principles of catalysis. Most important catalytic processes for clean fuel production. Catalytic purification of exhaust and flue gases. Catalytic combustion. Examples of new, environmentally acceptable chemical processes.
 Requirements: Exam
 Literature: Will be announced later
 Prerequisites: KE-40.2500 recommended
 Language: Finnish/English as agreed

KE-40.4520 Industrial chemistry seminar course (4 cr)

0 + 20 (period) III-IV
 Lecturer: prof. Outi Krause
 Contents: Seminar course. Seminar presentations dealing with selected chemical processes.
 Requirements: Approved seminar work and presentation.
 Prerequisites: KE-40.2500 or corresponding course.
 Language: Finnish.

KE-40.6000 Biofuels (5 cr) P

Autumn (period), odd years (next August 2007)
 Lecturer: Prof Outi Krause and visiting lecturers.
 Contents: The course will give an overview of present state of art in conversion of biomass to various fuels. Various raw materials and conversion processes will be introduced. Some examples of operational or designed commercial size processes will be given. The properties of bio-fuels and their applications will be presented.
 Requirements: Final exam.
 Literature: As agreed
 Language: English

KE-40.6020 Scale-up of Chemical Processes (5 cr) P

Autumn (period), even years
 Lecturer: Antti Vuori, Docent
 Contents: The course gives an overview of the scale-up of chemical reactions from laboratory to industrial scale. The course will discuss scale-up and modelling, the different stages of scale-up (laboratory->bench->pilot->production), common problems involved, environmental aspects, process safety and economy. The emphasis is on the heat and mass transfer issues of scale-up and on reactor safety.

Requirements: Exercises, seminar presentations and exam.
 Literature: As agreed
 Prerequisites: KE-40.4110 or corresponding course
 Language: English

KE-40.6500 Seminar on Industrial Chemistry (3-7 cr) P

Spring
 Lecturer: Prof Outi Krause
 Contents: Advanced course in industrial chemistry dealing with current topics in chemistry.
 Requirements: Seminar presentation and exam.
 Literature: As agreed
 Prerequisites: KE-40.2500, KE-40.4110 or corresponding courses
 Language: Finnish/English as agreed

Courses credited in ocr**Kem-40.113 Industrial Chemistry (5 ocr)**

Autumn, Will be lectured for the last time during academic year 2006-2007.
 Lecturer: Prof Outi Krause
 Contents: Thermodynamic equilibria together with mass- and energy balances in chemical processes. Most common chemical processes will be presented.
 Requirements: Homework, seminar presentations and exam.
 Literature: Moulijn, Makkee, van Diepen: Chemical Process Technology, John Wiley & Sons Ltd, 2001; Compendium.
 Prerequisites: Kem-40.103, Kem-40-150, Kem-31.117
 Language: Finnish

Kem-42 CHEMICAL ENGINEERING**Courses credited in ECTS**

Prof: Juhani Aittamaa., tel. 451 2630, room Ke E 306

KE-42.1700 Chemical Engineering I (5 cr)

Spring
 Lecturer: Prof Juhani Aittamaa
 Contents: Introduction to the calculation of processes and unit processes. Calculation of balances, principles of momentum, heat and mass transfer and introduction to unit operations.
 Requirements: 2 - 3 home exercises that must be completed during the course and before the final examination. The examination consists of two parts: theory and calculation.
 Literature: Geankoplis: Transport Processes and Separation Process Principles, 4th ed., Prentice Hall, 2003, as applicable.
 Prerequisites: Recommended Tfy-3.1241 and Mat-1.1410 (or corresponding courses).
 Language: Finnish, individual study in English possible

KE-42.3000 Chemical Engineering, laboratory course (3 cr)

Autumn/Spring
 Lecturer: Assistant Timo Seuranen
 Contents: Laboratory exercises to get familiar with the equipment in chemical engineering and a short literature survey to get familiar with the periodicals in the discipline.
 Requirements: 6 laboratory exercises with reports and literature survey. Reports and literature survey must be approved.
 Prerequisites: KE-42.1700 (compulsory). Recommended KE-42.3100, KE-42.3110 and KE-42.4100 either before this course or at the same time.
 Language: Finnish or English as agreed

KE-42.3100 Chemical Engineering IIa (5 cr)

Autumn (period I), lectured for the first time academic year 2007-2008
 Lecturer: Prof Juhani Aittamaa

Contents: Important unit operations in chemical engineering: distillation, extraction, leaching and membrane separations. Basics of mass transfer and thermodynamic methods.

Requirements: 2 home exercises that must be completed before the final examination. The examination consists of two parts: theory and calculation.

Literature: Geankoplis: Transport Processes and Separation Process Principles, 4th ed., Prentice Hall, 2003, as applicable.

Prerequisites: KE-42.1700

Language: Finnish, individual study in English possible

KE-42.3110 Chemical Engineering IIb (5 cr)

Autumn (period II), lectured for the first time academic year 2007-2008

Lecturer: Prof Juhani Aittamaa

Contents: Important unit operations in chemical engineering: evaporation, drying, absorption and stripping. Theory, equipment sizing and design methods.

Requirements: 2 home exercises that must be completed before the final examination. The examination consists of two parts: theory and calculation.

Literature: Geankoplis: Transport Processes and Separation Process Principles, 4th ed., Prentice Hall, 2003, as applicable.

Prerequisites: KE-42.1700

Language: Finnish, individual study in English possible

KE-42.4000 Chemical Engineering, advanced laboratory course (3 cr)

Autumn/Spring

Lecturer: Assistant Timo Seuranen

Contents: Laboratory exercises to get familiar with the equipment in chemical engineering.

Requirements: 5 laboratory exercises with extended reports. Reports must be accepted.

Prerequisites: KE-42.1700 and KE-42.3000 without literature survey (compulsory). Recommended KE-42.3100, KE-42.3110 and KE-42.4100 to be done at latest during the laboratory course. Recommended to take part in KE-42.4500 at latest during the laboratory work.

Language: Finnish or English as agreed

KE-42.4010 Chemical Engineering, exercise course on special topics (3-8 cr)

Autumn/Spring

Lecturer: Assistant Timo Seuranen

Contents: Homework exercises or laboratory experiments on selected topics of chemical engineering.

Requirements: Approved reports.

Prerequisites: KE-42.4000 (compulsory).

Language: Finnish or English as agreed

KE-42.4100 Mechanical Unit operations (3 cr)

Autumn

Lecturer: Jouko Laine, Docent

Contents: Mechanical unit operations such as crushing, grinding, screening and mixing.

Requirements: 3 homework exercises must be completed before final examination.

Literature: According to agreement

Prerequisites: Recommended KE-42.1700

Language: Finnish

KE-42.4110 Unit Operations, advanced course (4 cr)

Autumn, even years

Lecturer: D.Sc (Tech.) Harri Niemi, D.Sc (Tech.) Marjatta Louhi-Kultanen, Juha Kallas, Docent

Contents: Crystallisation, adsorption and membrane technologies.

Requirements: Examination.

Literature: As agreed

Prerequisites: KE-42.1700 (compulsory)

Language: Finnish

KE-42.4120 Process Development (4 cr)

Autumn, even years

Lecturer: Prof Juhani Aittamaa

Contents: Nowadays the same time scale of process development must be short to be competitive. The steps of process development from idea to product or process are taught to find innovative solutions into technical problems and process configurations. Case based learning.

Requirements: Lectures and exercises.

Literature: As agreed

Prerequisites: KE-42.3100 and KE-107.4300

Language: English

KE-42.4500 Chemical Engineering III (9 cr)

Spring, lectured for the first time academic year 2007-2008

Lecturer: Senior assistant Juha-Pekka Pokki

Contents: Selected topics of modelling and design of unit operations. Thermodynamics, mass transfer, heat transfer and momentum transfer in detail.

Requirements: 4 home exercises that must be completed before the final examination. The examination consists of two parts: theory and calculation.

Literature: Geankoplis: Transport Processes and Separation Process Principles, 4th ed., Prentice Hall, 2003, as applicable.

Prerequisites: KE-42.1700, recommended also KE-42.3100

Language: Finnish, individual study in English possible

KE-42.4510 Equipment Design, advanced course (4 cr)

Spring, even years

Lecturer: Jouko Laine, Docent

Contents: Detailed process equipment design in small groups.

Requirements: Completed homework exercise reports.

Literature: As agreed

Prerequisites: KE-42.1700, KE-42.3100, KE-42.3110. Maximum 16 participants, if more than 16 applicants the selection is made: 1) grade of KE-42.1700, 2) sum of study credits of KE-42.xxxx courses, 3) the study credit weighted average of grades of KE-42.xxxx courses.

Language: Finnish

KE-42.5500 Physical Properties in Chemical Engineering (4 cr)

Spring, odd years

Lecturer: Prof Juhani Aittamaa

Contents: Lectures on the estimation methods for the important thermophysical properties and where they can be applied. Exercises consist of comparisons of estimation methods to each other and to measurements. Also the accuracy and sensitivity of the estimation methods to the process design is studied using process simulators.

Requirements: Lectures and exercises.

Literature: As agreed

Prerequisites: KE-42.3100 and KE-42.3110

Language: English

KE-42.6000 Chemical Engineering Licentiate Seminar (3-6 cr) P V

Autumn/Spring, if needed

Lecturer: Prof Juhani Aittamaa

Contents: Specific topics on chemical engineering, process modelling, methods and tools and their applications in various fields of chemical engineering. Alternating content. Seminar lectures.

Requirements: Exercises and seminar lectures.

Literature: As agreed.

Prerequisites: KE-42.3100 and KE-42.3110.

Language: Finnish or English as agreed

KE-42.6010 Distillation Design (4 cr) P

Autumn (period), odd years

Lecturer: Prof Juhani Aittamaa, Kari Keskinen, Docent and other visiting lecturers

Contents: One-week intensive course with lectures and exercises and home work case studies. The course will give an overview of practical aspects of distillation simulation and design. Thermodynamics models, both predictive and experimental are presented. Design of plate and packed columns and the auxiliary equipment are considered. Modeling of distillation by equilibrium and rate based approach are presented. Control and costing of distillation system are also included. The course consists of some 30 hours of lectures and exercises. A simulation program is used in the exercises. There will be no examination, but case studies will be held instead.

Requirements: Case studies.

Literature: Will be delivered during the lectures.

Language: English

KE-42.6500 Unit Operations of Environmental Technology (4 cr) P

Spring

Lecturer: Juha Kallas, Docent

Contents: Selected topics of unit operations that are used in environmental techniques. Membrane separations, separations of liquid/gas and solid/gas mixtures, chemical and biochemical methods, modelling. Number of participants limited to 25.

Requirements: Literature exercise and examination.

Literature: As agreed

Prerequisites: KE-42.3100 and KE-42.3110

Language: English

KE-42.6510 CFD Applications in Multiphase Flows in Chemical Engineering (4 cr)

Spring, even years

Lecturer: Prof Juhani Aittamaa

Contents: An intensive course of fluid dynamics, especially in modeling of complex flow fluids in multiphase chemical processes. The principles of turbulence theory and measurement techniques are introduced. The effects of turbulent flow field on bubble/droplet/particle sizes and their distributions in practical applications are studied in detail. The topic area is encountered in hydrodynamics of fluid flows in pipes and multiphase reactors (suspension and emulsion reactors, fermentation etc.) in all areas of chemical, biotechnical and pulping etc. technology.

Requirements: Lectures and seminar.

Literature: As agreed

Prerequisites: KE-42.1700, KE-42.3100 and KE-42.3110 or corresponding courses.

Language: English

Courses credited in ocr**Kem-42.121 Chemical Engineering III (6 ocr)**

Autumn, lectured for the last time academic year 2006-2007

Lecturer: Juha-Pekka Pokki, senior assistant

Contents: Selected topics of modelling and design of unit operations.

Requirements: 4 home exercises that must be completed before final examination.

Literature: As agreed

Prerequisites: Kem-42.111 or Kem-42.112 (compulsory).

Recommended to be done at the same time as Kem-42.125.

Language: Finnish

Kem-70 BIOPROCESS ENGINEERING

Prof. Matti Leisola, tel. 451 2546

Courses credited in ECTS**KE-70.2500 Bioprocess Engineering I (5 cr)**

Spring (period III)

Lecturers: Prof Matti Leisola and Tero Eerikäinen, teaching researcher

Contents: Food and biotechnology processes and their equipments. Bioreactors, mass transfer, heat transfer, cultivation techniques, growth kinetics, optimization of growth conditions, basic principles of measurements and control, product recovery, calculations

Requirements: Examination, literature study

Literature: Aittomäki, E. et al: Bioprosessiteknikka, WSOY, 2002

Language: Finnish, individual study in English possible

KE-70.2600 Unit Operations of Food and Biotechnology (5 cr)

Spring (period IV)

Lecturer: Heikki Ojamo, Docent

Contents: Unit operations such as sterilization, filtration, membrane techniques, chromatographic separation, ion exchange, distillation, centrifugation, extraction, milling, precipitation, homogenization, breaking of cells, crystallization, evaporation, drying, extrusion, freeze-drying

Requirements: Examination

Literature: As agreed

Language: Finnish, individual study in English possible

KE-70.3100 Bioprocess Engineering II (3 cr)

Autumn (period I), lectured for the first time academic year 2007-2008

Lecturers: Prof Matti Leisola and senior scientists (Kem-70)

Contents: Enzymes and cells as catalysts: selection criteria for enzymes, gene technology, industrial enzyme kinetics, manufacturing and stabilization of enzyme products and their applications.

Requirements: Examination, seminar

Literature: Enzyme Technology (Pandey, A, Webb C., Soccol CR and Larroche C, ed, Asiatech Publishers, Inc, New Delhi, 2005) chapters 1-7,9,12, 25-32, 34, 35

Language: Finnish, individual study in English possible

KE-70.3200 Laboratory course of Bioprocess Engineering (3 cr)

Autumn (period I), lectured for the first time academic year 2007-2008

Instructors: Senior scientists and assistants (Kem-70)

Contents: The course includes an introduction to experimental bioprocess engineering such as batch cultivations of microorganisms in laboratory/pilot plant scale bioreactors, as well as the purification and analysis of the products. The laboratory work is demonstrative.

Requirements: Written report, literature review and final examination

Prerequisites: KE-70.2100

Language: Finnish, individual study in English possible

KE-70.3500 Bioprocess Simulation (3 cr)

Spring (period III), lectured for the first time academic year 2007-2008

Lecturer: Tero Eerikäinen, teaching researcher

Contents: Computer simulations of pharmaceutical and biotechnical reactors and up- and down-stream equipments and processes. The effect of equipment design factors, material and energy balances, scheduling of process steps, and process economy is monitored. Simulations of growth kinetics and bioreactor control are carried out.

Requirements: Examination

Literature: As agreed

Prerequisites: KE-70.2100

Language: Finnish, individual study in English possible

KE-70.3600 Bioprocess Engineering III (5 cr) L

Spring (period IV), lectured for the first time academic year 2007-2008

Lecturers: senior scientists and docents

Contents: In-depth course on bio- and food industry processes and research: measurement and estimation of product quality, rheological measurements, GMP

Requirements: Examination

Literature: As agreed

Prerequisites: KE-70.2500, KE-70.3500

Language: Finnish, individual study in English possible

KE-70.4100 Process Design of Bioindustry (5 cr)

Autumn (period I), lectured for the first time academic year 2008-2009

Instructors: Prof Matti Leisola and Tero Eerikäinen, teaching researcher

Contents: Special features of food and biotechnology processes and process design. Teamwork to calculate the effect of raw materials, process choice and investment on the price of a bio-product.

Requirements: Teamwork and final examination

Literature: Aittomäki, E. et al: Bioprosessiteknikka, Luku 5, WSOY, 2002

Prerequisites: KE-70.3100

Language: Finnish, individual study in English possible

KE-70.4200 Bioprocess Scale-up (5 cr)

Autumn (period II), lectured for the first time academic year 2008-2009

Instructors: Kem-70 scientists and assistants

Contents: The course objective is to deepen the students understanding of bioprocess engineering by experimental work on mixed bioreactors and down-stream processing. The laboratory work consists of cultivating a microbe from test-tube to pilot plant scale and down-stream processing and analysis of the product.

Requirements: Written report of laboratory work and literature review

Literature: As agreed

Prerequisites: KE-70.3200, KE-70.3600

Language: Finnish, individual study in English possible

KE-70.4300 Metabolic Engineering and Modeling (5 cr)

Autumn (period II), lectured for the first time academic year 2008-2009

Instructors: Tero Eerikäinen, teaching researcher, Dr Antti Nyssölä and M. Sc (Tech.) Kristiina Kiviharju

Contents: Central parameters effecting cell growth and metabolite production, cell level mass balances, modelling of basic microbial metabolism and evaluation and understanding the effects of metabolic engineering. Modelling of metabolic fluxes, their control and thermodynamic balances.

Requirements: Examination

Literature: As agreed

Prerequisites: KE-70.3500, KE-70.3600

Language: Finnish, individual study in English possible

KE-70.4500 Protein Engineering (5 cr) L

Spring (period III)

Lecturer: Ossi Turunen, teaching researcher

Contents: Applications of gene technology in enzyme production and engineering of enzymes and metabolism. Mutation simulations by computers and site-directed mutagenesis to change enzyme properties in a laboratory experiment.

Requirements: Examination

Literature: Up-to-Date material

Prerequisites: KE-70.3100, KE-70.3500

Language: Finnish, individual study in English possible

KE-70.4600 Practical Course in Bioprocess Engineering (5 cr)

Spring, lectured for the first time academic year 2008-2009

Instructors: Assistants and scientists (Kem-70)

Contents: A broad research project with an experimental work in bioprocess engineering

Requirements: Independent research work, literature review, report and final seminar

Prerequisites: KE-70.4100, KE-70.4200

Language: Finnish, individual study in English possible

Courses credited in ocr

Kem-70.405 Technical Biochemistry and Food Technology, Laboratory Course I (4 ocr)

Autumn

Instructors: Senior assistant Marjatta Vahvaselkä (Kem-30) and assistants

Contents: Introductory microbiology and food hygiene, aseptic technique, sterilization and microscopy.

Requirements: Participation in laboratory practical work and written examination.

Attending must be confirmed by May 15 via webTopi the spring prior to the commencing autumn Laboratory Course I.

Participation is confirmed after approved course entrance examination immediately prior to the course.

Prerequisites: Kem-4.252, Kem-30.102, Kem-30.104

Language: Finnish

Kem-70.410 Technical Biochemistry and Food Technology, Laboratory Course III (4 ocr)

Autumn

Instructors: Senior assistants (Kem-30) and assistants

Contents: Experiments with agitated bioreactors and separation techniques; batch and continuous cultures; downstream processing and product analysis

Requirements: Written report, literature review and final examination. Attending must be confirmed by May 15 via webTopi the spring prior to the commencing autumn Laboratory Course I. Participation is confirmed after approved course entrance examination immediately prior to the course.

Prerequisites: Kem-30.305.

Language: Finnish

Kem-70.415 Bioprocess Engineering II (4.5 ocr)

Autumn (Period I)

Lecturer: Prof Matti Leisola, senior lecturer (Kem-70)

Contents: Enzyme technology: selection, importance of genetic engineering, manufacturing process, stabilisation and applications

Requirements: Examination

Literature: As agreed

Prerequisites: Kem-70.400.

Language: Finnish

Kem-70.420 Practical Course in Bioprocess Engineering (4.5 ocr)

Spring

Lecturers: Senior lecturer (Kem-70) and researchers (Kem-70)

Contents: Major planning task and experimental execution of the plan. Literature survey, work report, casebook and seminar work are included to the course.

Requirements: This course is carried out as a project work and is a prerequisite for the diploma work.

Prerequisites: Kem-70.400, Kem-70.405 and Kem-70.410.

Language: Finnish

Kem-70.425 Computer Applications in Biotechnology (2 ocr) P

Spring (Period IV), odd years

Lecturer: Tero Eerikäinen, teaching researcher

Contents: Basic features of data processing in bioengineering; control, modelling and simulation, new software and hardware applications

Requirements: Examination

Literature: As agreed

Prerequisites: T-106.061/T-106.213 and Kem-70.400.

Recommended: Kem-90.147.

Language: Finnish

Kem-70.430 Process Design in Food and Bio-Industries (4 ocr)

Autumn (Period I)

Lecturers: Prof Matti Leisola and Tero Eerikäinen, teaching researcher

Contents: Specific features of process design in bio- and food industry. Teamwork to calculate the effect of raw materials, process choice and investment on the price of a bio product.

Requirements: Teamwork and final examination

Literature: As agreed.

Prerequisites: Kem-107.100 (for students of option Technical Biochemistry), Kem-70.400.

Language: Finnish

Kem-70.440 Physical Properties of Food Materials (2 ocr) P

Spring (Period IV), even years

Lecturer: Karin Autio, Docent

Contents: Physical behaviour and properties of food stuff in food processing.

Requirements: Examination

Literature: As agreed

Prerequisites: Kem-70.400.

Language: Finnish

Kem-70.501 Postgraduate Engineering Seminar on Bioprocess (1 ocr) P

Autumn & spring if needed

Lecturer: Prof Matti Leisola

Prerequisites: Degree (M.Sc. (Tech.))

Kem-70.502 Postgraduate Engineering Seminar on Bioprocess (2 ocr) P

Autumn & spring if needed

Lecturer: Prof Matti Leisola

Literature: Lecture notes

Prerequisites: Degree (M.Sc. (Tech.))

Kem-70.504 Postgraduate Engineering Seminar on Bioprocess (4 ocr) P

Autumn & spring if needed

Lecturer: Prof Matti Leisola

Literature: As agreed

Prerequisites: Degree (M.Sc. (Tech.))

Kem-70.507 Postgraduate Engineering Seminar on Bioprocess (7 ocr) P

Autumn & spring if needed

Lecturer: Prof Matti Leisola

Literature: As agreed

Prerequisites: Degree (M.Sc. (Tech.))

Kem-70.552 Bioprocess and Metabolic Modelling (4 ocr)

Autumn

Lecturer: Antti Nyssölä, researcher and Tero Eerikäinen, teaching researcher

Contents: Lectures, which are integrated to laboratory work consisting of a continuous chemostat cultivation. The student will learn to measure the main parameters of bioprocess, build material balances, model basic microbial metabolism and estimate the effects of metabolic engineering.

Literature: As agreed

Requisites: Examination

Prerequisites: Course of the Degree Programme of Bioinformation Technology, Kem-70.551.

Language: Finnish

Kem-90 PROCESS CONTROL

Courses credited in ECTS

Prof: Sirkka-Liisa Jämsä-Jounela, tel. 451 2631

KE-90.2100 Basics of Process Automation (3 cr)

Autumn (Period I)

Lecturer: Prof Sirkka-Liisa Jämsä-Jounela

Contents: Basics in process automation, structure of the process automation systems, instrumentation and special measurements at the plant. Basics in control: process dynamics, PID controller, controller tuning, production planning and control systems, planning and implementation of the automation project. Guest speakers from the industry.

Requirements: Final exam.

Literature: Lecture notes

Language: Finnish

KE-90.2110 Process Industry Measurements (3 cr)

Autumn (Period II)

Lecturer: Prof Sirkka-Liisa Jämsä-Jounela

Contents: An overview of process industry measurements essential to process control. Guest speakers from the industry.

Requirements: Compulsory lectures and final exam

Literature: Lecture notes

Language: Finnish

KE-90.2500 Basics in production planning and control (6 cr)

Spring (Period IV)

Lecturer: Prof Sirkka-Liisa Jämsä-Jounela

Contents: The aim of the course is to give knowledge about methods used in production planning and control of industrial processes. Applications of production control are also discussed. Company visits.

Requirements: Final exam.

Literature: Hillier, F. S., Lieberman, G. J.: Introduction to Operations Research, 7th.ed.; Compendium

Prerequisites: KE-90.2100

Language: English

KE-90.3100 Process modelling and simulation (6 cr)

Autumn (Period II)

Lecturer: Prof Sirkka-Liisa Jämsä-Jounela

Contents: The aim of the course is to give an introduction to mechanical process modelling and simulation using computer tools.

Requirements: Exercises and final exam.

Literature: Luyben: Process Modelling, Simulation and Control for Chemical Engineers, McGraw-Hill

Prerequisites: KE-90.2100

Language: English

KE-90.3500 Process modelling and simulation in practice (3 cr)

Spring (Period III)

Lecturer: Prof Sirkka-Liisa Jämsä-Jounela

Contents: Laboratory exercises in modelling and simulation with Matlab and Simulink.

Requirements: Exercises and final exam.

Literature: Compendium; Luyben: Process Modelling, Simulation and Control for Chemical Engineers, McGraw-Hill

Prerequisites: KE-90.3100

Language: English

KE-90.4100 Production planning in practice (4 cr)

Autumn (Period I)

Lecturer: Prof Sirikka-Liisa Jämsä-Jounela

Contents: Project works with Arena, SAPr3 and APO.

Requirements: Exercises and final exam.

Literature: W. David Kelton, Randall p. Sadowski, Deborah A. Sadowski: Simulation with Arena, McGraw-Hill, USA, 2003

Prerequisites: KE-90.2500

Language: English

KE-90.4500 Project work in process automation (3 cr)

Spring (Period IV)

Lecturer: Jerri Käimpe, M.Sc (Tech.)

Contents: The aim of this course is to practice process control with the PC-based Wonderware control system. Course includes PC-, PLC- and soft-PLC-based control systems, system configuration, PLC programming and user interface design.

Requirements: Project work.

Prerequisites: Basic knowledge of control and process engineering (KE-90.3100) and basic programming skills.

Language: English

NOTE: Registration to this course during period III

KE-90.4510 Control applications in process industries (6 cr)

Spring (Period III)

Lecturer: Prof Sirikka-Liisa Jämsä-Jounela, Mats Nikus, D.Sc (Tech.), Jouni Savolainen, M. Sc (Tech.)

Contents: The aim of the course is to give an overview of control strategies used in process industry. Classical and modern control theory is discussed briefly. Process dynamics, process modelling and identification, single-loop control and controller design, multivariable control, discrete time systems and design of digital controllers, model predictive control, selected topics in advanced process control and case studies.

Requirements: Final exam and assignment.

Literature: Ogunnaike, Babatunde A. & Ray, W.: Process Dynamics, Modelling and Control, Oxford university Press

Prerequisites: KE-90.3100

Language: English

KE-90.4520 Information technology in process automation (3 cr)

Spring (Period III)

Lecturer: visiting lecturers

Contents: Design methods, tools and interfaces (OPC, ODBC) for application software development of process automation. Laboratory project works using fieldbus, wireless network and XML technologies. Guest speakers from the industry. The course is designed for the students whose major is Process control and automation.

Requirements: Assignments and final exam.

Literature: Compendium

Prerequisites: Basic knowledge of control and process engineering (KE-90.3100) and basic programming skills

Language: English

KE-90.5100 Process monitoring (4 cr)

Autumn (Period I)

Lecturer: Mats Nikus, D.Sc (Tech.)

Contents: The aim of the course is to give an overview on process monitoring and an introduction to neural and fuzzy process control methods. The main principles of the statistical and neural data-based process monitoring methods (principal component analysis, partial least squares regression, self-organizing maps) as well as their combinations and applications will be covered. An insight how neural and fuzzy methods can be used to improve control systems will be given. the course will combine conceptual frameworks with a practical approach.

Requirements: Assignments and final exam.

Literature: To be announced. Lecture notes.

Prerequisites: KE-90.3100

Language: English

Kem-100 POLYMER TECHNOLOGY**Courses credited in ECTS**

Prof. Jukka Seppälä, tel. 451 2614

KE-100.2300 Polymer Technology I (3 cr)

Autumn (Period II)

Lecturer: Pirjo Pietikäinen, university lecturer

Contents: Principles of polymer technology, properties of polymers and plastics and measurement thereof. Structure, production and use of plastics and rubbers. Engineering- and speciality polymers. Processing of plastics.

Literature: Billmeyer: Textbook of Polymer Science (selected parts)

KE-100.2600 Laboratory Exercises of Polymer Technology, short course (2 ocr)

Spring (Period III)

Lecturer: Pirjo Pietikäinen, university lecturer

Contents: 4-6 demonstrative laboratory exercises on polymerization, analyzing, testing and identifying of polymers. Recommended with courses KE-100.2300 or KE-100.9300 or KE-100.9310

KE-100.3100 Polymer Technology II a (5 cr)

Autumn (Period I)

Lecturer: Prof Jukka Seppälä

Contents: Mechanisms and ideal kinetics of polymerisation. Correlations between structure and properties of polymers. Lectures and calculations.

Literature: Odian: Principles of Polymerization, 3rd ed. (appropriate parts), Fried: Polymer Science and Technology, 2nd ed., Prentice Hall, USA, 2003

Prerequisites: KE-100.2300, KE-100.9300 or KE-100.9310

KE-100.3300 Polymer Technology II b (5 cr)

Autumn (Period II)

Lecturer: Prof Jukka Seppälä

Contents: Polymer physics, polymer analysis and testing of both chemical and mechanical properties of polymers. Durability and stability of both synthetic and biopolymers. Lectures and calculations.

Literature: Fried: Polymer Science and Technology, 2nd ed., Prentice Hall, USA, 2003

Prerequisites: KE-100.2300, KE-100.9300 or KE-100.9310

KE-100.3310 Laboratory Exercises of Polymer Technology, extensive course (5 cr)

Autumn (Period II-III)

Lecturer: Minna Annala, M. Sc. (Tech.)

Contents: Laboratory exercises to deepen the understanding of polymer technology. 8-10 practical exercises on polymer synthesis, measurement of physical properties of polymers and processing methods.

Prerequisites: KE-100.2300, KE-100.9300 or KE-100.9310 (and Organic Instrumental Analysis)

KE-100.3700 Polymerization Engineering (6 cr)

Spring

Lecturer: Prof Jukka Seppälä

Contents: Basics of polymerization processes, special features of process technology and reaction engineering of polymerisations, production processes of the most important polymers. Compulsory homework exercises.

Literature: Odian: Principles of Polymerization, 3rd ed. (appropriate parts)

Prerequisites: Recommended: KE-100.3100 and KE-100.3300.

Language: English, if needed

KE-100.4100 Polymer Composites (4 cr)

Autumn (Period I), even years

Lecturer: Pirjo Pietikäinen, university lecturer

Contents: Raw materials, structures, properties and production of polymer composites. Paper and oral presentation of selected theme in polymer composite technology.

Prerequisites: KE-100.2300, KE-100.9300 or KE-100.9310.

KE-100.4110 Polymer Processing and Characterization (4 cr)

Autumn (Period I), odd years

Lecturer: Prof Jukka Seppälä, Pirjo Pietikäinen, university lecturer

Contents: The aim is to give thorough knowledge of processing of polymers, especially extrusion and injection moulding. Essay and oral presentation of selected theme in processing and characterization of polymers. The course is intended for advanced graduate students and postgraduate students.

Prerequisites: KE-100.2300, KE-100.9300 or KE-100.9310

KE-100.4800 Biopolymers (3 cr)

Spring (Period IV), even years

Lecturer: Prof Jukka Seppälä, Risto Hakala, assistant

Contents: Basics and beyond of biopolymers

Prerequisites: KE-100.2300, KE-100.9300 or KE-100.9310

KE-100.5000 Special Study in Polymer Technology (4-7 cr)

Autumn/Spring (Period)

Lecturer: Prof Jukka Seppälä, Pirjo Pietikäinen, university lecturer

Contents: The aim is to deepen the knowledge of a special area of polymer science. Both literal and experimental work is included.

Prerequisites: KE-100.2300, KE-100.9300 or KE-100.9310 and KE-100.3100 and KE-100.3300

KE-100.5010 Seminar on Polymer Technology (3-9 cr) P

Autumn/Spring (Period) alternate years (if needed)

Lecturer: Prof Jukka Seppälä, Pirjo Pietikäinen, university lecturer

Contents: Provides profound knowledge of very recent topics of polymer science for those who are especially interested in polymer science and technology. The contents of the course may vary from year to year.

Prerequisites: KE-100.2300, KE-100.9300, KE-100.9310, KE-100.3100 and KE-100.3300

KE-100.9300 Basics of Polymer Technology (MT, K, for students of the degree programme of Materials Science and Engineering and Mechanical Engineering) (3 cr)

Autumn (Period II)

Lecturer: Pirjo Pietikäinen, university lecturer

Contents: Principles of polymer technology, properties of polymers and plastics and measurement thereof. Structure, production and use of plastics and rubbers. Processing of plastics.

Literature: Billmeyer: Textbook of Polymer Science (appropriate parts)

KE-100.9310 Basics of Polymer Technology (P, for students of the degree programme of Forest Products Technology) (3 cr)

Autumn (Period II)

Lecturer: Pirjo Pietikäinen, university lecturer

Contents: Principles of polymer technology, properties of polymers and plastics and measurement thereof. Structure, production and use of plastics and rubbers. Processing of plastics.

Literature: Billmeyer: Textbook of Polymer Science (appropriate parts)

Kem-107 PLANT DESIGN

Courses credited in ECTS

Prof: Markku Hurme, tel. 451 2632

KE-107.2100 Plant Design I (4 cr)

Autumn

Lecturer: Prof Markku Hurme

Contents: Fundamentals of process plant design and development, process economics and project engineering.

Requirements: Home exercises and exam.

Literature: Lecture notes.

Prerequisites: KE-42.1700 or equivalent

Language: Finnish

KE-107.3100 Process Simulation (3 cr)

Autumn (Period I)

Lecturer: Prof Markku Hurme

Contents: Fundamentals of chemical process simulation, flowsheeting, optimization and soft computing. Course focuses on simulation of physical properties, equipment and processes using Pro/2 program

Requirements: Exam, exercise participation and accepted home work.

Literature: Lecture notes.

Prerequisites: KE-107.2100

Language: English

KE-107.3210 Exercise Course in Bioprocess Design (5 cr)

Autumn, lectured for the next time academic year 2007-2008

Lecturer: M. Sc (Tech.) Raisa Vermasvuori

Contents: During the course a preliminary process design and an economic study of a bioprocess is done partially as a group.

Requirements: Design exercise and home works

Literature: Compendium

Prerequisites: KE-42.1700, KE-70.2500

Language: Finnish

KE-107.4000 Process Safety (3 cr)

Autumn&spring

Educator: Prof Markku Hurme

Contents: Process safety, risk management, dangerous properties of chemicals. Course doesn't contain lectures.

Requirements: Literature work, exam based on literature given.

Prerequisites: Basic knowledge on chemical processes.

Language: English.

KE-107.4300 Process Design I (3 cr)

Autumn (Period II)

Lecturer: Prof Markku Hurme

Contents: Course gives practical knowledge on process development and process design. A case study on selection, design and feasibility of an inorganic chemical process is presented including safety, environmental and economic aspects.

Requirements: Exam, exercise participation and accepted home work.

Literature: Lecture notes.

Prerequisites: KE-107.3100

Language: English

KE-107.4600 Process Design II (3 cr)

Spring (Period III)

Lecturer: Prof Markku Hurme

Contents: The course gives knowledge on process design by using process simulation in petrochemical industry. Also heat integration and process safety aspects are discussed. A case study process with reactor & distillation systems is presented.

Requirements: Participation in exercises, accepted home work and exam.

Literature: Lecture notes.
Prerequisites: KE-107.3100
Language: English

KE-107.5500 Plant design II (8 cr)

Spring

Lecturer: Prof Markku Hurme

Contents: A preliminary design and feasibility study of a process, which is done as a design project. Project work is done in teams of ca. 5 students.

Requirements: Accepted design reports and presentations, participation in meetings.

Prerequisites: KE-107.3100, KE-107.4300, KE-42.3100, KE-42.3110 or equivalent

Language: English / Finnish

NOTE: Registrations for the course before the end of exam period in December

KE-107.5510 Plant design II B (6 cr)

Spring

Lecturer: Prof Markku Hurme

Contents: A preliminary design and feasibility study of a bio or food process, which is done as a design project. Project work is done in teams of ca. 5 students.

Requirements: Accepted design reports and presentations, participation in meetings.

Prerequisites: KE-70.2500 or equivalent

Language: English / Finnish

NOTE: Registrations for the course before the end of exam period in December

KE-107.6000 Special Course in Plant Design (1-5 cr) P V

Autumn&spring

Instructors: Prof Markku Hurme and specialist teachers

Contents: Special topics in process plant design. The subject of the course varies.

Prerequisites: Kem-107.100.

Language: English

KE-107.6010 Special Study in Plant Design (1-7 cr) P V

Autumn&spring

Lecturer: Prof Markku Hurme

Contents: One ore more special studies on plant design as agreed with the instructor.

Requirements: Special work reports or literature studies. Grades: pass / fail.

Prerequisites: Kem-107.100

Language: English

KE-107.6020 Special Study in Bioplant Design (1-7 cr) P V

Autumn/Spring

Lecturer: Prof Markku Hurme

Contents: One or more individual special studies on bioplant design as agreed with the instructor.

Requirements: Special work reports or literature studies.

Grades: pass / fail.

Prerequisites: KE-107.4300

Language: English / Finnish

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Head of department: Pertti Vakkilainen, tel. 451 3820
 Planning Officer: Seppo Hänninen, tel. 451 3686
 International Study Adviser: Marko Asell, tel. 451 3687, e-mail rkvopinto@hut.fi
 Department office: Rakentajanaukio 4, 02150 Espoo

Chairs:

Rak-11 Bridge Engineering
 Rak-32 Rock Engineering
 Rak-43 Structural Engineering and Building Physics
 Rak-50 Foundation Engineering and Soil Mechanics
 Rak-54 Structural Mechanics
 Rak-63 Construction Economics and Management
 Rak-82 Building Material Technology
 Rak-83 Steel Structures
 Yhd-10 Highway Engineering
 Yhd-12 Water Resources Engineering
 Yhd-33 Geoenvironmental Technology (Engineering Geology an Applied Geophysics)
 Yhd-71 Transportation Engineering
 Yhd-73 Environmental and Sanitary Engineering
 Yhd-102 Environmental Protection

Courses credited in ECTS

Rak-0.1200 Basic Course in Structural Engineering and Building Technology (3 cr)

Autumn

Lecturer: Hannu Hirsi, M.Sc

Contents: Introduction to structural engineering and building technology.

Literature: To be announced separately.

Language: Finnish.

Yhd-0.1100 Basic Course in Municipal and Environmental Engineering (3 cr)

Spring

Lecturer: prof. Markku Pelkonen

Contents: Introduction to municipal and environmental engineering. Role of water supply and sanitation systems in municipalities. Water consumption, treatment and supply, wastewater treatment. Introduction to municipal solid waste management. Water resources in the world, their use and connection to food production. Basics of water construction. A general view of highway engineering. Structure and geometry of highways and streets.4) Introduction to traffic engineering and planning. Solutions to problems for different traffic forms.

Structure: Lecture period, exercises.

Literature: Lecture notes.

Language: Finnish; individual study in English possible.

Yhd-0.1110 Basic Course of Transportation and Highway Engineering (4 cr)

Spring

Lecturers: Prof. Timo Ernvall, Prof. Tapio Luttinen, Prof. N.N.

Contents: Importance of transportation. Traffic studies. Traffic flow characteristics. Transportation planning. Impacts of transportation. Transportation economics. Road planning. Street planning. Structures and surfaces of roads. Maintenance.

Requirements: Exam. Compulsory calculation exercises.

Literature: O-P. Hartikainen: Tietekniikan perusteet, Otatieto 467; Lecture notes.

Language: Finnish; individual study in English possible.

Rak-11 BRIDGE ENGINEERING

Prof. Aarne Jutila, tel. 451 3700, room R 246

Courses credited in ECTS

Rak-11.1201 R-CAD (4 cr)

Spring. First time in spring 2007.

Teacher: Prof. Aarne Jutila, special teacher N. N.

Contents: Use of AutoCAD-, Revit-, Staad- and Mathcad-programs.

Requirements: Computer exercises, 4 compulsory computer works.

Literature: Electric program manuals (helps) and lecture notes.

Language: Finnish; individual study in English possible.

Rak-11.2107 Bridges and Foundation Structures (4 cr)

Autumn, first time autumn 2007

Lecturer: Prof. Aarne Jutila, Lauri Salokangas, special teacher

Contents: Loads in structures. Bridge types. General foundation methods. Design, analysing and dimensioning of foundations. Computational models of base slabs, piles and pile groups.

Requirements: Lectures, exercises, compulsory assignments, examination.

Literature: To be announced separately. Lecture notes.

Prerequisites: Rak-54.106 (compulsory).

Language: Teaching in Finnish; individual study in English possible.

Courses credited in ocr

Rak-11.107 Bridges and Foundation Structures (3 ocr)

Autumn, last time autumn 2006

Lecturer: Prof. Aarne Jutila, Lauri Salokangas, special teacher

Contents: Loads in structures. Bridge types. General foundation methods. Design, analysing and dimensioning of foundations. Computational models of base slabs, piles and pile groups.

Requirements: Lectures, exercises, compulsory assignments, examination.

Literature: To be announced separately. Lecture notes.

Prerequisites: Rak-54.106 (compulsory).

Language: Teaching in Finnish; individual study in English possible.

Rak-11.115 Safety of Structures (2 ocr)

Autumn

Lecturer: Tor-Ulf Weck, special teacher

Contents: Structural failure, failure mechanisms, design parameters. Principles and analysis of structural safety. Safety philosophy of structural design standards.

Requirements: Lectures, exercises, examination.

Literature: To be announced separately.

Prerequisites: Rak-54.111 (compulsory).

Language: Finnish.

Rak-11.127 Bridges, General Course (4 ocr)

Spring

Teacher: Prof. Aarne Jutila.

Contents: Codes concerning bridges. General design of bridges. Design and dimensioning of supporting structures. Design of simple timber, concrete and steel bridges. Construction and scaffolds.

Requirements: Lectures, compulsory demonstration lecture 2 h, design task under supervision, consulting 2 h/w, laboratory exercises 3 h/w, examination.

Literature: Iványi, M.: Steel Bridges, Budapest 1994, 336 p., Menn, C.: Prestressed Concrete Bridges. Birkhäuser Verlag, 1990, p. 1 - 126. Lecture notes.

Prerequisites: Rak-11.107 (compulsory), Rak-43.220 (recommended), Rak-54.111 (recommended).

Language: Teaching in Finnish; individual study in English possible.

Rak-11.133 Load-Carrying Structures (4 ocr)

Autumn and spring

Teacher: Prof Aarne Jutila

Contents: Main types of load-carrying structures and their analysing methods. Girders, grillages, trusses, arches, cable-stayed and suspension structures.

Requirements: Exercises, 4 special exercises, examination

Literature: O'Connor, C.: Design of Bridge Superstructures, USA 1971, Wiley, 564 p.

Prerequisites: Rak-54.116 or adequate knowledge

Language: English or Finnish according to agreement

Rak-11.143 Bridges, Special Course (4 ocr)

Autumn and spring

Teacher: Prof Aarne Jutila

Contents: Special items of the design (structural, economic and aesthetic design), analysis and construction of different types of bridges. Design exercise of a whole bridge.

Requirements: Lectures, compulsory demonstration lecture (2 h), design task under supervision, examination

Literature: Menn, C.: Pre stressed Concrete Bridges, Birkhauser Verlag, 1990, p. 126-535, lecture notes

Prerequisites: Rak-11.127 or adequate knowledge

Language: English or Finnish according to need

Rak-11.146 Seminar in Bridge Engineering (2 ocr)

Spring

Teacher: Prof Aarne Jutila

Contents: Advanced analysis method and production technologies of different types of bridges. Different topics yearly.

Requirements: Seminar meetings 2 h/w. One presentation per participant.

Language: English or Finnish according to agreement.

Rak-11.151 Bridge Engineering, Special Assignment (4-8 ocr)

Autumn and spring

Teacher: Prof Aarne Jutila.

Contents: Literature research, computer program or computation, or experimental or theoretical research on selected topic.

Requirements: Individual study including a report.

Language: English, Finnish or Swedish according to agreement.

Rak-11.163 Licentiate Seminar in Bridge Engineering (2-4 ocr) P

Spring

Teacher: Prof Aarne Jutila

Contents: The aim of the seminar is to present advanced analysis methods and production technologies of different types of bridges. Different topics yearly.

Requirements: Seminar meetings 2 h per week. 1-3 presentations per participant.

Language: English or Finnish according to agreement

Rak-32 ROCK ENGINEERING

Prof: Pekka Särkkä, tel. 451 2804, room B 271

Courses credited in ECTS

Rak-32.2010 Rock Mechanics (3 cr)

Autumn, first time autumn 2007

Lecturer: Juha Antikainen D.Sc. (Tech.)

Contents: Rock as a material, the stress-strain relation, friction, yield, elasticity and strength of rock, laboratory and field testing, failure mechanisms, effect of size and stress gradient.

Requirements: Solving a set of numerical exercises, exam

Literature: Compendium; Brady, Brawn: Rock Mechanics for Underground Mining; ISRM: Rock Characterization, Testing and Monitoring.

Prerequisites: Rak-32.1200

Language: English on demand

Rak-32.2020 Blasting Engineering (2 cr)

Autumn, first time autumn 2007

Lecturer: N.N.

Contents: After completing the course the student has the theoretical knowledge required for a blasting license. Theory and applications of blasting engineering. Explosives, detonators, planning and implementation of the most usual blasting work.

Requirements: obligatory exercises and final exam

Literature: Vuolio: Räjätystyöt, SML, 1991; Persson, Holmberg & Lee: Rock Blasting and Explosives Engineering, CRC Press, 1993.

Prerequisites: Rak-32.2010

Language: Finnish

Rak-32.2030 Rock Engineering (5 cr)

Spring, first time spring 2008

Lecturer: Prof Pekka Särkkä

Contents: Drilling and mechanical rock excavation methods. Quarrying and underground excavation and excavation methods. Processing of blasted rock. Raising and shaft sinking. Reinforcement work. Ventilation and pumping. Selection of machines.

Requirements: Guided site and industry visits, machine exercises, obligatory computational exercises and exam

Literature: Compendium: Tamrock: Rock Excavation Handbook, 1999

Prerequisites: Rak-32.2010 and Rak-32.2020

Language: English on demand

Rak-32.2040 Mining Engineering (5 cr)

(Period) Spring, first time spring 2008

Lecturer: Prof Pekka Särkkä

Contents: Design and economic principles of design and operation of surface and underground mines. Opening decision, mine start-up, mining methods, hoisting, ventilation, drainage, mine closure. Mine legislation, work safety, environmental matters.

Mining project evaluation and economic control of operating mines.

Requirements: Final exam

Literature: IME/SME: Mining Engineering Handbook 1-2, 1992; Hustrulid, W., Kuchta, M.: Fundamentals of Open Pit Mining and Design, A. A. Balkema, 1995; lecture notes.
Language: English on demand.

Rak-32.3510 Applied Rock Mechanics for Hard Rock Mining (3 cr)

(period) autumn

Teacher: Juha Antikainen D. Sc. (Tech)

Contents: Slope and pillar design in underground hard rock mining, rock stress and rock stress measurements, rock reinforcement, mechanized rock bolting, cablebolting, shotcreting. Mine visit.

Requirements: Compulsory exercises and examination.

Literature: Lecture notes. Hoek, E., Kaiser, P., Bawden, W.: Support of Underground Excavations in Hard Rock., A.A. Balkema, 1995.

Language: English

Rak-32.3520 Numerical Mine Modelling (3 cr)

(period) autumn

Teacher: Petteri Somervuori M.Sc. (Tech.), Juha Antikainen D. Sc. (Tech)

Contents: Management of investigation data, data analyses, visualization, geological and geotechnical modelling, rock mechanical analyses, open pit and underground mine design.

Requirements: Compulsory exercises and examination.

Literature: Lecture notes.

Language: English

Rak-32.3530 Mining Technology and Economics (3 cr)

autumn

Teacher: prof. Pekka Särkkä

Contents: Mine as an economical project, different feasibility studies, mining production planning parameters, strategic planning, financing and management, case studies. Mine visit.

Requirements: Compulsory exercises and final examination.

Literature: Lecture notes.

Rak-32.3540 Automation and Maintenance of Mining Equipment (3 cr)

autumn

Teacher: prof. U. Kumar

Contents: Production automation and maintenance as an elementary part of highly mechanized mine's total economy. Operational reliability of production machinery. Effects of automation on process planning and maintenance.

Requirements: Compulsory exercises and examination.

Literature: Lecture notes.

Language: English

Rak-32.3550 Mine excursion (3 cr)

autumn

Teacher: prof. Pekka Särkkä

Contents: Several operating hard rock mines are visited. Their operation processes are studied and compared. Students prepare and present reports on selected subjects after the tour.

Requirements: Presented report.

Literature: Material obtained from the mines.

Prerequisites: Rak-32.3510, Rak-32.3520, Rak-32.3530 and Rak-32.3540.

Language: English

Courses credited in ocr

Rak-32.122 Rock Engineering (3 ocr)

(Partly period) autumn, last time autumn 2007

Lecturer: Jarmo Roinisto, M.Sc. (Tech.)

Contents: General planning and special requirements for the most general rock facilities. Special solutions for excavation and reinforcement in rock construction. The knowhow needed for a rock facility planner in general or for structural planning.

Requirements: Guided industry visits and examination

Literature: MTR: Rock Engineering Alternative; Carmody, Sterling: Underground space design: A guide to subsurface utilisation and design for people in underground spaces; RIL: 169-1987 Kalliotilojen rakentamissuhteet; Valtion painatuskeskus: S3- ja S6-luokan väestönsuojien teknilliset määräykset.

Prerequisites: Mak-32.116, Mak/Rak-32.118 (obligatory) and Mak/Rak-32.137

Language: English on demand

Rak-32.127 Seminar on Design of Underground Excavations (6 ocr)

Autumn + spring, last time autumn 2007-spring 2008

Lecturers: Prof Pekka Särkkä and Jarmo Roinisto, M.Sc. (Tech.)

Contents: Comprehensive feasibility study for a rock facility: pre-investigations, general planning, dimensioning, selection of method, cost calculations. Acquaintance the work of a general rock and structural planning engineer.

Requirements: Feasibility study of a given subject, seminar presentation and examination.

Literature: Compendium; Hudson (ed.): Comprehensive Rock Engineering, Pergamon Press, Oxford 1993 (where applicable).

Prerequisites: Mak-32.118 or Rak-32.118, Mak-32.122 or Rak-32.122 (obligatory), and Mak-32.137 or Rak-32.137

Additional information: Recommended to be studied simultaneously with Rak-32.122.

Language: English on demand

Rak-32.137 Rock Mechanics (4 ocr)

Autumn, last time autumn 2006

Lecturer: Juha Antikainen D.Sc. (Tech.)

Contents: Rock as a material, the stress-strain relation, friction, yield, elasticity and strength of rock, laboratory and field testing, failure mechanisms, effect of size and stress gradient.

Requirements: 3 mandatory laboratory exercises with reports, solving a set of numerical exercises, examination

Literature: Compendium; Brady, Brown: Rock Mechanics for Underground Mining; ISRM: Rock Characterization, Testing and Monitoring.

Prerequisites: Kul-49.117, Mak-32.116

Language: English on demand

Rak-32.138 Rock Mechanics B (2 ocr)

Autumn

Lecturer: Juha Antikainen, D.Sc. (Tech.)

Contents: Rock as a material, the stress-strain relation, friction, yield, elasticity and strength of rock, laboratory testing, failure mechanisms, effect of size and stress gradient, strain waves, crushed rock

Requirements: examination

Literature: Compendium; Brady, Brown: Rock Mechanics for Underground Mining.

Prerequisites: Kul-49.117, Mak-32.116 (recommended)

Additional information: This course is intended for students from other universities.

Language: English on demand

Rak-32.187 Seminar on Rock Mechanics (3 ocr) P V

Autumn

Lecturer: Juha Antikainen, D.Sc. (Tech.)

Contents: The use of rock mechanics knowledge in practical problems, case studies. The contents of the study module change annually

Requirements: Seminar presentation and report

Prerequisites: Mak-32.137 or Rak-32.187 (obligatory)

Language: English on demand

Rak-32.188 Rock Engineering (1-6 ocr) P V

(Period) spring

Lecturer: N.N., Prof. Pekka Särkkä

Contents: Postgraduate course on rock engineering and mining engineering. The contents of the study module change annually.

Prerequisites: Mak-32.122 or Rak-32.122 or Mak-32.224 or Rak-32.224

Language: English on demand

Rak-32.224 Mining Engineering (4 ocr)

(Period) Autumn and spring, first time autumn 2006 and spring 2007

Lecturer: Prof Pekka Särkkä

Contents: Design and economic principles of design and operation of surface and underground mines. Opening decision, mine start-up, mining methods, hoisting, ventilation, drainage, mine closure. Mine legislation, work safety, environmental matters. Mining project evaluation and economic control of operating mines.

Requirements: Final examination

Literature: IME/SME: Mining Engineering Handbook 1-2, 1992; Hustrulid, W., Kuchta, M.: Fundamentals of Open Pit Mining and Design, A. A. Balkema, 1995; lecture notes.

Prerequisites: TU-22.101, Mak-32.118 or Rak-32.118

Language: English on demand.

Rak-43 STRUCTURAL ENGINEERING AND BUILDING PHYSICS

Prof. Ilmari Absetz (pro vtem), tel. 451 3676, room R 346

Prof. Martti Viljanen, tel. 451 3713, room R 349

Prof. Seppo Huovinen, tel. 451 3718, room R 347

Courses credited in ECTS**Rak-43.1215 Introduction to the design of load-bearing structures (4 cr)**

spring

Lecturer: N.N.

Contents: Loads of structures, limit states and principles of safety philosophy. Determination of support reactions, stress resultants and displacements of structures. Structural design of concrete, timber and steel beams and columns. Utilization of computer software in structural design.

Requirements: Examination.

Literature: Lecture notes, selected parts of Eurocodes 0-3 and 5 (EN1990, EN1991, EN1992, EN1993, EN1995) concerning the principles of design, loads and design of concrete, steel and timber structures. RIL 201.

Prerequisites: Rak-54.1100, Rak-54.1200, Rak-82.1106.

Language: Finnish.

Rak-43.1210 Introduction to Building Physics (4 cr)

Autumn, first time autumn 2007

Lecturer: Prof Martti Viljanen

Prerequisites: Rak-82.1106

Language: Finnish.

Rak-43.2100 Basis of Structural Design I (4 cr)

Autumn, first time autumn 2007

Lecturer: prof. N. N.

Contents: Common design basis, models for calculation, loads and safety of structures. Fundamental design principles of reinforced concrete structures. Design of reinforced concrete beams and columns, slabs and frames.

Literature: Lecture notes. Adapted parts of Eurocode 0, 1, 2 (EN1990, EN1991, EN1992) BY 203; Betonirakenteiden perusteiden oppikirja, BY 202; Betonirakenteiden suunnittelun oppikirja, osat 1 ja 2 (,3). BY50 Betoninormit. BY38-1; Element-

tirakennuksen mallisuunnitelmat, BY38-2; Paikanlavaletun rakennuksen mallisuunnitelmat.

Prerequisites: Rak-0.1200, Rak-43.1215 and Rak-54.1215

Rak-43.2400 Heat Insulation and Vapour Barrier Materials and Structural Solutions (4 cr)

Spring, first time spring 2008

Lecturer: prof. Martti Viljanen

Contents: Most common insulation solutions for structures and selection of them on the basis of building physics. Selection of building materials on the basis of needed material properties. Structural solutions on the basis of productization.

Requirements: Lectures, exercises, homeworks, compulsory design exercise, laboratory exercises and examination.

Literature: To be announced separately

Prerequisites: Rak-43.1210

Courses credited in ocr**Rak-43.210 Introduction to Building Physics (3 ocr)**

Autumn, last time autumn 2006

Lecturer: Prof Martti Viljanen

Prerequisites: Rak-82.106

Language: Finnish.

Rak-43.220 Introduction to Design of Concrete Structures (3 ocr)

Autumn, last time autumn 2006

Lecturer: N.N.

Prerequisites: Rak-43.200

Language: Finnish; individual study in English possible..

Rak-43.230 Introduction to Design of Timber Structures (3 ocr)

Autumn, last time autumn 2006

Lecturer: Prof Ilmari Absetz

Prerequisites: Rak-43.200, Rak-54.106 and Rak-54.111

Language: Finnish.

Rak-43.240 Design of Load-bearing Building Frames of Buildings (4 ocr)

Spring

Lecturer: N.N.

Prerequisites: Rak-43.200, Rak-43.210, Rak-43.220, Rak-43.230, Rak-83.112

Language: Finnish.

Rak-43.250 Design of Non-load-bearing Members of Buildings (4 ocr)

Spring

Lecturer: Prof Martti Viljanen

Prerequisites: Rak-43.200, Rak-43.210

Language: Finnish.

Rak-43.260 Special Course in Design of Timber Structures (4 ocr)

Spring

Lecturer: N.N.

Prerequisites: Rak-43.230

Language: Finnish.

Rak-43.270 Special Course in Design of Concrete Structures (4 ocr)

Spring, every second year, next time spring 2006

Lecturer: Prof Seppo Huovinen

Prerequisites: Rak-43.200, Rak-43.220

Language: Finnish; individual study in English possible..

Rak-43.280 Special Course in Material Engineering of Wood and Joining (4 ocr)

Spring

Lecturer: N.N.

Prerequisites: Rak-43.210, Rak-43.230
Language: Finnish.

Rak-43.290 Structural Engineering: Special Assignment (4 ocr)

Autumn and Spring
Lecturer: Prof Pekka Kanerva, Prof Martti Viljanen, Prof Seppo Huovinen
Language: Finnish.

Rak-43.310 Damage Diagnostics and Design of Building Repairs (4 ocr)

Autumn
Lecturer: Prof Seppo Huovinen
Language: Finnish.

Rak-43.320 Repair Methods of Structures (4 ocr)

Spring
Lecturer: Prof Seppo Huovinen
Prerequisites: Rak-43.310
Language: Finnish.

Rak-43.410 Building Physics Design (4 ocr)

Autumn, every second year, next time autumn 2006
Lecturer: Prof Martti Viljanen
Prerequisites: Rak-43.210, Rak-43.250
Language: Finnish.

Rak-43.415 Health Aspects in Building Design (4 ocr)

Spring
Lecturer: N.N.
Language: Finnish.

Rak-43.420 Calculations in Building Physics (4 ocr)

Spring, every second year, next time spring 2006
Lecturer: Prof Martti Viljanen
Prerequisites: Rak-43.210, Rak-43.250
Language: Finnish.

Rak-43.500 Introduction to Fire and Safety Engineering (2 ocr)

Autumn
Lecturer: Tuomas Paloposki, specialist teacher
Language: Finnish.

Rak-50 FOUNDATION ENGINEERING AND SOIL MECHANICS

Prof: Olli Ravaska, tel. 451 3730, room R 146
Prof: Pauli Vepsäläinen, tel. 451 3731, room R133

Courses credited in ECTS

Rak-50.1119 Basics of geomechanics (4 cr)

Spring
Lecturer: prof. Olli Ravaska, op.tutk. Juha Antikainen
Contents: Soil and rock classifications. Physical and geotechnical properties of soils and their determination in the laboratory. Mechanical properties of rock and their determination. Site investigations.
Requirements: Examination, compulsory maths, site and laboratory exercises.
Literature: Scott: An Introduction to Soil Mechanics and Foundation, Applied Science Publishers. Others will be given in lectures.
Language: Finnish, individual study in English possible.

Rak-50.2121 Basic course in geotechnics (5 cr)

Autumn, first time autumn 2007
Lecturer: prof. Olli Ravaska

Contents: Groundwater. Settlement, bearing capacity and stability of soil layers. Earth pressure. Geotechnical design. Foundation methods. Excavations. Frost protection. Drainage. Soil Improvement.

Requirements: Examination, compulsory maths and laboratory exercises.

Literature: Will be given in lectures.

Prerequisites: Rak-50.1119

Language: Finnish, individual study in English possible.

Rak-50.2123 Geotechnics of structures (5 cr)

Spring, first time spring 2008

Lecturer: prof. Olli Ravaska

Contents: Site investigations. Foundations on ground. Pile foundations. Soil improvement. Retaining structures. Earth works in house construction. Foundation of pipes. Dewatering of construction site. Frost protection.

Requirements: Examination, compulsory maths and design exercises.

Literature: Will be given in lectures.

Prerequisites: Rak-50.1121

Language: Finnish, individual study in English possible.

Rak-50.2132 Community Geotechnics (5 cr)

spring, first time spring 2008

Lecturer: prof. Pauli Vepsäläinen

Contents: Site investigations for construction of road and water works and municipal engineering. The failures of cut slopes and embankments and the reasons of failures. Ground improvement methods of cut slopes and embankments: Process descriptions, design basics and risk estimation. Transition constructions. Earth dams.

Requirements: Examination, compulsory maths exercises.

Literature: Will be given in lectures.

Prerequisites: Rak-50.2121.

Language: Finnish, individual study in English possible.

Courses credited in ocr

Rak-50.121 Basic Course in Soil Mechanics and Foundation Engineering (4 ocr)

Autumn, last time autumn 2006

Lecturer: Prof Olli Ravaska

Contents: Settlement, bearing capacity and stability of soil layers. Earth pressure. Site investigations. Geotechnical design of foundations. Foundation methods. Ground improvement. Excavations. Permanent drainage of construction site. Safety in geotechnical design.

Requirements: Examination, compulsory maths exercises.

Literature: Will be given in lectures.

Prerequisites: Rak-50.119

Language: Finnish; individual study in English possible.

Rak-50.123 Earth Construction and Foundations of Houses (4 ocr)

Spring, last time spring 2007

Lecturer: Prof Olli Ravaska

Contents: Site investigations. Soil supported foundations. Pile foundations. Soil improvement. Excavations. Earth works for houses. Pipeline foundations. Dewatering. Frost protection.

Requirements: Examination, compulsory maths and laboratory exercises. Design exercise.

Literature: Will be given in lectures.

Prerequisites: Rak-50.121

Language: Finnish

Rak-50.125 Advanced Soil Mechanics (4 ocr)

Autumn

Lecturer: Prof Pauli Vepsäläinen

Contents: The theories of soil mechanics. Mechanical properties of soils. The elastic and plastic theories and applications. Rheology applications in soil mechanics. Seepage flow.

Requirements: Examination. Compulsory maths and laboratory exercises (50 h). Design exercise.

Literature: RIL 157-2: Geomekaniikka II.

Prerequisites: Rak-50.121.

Language: Finnish; individual study in English possible.

Rak-50.132 Geotechnics in Construction of Earth and Water Works (4 ocr)

Autumn, last time autumn 2006

Lecturer: Prof Pauli Vepsäläinen

Contents: Settlement due to the lowering of the water table. The failures, improvement and repair of waterways and embankments. Earth dams and dykes.

Requirements: Examination. Compulsory maths exercises.

Literature: Will be given in lectures.

Prerequisites: Rak-50.121

Language: Finnish

Rak-50.135 Advanced Foundation Engineering and Geotechnical Design (4 ocr)

Spring

Lecturer: Prof Pauli Vepsäläinen

Prerequisites: Rak-50.121

Contents: Geotechnical design. Pile foundations. Foundation damage inspection, control and repair. Monitoring. Soil improvement. Excavations.

Requirements: Examination. Design exercises.

Literature: Will be given in lectures.

Language: Finnish

Rak-50.138 Environmental Geotechnics (3 ocr)

Spring (odd years)

Lecturer: Prof Pauli Vepsäläinen

Contents: Investigations and purification of contaminated land, seal constructions for soil and groundwater, industrial by-products in earth structures and recycling of materials.

Requirements: Examination, compulsory exercises.

Literature: Will be given in lectures.

Prerequisites: Rak-50.121

Language: Finnish; individual study in English possible.

Rak-50.145 Seminar on Foundation Engineering and Soil Mechanics (2 ocr)

Spring

Lecturers: Prof Olli Ravaska, Prof Pauli Vepsäläinen

Contents: Seminar lectures on soil mechanics or foundation engineering.

Requirements: Presentation of a seminar lecture and attending other lectures.

Prerequisites: Rak-50.121, Rak-50.125, Rak-50.123 or Rak-50.132

Language: Finnish, Swedish or English

Rak-50.149 Numerical Methods of Geotechnics (4 ocr) P

Spring

Lecturer: Prof Pauli Vepsäläinen

Contents: The basics of Finite Element Method and its application in geotechnology: seepage, consolidation, stress-strain analysis. Modelling of construction. Computer programs used for calculations of geotechnical problems.

Requirements: Lectures. Compulsory maths exercises (30 h). Design exercise.

Literature: Zienkiewicz: The Finite Element Method. Desai & Christian: Numerical Methods in Geotechnical Engineering.

Language: Finnish; individual study in English possible.

Rak-50.151 Foundation Engineering and Soil Mechanics, special assignment (2-4 ocr)

Autumn, spring

Lecturers: Prof Olli Ravaska, Prof Pauli Vepsäläinen, Matti Lojander, Laboratory Manager, Henry Gustavsson, senior assistant

Contents: Research work on soil mechanics or foundation engineering: either based on laboratory experiments, field measurements or academic work.

Language: Finnish, Swedish or English

Rak-50.155 Postgraduate Seminar on Geotechnics (2 ocr) P V

Autumn + spring, not in program 2006-2007

Lecturers: Prof Olli Ravaska, Prof Pauli Vepsäläinen

Contents: Will be given during the autumn term.

Language: Finnish, Swedish or English

Rak-50.158 Postgraduate Course in Soil Mechanics (4 ocr) P V

Autumn, not in program 2006-2007

Lecturer: Prof Olli Ravaska, Prof Pauli Vepsäläinen

Contents: Will be given during the previous Spring term.

Requirements: Lectures, examination.

Literature: Will be given in lectures (mainly English).

Prerequisites: Rak-50.123, Rak-50.125, Rak-50.132 or equivalent knowledge

Language: Finnish

Rak-50.160 Postgraduate Course in Foundation Engineering (4 ocr) P V

Autumn, in program 2006-2007

Lecturer: Prof Olli Ravaska, Prof Pauli Vepsäläinen

Contents: Will be agreed with students.

Requirements: Lectures, examination.

Literature: Will be given in lectures.

Language: Finnish

Rak-54 STRUCTURAL MECHANICS

Prof: Jukka Aalto, tel. 451 3750, room R 246

Prof: Juha Paavola, tel. 451 3751, room R 227

Courses credited in ECTS

Rak-54.1100 Statics (3 cr)

Autumn

Lecturer: Juha Hartikainen, university teacher

Contents: The purpose of the course is to introduce the fundamentals of Newtonian mechanics and to apply this to the determination of bodies at rest

Course requirements: Examination.

Literature: Recommended: R. C. Hibbeler: Engineering Mechanics, Statics, Prentice-Hall, J. L. Meriam & L. G. Kraige: Engineering Mechanics, Statics, Wiley.

Additional information: Replaces course Rak-54.200 Statics.

Language: Finnish.

Rak-54.1200 R Mechanics of Materials for Structures (4 cr)

Autumn

Lecturer: Prof Jukka Aalto

Contents: Stresses, strains and mechanical properties of materials. Concepts of extension, compression, torsion, bending and shear. Geometrical properties of cross-sections. Differential equation of beam deflection. Compression and buckling of columns. Three-dimensional state of stress and strain and generalization of Hooke's law.

Requirements: Examination. Obligatory exercises.

Literature: Lecture notes. Recommended: R. C. Hibbeler, Mechanics of Materials, Prentice Hall. F. P. Beer & E.R. Johnston, Mechanics of Materials, McGraw-Hill.

Prerequisites: Rak-54.1100
Language: Finnish; individual study in English possible.

Rak-54.1300 Introduction to Structural Mechanics (4 cr)
Spring

Lecturer: Prof Juha Paavola
Contents: Analysis of statically determinate structures. Cable, frame, arch and compression line. Stresses in unsymmetric bending. Deflection of beams by the moment-area method. Principle of virtual work and energy methods. Displacements of structures by the unit load method. Principles of statically indeterminate structures. Compressed and bent beams and buckling. Requirements: Obligatory exercises and examination.
Literature: Lecture notes. Recommended: R. C. Hibbeler, Mechanics of Materials, Prentice Hall. F. P. Beer & E.R. Johnston, Mechanics of Materials, McGraw-Hill.
Prerequisites: Rak-54.1200.
Language: Finnish; individual study in English possible.

Rak-54.2100 Structural Mechanics I (4 cr)

Autumn, first time in autumn 2007
Lecturer: Prof. Jukka Aalto
Contents: Force method for beam structures. Moment and slope deflection methods for frames. Displacement method and finite element method for beam structures. Buckling of frames. Beams on elastic foundation. Physically non-linear beams. Plastic methods for beams and frames.
Requirements: Obligatory exercises and examination.
Literature: Lecture notes.
Prerequisites: Rak-54.1300.
Language: Finnish; individual study in English possible.

Rak-54.2200 Structural Mechanics II (4 cr)

Spring, first time in spring 2008
Lecturer: Teaching research scientist Reijo Kouhia
Contents: Elastic methods for disks and plates. Plate on elastic foundation. Flexible plates and plate buckling. Plastic methods for plates.
Requirements: Obligatory exercises and examination.
Literature: Lecture notes.
Prerequisites: Rak-54.2100.
Language: Finnish; individual study in English possible.

Rak-54.3100 Structural Mechanics III (4 cr)

Spring, first time in spring 2009
Lecturer: Prof. Juha Paavola
Contents: Principles of shell theory. Thin-walled structures. Lateral and torsional buckling.
Requirements: Obligatory exercises and examination.
Literature: Lecture notes.
Prerequisites: Rak-54.2200.
Language: Finnish; individual study in English possible.

Courses credited in ocr

Rak-54.111 Structural Mechanics B (4 ocr)

Spring, last time in spring 2007
Lecturer: Prof Jukka Aalto
Contents: Analysis of statically and kinematically indeterminate beams and frames using force- and displacement methods. Frame analysis using finite element method. Energy principles. Plastic methods of beams and frames. Elastic plates and yield line theory of plates.
Course requirements: Examination. Obligatory exercises.
Literature: Lecture notes. Ghali/Neville: Structural analysis, Chapman and Hall.
Prerequisites: Rak-54.106.
Language: Finnish; individual study in English possible.

Rak-54.116 Structural Mechanics C (4 ocr)

Spring, every second year, next time spring 2007

Lecturer: Prof Juha Paavola

Contents: Derivation of the expressions for strains and equilibrium equations in general elastic analyses of load bearing plates, shells and folded plate constructions. Saint Venant's and Vlasov's theories for torsion of beams with open and closed cross-sections. Torsional and lateral buckling of thin-walled beams. Buckling of plates. Fundamentals of structural dynamics.

Course requirements: Examination. Obligatory exercises.
Literature: Lecture notes. Mäkeläinen P., Paavola J.: Rakenteiden mekaniikan ja lujuusopin harjoituskirja, Osa 1, Otakustantamo 1981; Mikkola M.: TKY 275, Levyjen, laattojen ja kuorien teoriaa. Otakustantamo 1988. English literature: see home page.

Prerequisites: Rak-54.111.

Language: Finnish

Rak-54.126 Theories of Plasticity and Visco-Elasticity (4 ocr)

Spring, every second year, next time spring 2008
Lecturer: Prof Juha Paavola
Contents: Introduction to the theory of plasticity and visco-elasticity and applications to structural analysis. Plastic properties of materials, yield criteria and flow rules. Upper and lower bound methods for determination of limit loads. Time dependent material properties, creep and relaxation.
Course requirements: Examination. Obligatory exercises.
Literature: Lecture notes. W.F. Chen, D.J. Han: Plasticity for Structural Engineers. Springer Verlag 1988; W. Flugge: Viscoelasticity, Springer Verlag 1975.
Prerequisites: Rak-54.111, Rak-54.116.
Language: Finnish

Rak-54.131 Structural Stability (4 ocr)

Autumn, every second year, next time autumn 2007
Lecturer: Reijo Kouhia, teaching research scientist
Contents: Foundations of general theory of stability. Differential equations and variational formulations of stability problems. Buckling, torsional buckling and lateral buckling of beams using equilibrium and energy methods. Buckling of plates and cylindrical shells.
Course requirements: Examination. Obligatory exercises and laboratory exercises.
Literature: Lecture notes.
Prerequisites: Rak-54.111, Rak-54.116.
Language: Finnish; individual study in English possible.

Rak-54.136 Structural Dynamics (2-4 ocr)

Not offered in 2006-2007.
The course can be passed by an exam from the book: Clough R.W., Penzien J.: Dynamics of Structures, McGraw-Hill Book Company 1975 or Tedasco, J.W., McDouglas, W.G, Ross, C.A.: Structural Dynamics, Theory and Applications, Addison Wesley 1998. An alternative is to pass the course Kul-49-170 Vibrations of machines and structures.
Prerequisites: Rak-54.111.
Language: Finnish; individual study in English possible.

Rak-54.141 Numerical Methods of Structural Mechanics (4 ocr)

Autumn, every second year, next time autumn 2006
Lecturer: Reijo Kouhia, teaching research scientist
Contents: Introduction to the finite element method. Applications of the finite element method to plane stress problems and to bending of plates. Solution of heat transfer problem. Finite element computer codes.
Course requirements: Examination.
Literature: Lecture notes.
Prerequisites: Rak-54.111, Rak-54.116.
Language: Finnish; individual study in English possible.

Rak-54.145 Experimental Methods (2 ocr)

Autumn

Not offered in 2006-2007.

Supplementary course is Kul-49-201 Experimental methods (3 cr).

Prerequisites: Rak-54.106.

Language: Finnish; individual study in English possible.

Rak-54.150 Seminar on Structural Mechanics (2 ocr)

Spring, every second year, next time 2008.

Lecturers: Prof Jukka Aalto and Prof Juha Paavola

Contents: Studies of special problems in structural mechanics. Use of literature, oral and written presentation. Topics change annually.

Course requirements: Seminar meetings (2h/week). Preparing written and oral presentation.

Prerequisites: Rak-54.116.

Language: Finnish; individual study in English possible.

Rak-54.155 Structural Mechanics, special assignment (2-4 ocr)

Autumn + spring

Lecturers: Prof Jukka Aalto and Prof Juha Paavola.

Contents: Studies of methods, applications or special problems of structural mechanics. Use of literature and writing of technical reports. Special assignment is a literature study, limited theoretical or experimental research work or a part of a research project, writing of computer code etc.

Course requirements: Special assignment is prepared under supervision of the teacher.

Prerequisites: Rak-54.111, Rak-54.116.

Language: Finnish or English.

Rak-54.180 Postgraduate Seminar on Structural Mechanics (3-5 ocr) P V

Spring, every second year, next time 2008

Lecturer: Prof Jukka Aalto.

Contents: Studies of special applications and methodologies of structural mechanics. Topics of postgraduate seminar change annually.

Course requirements: Seminar meetings. Preparing written and oral presentation.

Prerequisites: Rak-54 Structural Mechanics or corresponding knowledge.

Language: Finnish or English

Rak-54.191 Structural Mechanics, special topics (3 ocr) P V

Autumn

Not offered in 2005-2006.

Language: Finnish

Rak-63 CONSTRUCTION ECONOMICS AND MANAGEMENT

Prof: Juhani Kiiras, tel. 451 3741, room R 150

Prof: Jouko Kankainen, tel. 451 3742, room R 147

Courses credited in ECTS

Rak-63.1206 Building Production Technologies (4 cr)

Spring

Instructors: Prof Jouko Kankainen

Content: Production development, production technology types, task planning, quality assurance during the building construction phase, occupational safety

Requirements: Exam. Planning exercise

Literature: Kankainen, Junnonen: Tehtäväsuunnittelu ja -valvonta rakentamisessa; Koskenvesa, Pussinen: Opas urakoitsijan tehtäväsuunnitteluun - esimerkkejä; Siikanen: Aliurakkasopimuksen liiteasiakirjat; Junnonen, Kankainen: Asuntotuotannon laadunvarmistus; RATU -menetelmäkortit; RYL ja vastaavat yleiset laatuvaatimukset; RATU: Rakennustöiden laatu 2002; RATU: Rakennustöiden turvallisuusohjeet.

Language: Finnish, individual study in English possible.

Rak-63.2235 Management of Building Projects (4 cr)

Autumn (period I), first time autumn 2007

Instructors: Prof Jouko Kankainen, Riku Kolhonen M.Sc.(Tech.)

Content: Students learn to make cost estimates, production, procurement and resource plans of a building project in routine construction.

Requirements: Exam. Planning exercise

Literature: Kankainen, Sandvik: Rakennushankkeen ohjaus; Junnonen, Kankainen: Rakennusurakoitsijoiden hankintakäsikirja; Talo-90: Rakennuskustannusten laskentaohje; Kankainen, Junnonen: Laatuajattelu ja rakennustyömaan laatu-toiminnot; other literature announced separately.

Language: Finnish, individual study in English possible.

Rak-63.1240 Management of infrastructure projects (4 cr)

Autumn (period I), first time autumn 2007

Instructors: Prof Jouko Kankainen, Jani Kempainen M.Sc. (Tech.)

Content: Students learn typical construction management issues concerning civil engineering projects e.g. schedules, cost estimates, production, procurement and resource plans.

Requirements: Exam. Planning exercise

Literature: Suomen ympäristökeskus: Maarakennustyömaan ympäristöopas; Kankainen, Junnonen: Laatuajattelu ja rakennustyömaan laatu-toiminnot; Junnonen, Kankainen: Rakennusurakoitsijoiden hankintakäsikirja; other literature announced separately.

Language: Finnish, individual study in English possible.

Courses credited in ocr

Rak-63.185 Seminar on Construction Economics and Management (2 ocr)

Autumn and spring

Instructors: Prof Juhani Kiiras, Prof Jouko Kankainen

Content: After the seminar, the student knows the requirements for giving a presentation and writing a paper on a given topic.

Course requirements: Seminar study, report and presentation, and acting as an opponent. Mandatory lectures and seminar sessions.

Literature: Guidelines for the presentation of a seminar paper and a special assignment in CEM.

Language: mostly Finnish; Swedish or English

Rak-63.187 Postgraduate Seminar on Construction Economics and Management (2-4 ocr) P

Autumn and spring

Instructors: Prof Juhani Kiiras, Prof Jouko Kankainen

Content: The aim of the seminar is to connect a postgraduate within the research in the field of the construction. In the beginning the postgraduate student presents objectives, research methods, frameworks or theories and the scheme of the implementation; and later the results and conclusions of the licentiate thesis.

Course requirements: Seminar presentations and the attendance at the related sessions.

Literature: Cases and examples of research in CEM.

Prerequisites: CEM as a major or a minor subject.

Language: mostly Finnish; Swedish or English

Rak-63.191 Construction Economics and Management, special assignment (4-8 ocr)

Autumn and spring

Instructors: Prof Juhani Kiiras, Prof Jouko Kankainen

Content: The student knows the requirements of a professional or research study and a report.

Course requirements: The planning and implementation of a study or a development task related to CEM.

Literature: Guidelines for the presentation of a seminar paper and a special assignment in CEM.

Prerequisites: CEM as a major subject.
Language: Finnish; Swedish or English

Rak-63.196 Construction Economics and Management, special topics (3 ocr) P V

In every 3rd term, next time in autumn 2006

Instructors: Prof Juhani Kiiras or Prof Jouko Kankainen

Content: Lectures guide the students to deeper understanding and current topics in CEM. Participants are students, postgraduates and representatives of the construction industry.

Course requirements: Topic-specific requirements.

Literature: To be announced separately.

Language: Finnish, English

Rak-63.200 Information Technology in Construction (3 ocr)

In every 3rd term, next time in autumn 2006

Instructors: N.N.

Content: The aim is to provide students with the basic knowledge needed for participating in setting IT strategies and solutions for design and construction companies. The course gives a general introduction to ways in which IT is and can be used to facilitate design, construction, and maintenance of buildings and other civil engineering work. Topics covered include CAD, document management, product modelling, and the use of the Internet.

Course requirements: Mandatory attendance at lectures, exercises, and company applications. No examination.

Literature: to be announced separately.

Language: English

Rak-63.211 Design Economics of Buildings (4 ocr)

In every 3rd term, next time in autumn 2006

Instructors: Prof Juhani Kiiras, Arto Saari D.Sc. (Tech.), Matti Tauriainen, M.Sc.

Content: The cost structure of a building project, construction and costs in use, value management and cost estimation control in the design. Investment appraisal. After the course the student can acquire and use building cost information.

Course requirements: Mandatory exercises. Examination.

Literature: Haahntela, Kiiras: Talonrakennuksen kustannustiето; Hyartt, Saari, Kiiras: Kiinteistöjen ylläpidon kustannustiето; Flanagan: Life cycle costing; lecture hand-outs.

Prerequisites: Rak-63.217

Language: Finnish; individual study in English possible.

Rak-63.213 Property Management (4 ocr)

In every 3rd term, next time in autumn 2006

Instructors: Arto Saari, docent

Content: Management of a property stock; operations maintenance and repair of buildings; energy and environmental management; renovation and modernisation of buildings.

Course requirements: Mandatory exercises. Examination.

Literature: To be announced on the bullet board before the lectures.

Language: Finnish; individual study in English possible.

Rak-63.217 Construction Contracting and Contractual Procedures (3 ocr)

Autumn

Instructors: Prof Juhani Kiiras

Content: Construction project management and contracting; project delivery systems, design management and contracting
Course requirements: Mandatory exercises. Examination.

Literature: Vuorela, Urpola, Kankainen: Johdatus rakentamistalouteen, 1998; Liuksiala: Rakennussopimukset, 1999; Kiiskinen, Seppälä: Rakennusten suunnittelu, 1995; Dorsey: Project delivery systems for building construction, 1997; RT-cards.

Prerequisites: Rak-63.106

Language: Finnish; individual study in English possible.

Rak-63.220 Real Estate Development (2 ocr)

Spring

Instructor: prof. Juhani Kiiras, Arto Saari, docent

Content: Real estate development; process, parties, markets, business idea, marketing, feasibility study, design targets.

Course requirements: Mandatory exercises. Examination.

Literature: Miles ym.: Real Estate Development, ULI: Office Development Handbook, Olkkonen ym.: Toimitilasijoittaminen, Leinberger: Strategy for Real Estate Companies

Prerequisites: Rak-63.217

Language: Finnish; individual study in English possible.

Rak-63.235 Management of Building Projects (3 ocr)

Autumn (period I), last time autumn 2006

Instructors: Prof Jouko Kankainen, Riku Kollhonen M.Sc.(Tech.)

Content: Students learn to make cost estimates, production, procurement and resource plans of a building project in routine construction.

Course requirements: Six mandatory exercises. Planning exercise. Examination.

Literature: Junnonen, Kankainen: Rakennusurakoitsijoiden hankintakäsikirja; Talo 90: Rakennuskustannusten laskentaohje; Kankainen, Sandvik: Rakennushankkeen ohjaus; other literature announced separately.

Language: Finnish; individual study in English possible.

Rak-63.238 Advanced Construction Project Management (4 ocr) (P)

Spring (period IV)

Instructors: Prof Jouko Kankainen

Content: This course focuses on project management in construction business and deals with all project management areas, e.g. scope, time, quality, cost, risk and human resources management.

Course requirements: Mandatory exercises. Examination. Planning exercise.

Literature: To be announced separately.

Language: Finnish; individual study in English possible.

Rak-63.240 Infrastructure Management of Projects (4 ocr)

Autumn (period I), last time autumn 2006

Instructors: Prof Jouko Kankainen, Jani Kempainen M.Sc. (Tech.)

Content: Student learn typical construction management issues concerning civil engineering projects: e.g. schedules, principles of construction management and control, cost management and resource planning and management.

Course requirements: Mandatory exercises and an examination. A planning exercise.

Literature: to be announced separately.

Language: Finnish; individual study in English possible.

Rak-63.245 Management of Construction Contractors (1-3 ocr)

Autumn 2005 and then spring 2007

Instructors: Pekka Huovinen, university teacher

Content: Introduction to the management of construction contractors in terms of strategic planning, business development, marketin gand accounting.

Course requirements: A pre-examination based on literature, teamwork.

Literature: Lecture notes. Additional literature to be announced separately.

Prerequisites: Rak-63.106 or TU-22.101

Language: Finnish; individual study in English possible.

Rak-63.250 Facility Services (2 ocr)

Autumn

Instructors: Jukka Puhto, M.Sc.

Content: Service quality, facility services, service purchasing, facility management, service agreements, relationship management.

Course requirements: Exercises. No examination.

Literature: Grönroos: Palveluiden johtaminen ja markkinointi; Puhto: Kiinteistönhoidon hankinnan kehittäminen; Atkin: Total Facilities Management.

Language: Finnish; individual study in English possible.

Rak-63.291 Postgraduate Course in Construction Contracting (5 ocr) P

Autumn or spring (a student may choose)

Instructors: Prof. Juhani Kiiras

Content: The aim of the course is to give deeper insight into the knowledge of construction contracting and to guide students to learn special issues.

Course requirements: Individual examinations, literature etc. reviews.

Literature: to be agreed on separately.

Language: Finnish, Swedish or English

Rak-63.292 Postgraduate Course in Design Economy and Maintenance Management of Buildings (5 ocr) P

Autumn or spring (a student may choose)

Instructors: Prof Juhani Kiiras, Arto Saari, docent

Content: The aim of the course is to give deeper insight into the knowledge of design economy and maintenance management and to guide students to learn special issues.

Course requirements: Examination.

Literature: to be agreed on separately.

Language: Finnish, Swedish or English

Rak-63.293 Postgraduate Course in Construction Project Management (5 ocr) P

Autumn or spring (a student may choose)

Instructors: Prof Jouko Kankainen

Content: The aim of the course is to give deeper knowledge of construction project management and to guide students to learn special issues.

Course requirements: Individual examinations, literature etc. reviews.

Literature: to be agreed on separately.

Language: Finnish, Swedish or English

Rak-63.294 Postgraduate Course in Management of Contractors and Internationalization (5 ocr) P

Autumn or spring (a student may choose)

Instructors: Prof Juhani Kiiras, Pekka Huovinen, senior assistant

Content: The aim of the course is to give deeper knowledge of the economy and the internationalization of a construction contractor and to guide students to learn special issues.

Course requirements: Individual examinations, literature etc. summaries.

Literature: To be agreed on separately.

Language: Finnish, Swedish or English

Rak-63.295 Postgraduate Special Assignment in Construction Economics (5-10 ocr) P

Autumn or spring (a student may choose)

Instructors: Prof Juhani Kiiras, Prof Jouko Kankainen

Content: The aim of the course is to make a pre-study for a licentiate thesis and to activate postgraduate studies.

Course requirements: The design and the implementation of a study or a development task related to a given subject.

Literature: Cases and examples of research in CEM.

Language: Finnish, Swedish or English

Rak-63.296 Personal Postgraduate Course in Construction Project Management (5-10 ocr) P

Autumn or spring (a student may choose)

Instructors: Prof Juhani Kiiras, Prof Jouko Kankainen

Content: The aim of the course is to give deeper insight into a special field selected by the postgraduate student. Content tailored separately according to the specialization of the postgraduate student.

Course requirements: Individual examinations, literature etc. reviews.

Literature: To be agreed upon separately.

Language: Finnish, Swedish or English

Rak-63.302 Finnish Cases in International Construction Business (2 ocr) P

Autumn or spring (a student may choose)

Instructor: Pekka Huovinen, university teacher

Content: Introduction to international developments of sectors and firms based in Finland; presentation of the selected typical firm based in Finland, its products/services and international operations.

Course requirements: Pre-examination based on literature. Web-based brief on a case firm supplemented with an interview report.

Literature: Guidelines for writing case papers in ICB. Literature is updated annually.

Language: English

Rak-63.312 Foreign Cases in International Construction Business (2 ocr) P

Autumn or spring (a student may choose)

Instructor: Pekka Huovinen, university teacher

Content: Requirements for a written case paper. Introduction to internationally leading contractors, designers, and suppliers. A crucial theme related to ICB. A student's in-depth orientation toward the given issue. The writing of a case paper.

Course requirements: Pre-examination based on literature. A case paper and its presentation.

Literature: Guidelines for writing case papers in ICB. Annually updated ENR surveys. Theme-specific references.

Prerequisites: Rak-63.302

Language: English

Rak-63.320 Strategies in International Construction (3 ocr) P

Autumn 2005 (and then spring 2007)

Instructor: Pekka Huovinen, university teacher

Content: Introduction to theoretical, competing and collaborating views and concepts of a firm's strategy in strategic management literature, e.g. Porterian, resource-based, competence-based, knowledge-based, organization-based, process-based, dynamism-based, and evolutionary. Applications to businesses based on and firms operating in international capital investment markets.

Examination: Pre-examination based on literature. Attendance at the conceptual sessions. Applied strategy paper.

Literature: To be updated bi-annually.

Prerequisites: Rak-63.302, Rak-63.312

Language: English

Rak-63.330 Operations in International Construction Business (3 ocr) P

Autumn 2006 (and then spring 2008)

Instructors: Pekka Huovinen, university teacher and visiting experts

Content: Introduction to foreign projects (contracts) in terms of entry management marketing and clients' behaviour, competitive bidding, Building design, risk management, acquisitions. Review of business environments in the selected markets such as the EU countries, Russia, the Baltic states, and central Europe. Guided, four-stage teamwork.

Course requirements: A team's four reports.

Literature: To be updated bi-annually.

Prerequisites: Rak-63.302, Rak-63.312

Language: English

Rak-63.340 Special Assignment in International Construction Business (4-8ocr) P

Autumn or spring (a student may choose)

Instructors: Pekka Huovinen, university teacher, Prof Juhani Kiiras

Content: Research paradigm and requirements for conducting studies in ICB.

Course requirements: Design and implementation of a study or a development task related to ICB. The topic, scope and size of the study/task in question are given by the instructor.

Literature: Guidelines for the special assignments in ICB. References to the selected, previous studies in ICB.

Prerequisites: Rak-63.302, Rak-63.312, Rak-63.320, and Rak-63.330

Language: English

Rak-82 BUILDING MATERIALS TECHNOLOGY

Prof. Vesa Penttala, tel. 451 3770, room R 249

Courses credited in ECTS**Rak-82.1106 Building Materials (3 cr)**

Spring

Lecturer: Maarit Järvinen, special teacher

Contents: Internal structure of materials: mechanical, thermal, and moisture properties of building materials. Production, quality control, utilisation, and prospects of building materials. Recycling and reclaiming of building materials. Wood based materials. Bricks and mortars. Organic materials: plastics, thermal insulators, bitumen. Corrosion. Composite materials. Plasters, paints, coverings, adhesives, joint sealants. Glass. Ceramic materials.

Requirements: Examination. Laboratory work.

Literature: Lecture notes, Ashby-Jones: Engineering Materials 1&2 or Askeland: The Science and Engineering of Materials, 1994.

Language: Finnish; individual study in English possible.

Rak-82.1111 Concrete Technology 1 (4 ocr)

Spring

Lecturer: Prof Vesa Penttala

Contents: The aim of the course is to acquaint the student with concrete technology. Concrete properties. Concrete technology: concrete proportioning and concreting methods. Corrosion of reinforced concrete.

Requirements: Examination. Laboratory work (6 h), which has to be approved before examination.

Literature: Lecture notes, Mehta: Concrete. Structure, properties and materials, 1986, Ljungkrantz et al.: Betonghandbok, Material, 1997., BY 201: Betonitestiikan oppikirja, 2004.

Language: Finnish; individual study in English possible.

Rak-82.2121 Production Technology of Concrete Structures (4 cr)

Autumn

Lecturer: Andrzej Cwirzen, teaching researcher

Contents: To acquaint the student with production and assembly of concrete structures. Utilisation of concrete in construction work. Production tools and methods in concrete engineering. Mould and reinforcement techniques. Fabrication of in situ concrete structures. Production and assembly of prefabricated concrete components. Winter concreting. Special concrete work methods. Cement and concrete industry.

Requirements: Examination. Design exercise. Excursions to construction sites.

Literature: Lecture notes, Nawy (ed): Concrete construction handbook, 1997, Ljungkrantz et al.: Betonghandbok, Arbetsutförande, 1997, BY 201: Betonitestiikan oppikirja, 2004.

Prerequisites: Rak-82.1111

Language: English

Courses credited in ocr**Rak-82.131 Concrete Technology 2 (4 ocr)**

Autumn

Lecturer: Prof Vesa Penttala

Contents: To improve the knowledge of concrete technology and to acquaint the student with the properties and production of special concretes. Chemistry of cement and additives, admixtures, fibre concrete, polymer concrete, high performance concrete, lightweight concrete. Durability of concrete structures.

Requirements: Examination. Laboratory work (17 h) and a design exercise, which have to be approved before examination. Total grade = 0.75 ´ grade of examination + 0.25 ´ grade of design exercise.

Literature: Lecture notes, Neville: Properties of Concrete, 1995, Cement and Mortar Technology and Additives, 1980., Rixom & Mailvanagam: Chemical Admixtures for Concrete, 1986, Czernin: Zementchemie für Bauingenieure, 1977, Hannant: Fibre Cements and Fibre Concretes, 1978, CBI: Armeringskorrosion 1980, The Concrete Society: Sprayed Concrete, Fibrous Concrete, Lightweight concrete, Admixtures, 1980, Penttala et al.: Korkealujuuksisen betonin valmistustekniikka, 1986; Mannonen et al: Itsetiivistyvien betonien suhteitus, valmistustekniikka ja perisominaisuudet, 2004; Tulimaa et al: Ympäristöystävälliset ja hyvin säilyvät betonit, 2005.

Prerequisite: Rak-82.121

Language: Finnish; individual study in English possible.

Rak-82.136 Product Development of Structures (3 ocr)

(Period) Spring. Lectures every two years. Will be held during academic year 2007-2008.

Lecturer: Prof Vesa Penttala

Contents: Methods and techniques of product development. Basis and new trends of product development for the building trade. Different phases in product development projects. Product development as a part of company functions. Product development projects presented by product developers.

A product development project (design exercise) of a given subject will be done as teamwork. The project will include the different phases of a product development process of a structure or building component aiming at a realistic result.

Requirements: Examination. Compulsory lectures. Design exercise.

Literature: Helin: Kehitämme ihmisvoimaa, 1986, Jaakkola & Tuunkelo: Tuotekehitys - ideoista markkinoille, 1987, Jokinen: Tuotekehityksen perusteet, 1981, Kangasluoma: Tutkimus- ja tuotekehityskäsikirja, 1979; Gerchels: The Product Manager's Handbook, 2000; Lagus et al: Managing Change, 2001.

Prerequisites: Rak-82.131

Language: Finnish

Rak-82.138 Advanced Building Materials Technology (3 ocr) P, V

Autumn +Spring

Lecturer: Prof Vesa Penttala

Contents: Advanced issues in building materials technology.

Requirements: Examination. Seminar lectures. Exercises.

Prerequisites: Rak-82.131

Language: Finnish; individual study in English possible.

Rak-82.141 Seminar on Building Materials Technology (2 ocr)

Spring

Lecturer: Prof Vesa Penttala

Contents: To further improve the knowledge acquired in earlier courses and to acquaint the student with independent research. Improve the quality of written and oral presentations. Presentations of subjects related to building materials technology.

Requirements: The student has to prepare a written presentation (10-30 pages), which will also be presented orally, and act as an opponent and as a chairman at one seminar.

Prerequisites: Rak-82.131

Language: Finnish

Rak-82.152 Building Materials Technology, special assignment (4-8 ocr)

Autumn and spring

Lecturer: Prof Vesa Penttala

Contents: To acquaint the student with independent research work and information retrieval. Literature review or small-scale experiments in the laboratory. The experimental results are presented as a research report.

Prerequisites: Rak-82.131.

Language: Finnish, English

Rak-82.161 Postgraduate Seminar on Building Materials Technology (3 ocr) P V

Spring

Lecturer: Prof Vesa Penttala

Contents: To further improve the knowledge of building materials technology. Presentations of topics related to building materials technology.

Language: Finnish; individual study in English possible.

Rak-83 STEEL STRUCTURES

Prof. Pentti Mäkeläinen, tel. 451 3780, room R 260

Courses credited in ECTS

Rak-83.2200 Basics of Structural Design II (4 cr)

Spring, first time spring 2008

Lecturer: Prof Pentti Mäkeläinen

Contents: Fundamental design principles of steel structures and timber structures. Design of steel beams and columns, steel trusses and steel frames. Design of timber beams and columns, timber trusses and timber frames.

Requirements: Exercises, homework, laboratory test demonstrations and examination.

Literature: Adapted parts of Eurocode 3 and Eurocode 5 (EN1993, EN1995). Jukka Kinnunen et al.: Teräsrakenteiden suunnittelu, Rakennustieto Oy, 2001. Kähkönen: Kantavat puurakenteet. RIL 120-1983: Puurakenteiden suunnitteluhjeet. RakMK B7 ja RakMK B10.

Prerequisites: Rak-0.1200, Rak-43.1215 and Rak-54.1300.

Language: Finnish; individual study in English possible.

Courses credited in ocr

Rak-83.112 Design of Steel Structures (3 ocr)

Spring, last time spring 2007

Lecturer: Prof Pentti Mäkeläinen

Contents: Basics for the design of steel structures. Design and dimensioning of beams, columns, trusses and frames. Design of bolted and welded connections. Design of steel frames.

Requirements: Exercise work, design exercise, examination.

Literature: Lecture notes, RakMK B7, Eurocode 3: EN 1993-1-1, ESDEP-material.

Prerequisites: Rak-82.106, Rak-54.111.

Language: Finnish; individual study in English possible.

Rak-83.122 Advanced Steel Structures (4 ocr)

Autumn

Lecturer: Prof Pentti Mäkeläinen

Contents: Fire engineering design of steel structures. Design of steel frames. Thin-walled steel structures. Steel plated structures. Fatigue design of steel structures.

Requirements: Exercise work, design exercise, examination.

Literature: Lecture notes, RakMK B6, RakMK B7, Eurocode 3: EN 1993-1.1-1.3 and 1.5, ESDEP-material.

Prerequisites: Rak-83.112.

Language: Finnish; individual study in English possible.

Rak-83.125 Composite Structures (4 ocr)

Spring, even years

Lecturer: Prof Pentti Mäkeläinen

Contents: Design of steel-concrete composite structures. Design of composite beams, slabs, and columns. Design of composite connections. Fire engineering design of composite structures.

Requirements: Exercise work, design exercise, examination.

Literature: Lecture notes, Eurocode 4: EN 1993-1.1, ESDEP-material.

Prerequisites: Rak-83.112, Rak-43.220.

Language: Finnish; individual study in English possible.

Rak-83.130 Fabrication Technology of Steel Structures (2 ocr)

Spring, odd years

Lecturer: Prof Pentti Mäkeläinen

Contents: Basics of steel structures fabrication. Steel structures project documentation and execution of a steel construction project. Steel fabrication plant. Fabrication of thin-walled steel structures. Transportation and erection of steel structures. Coating and corrosion protection of steel structures. Quality control of steel structures.

Requirements: Examination.

Literature: Lecture notes, ESDEP-material.

Prerequisites: Rak-83.112, Rak-83.122.

Language: Finnish

Rak-83.140 Seminar on Steel Structures (2 ocr)

Spring

Lecturer: Prof Pentti Mäkeläinen

Contents: Seminar concerning topics of current interest in design and fabrication of steel structures. The subject of the course changes yearly.

Requirements: Seminar with a contribution and written report.

Literature: To be announced at the course.

Prerequisites: Rak-83.112, Rak-83.122.

Language: Finnish; individual study in English possible.

Rak-83.150 Steel Structures, special assignment (4-8 ocr)

Autumn + spring

Lecturer: Prof Pentti Mäkeläinen

Contents: Literature survey or experimental research work.

Requirements: Written report.

Prerequisites: Rak-83.112, Rak-83.122.

Language: Finnish, English

Rak-83.160 Postgraduate Course in Steel Structures (2-4 ocr)

P V

Autumn

Lecturer: Prof Pentti Mäkeläinen and Finnish and foreign experts

Contents: Postgraduate course concerning topics of current interest in design and fabrication of steel structures. The subject of the course changes yearly.

Requirements: Lectures with a contribution and examination.

Language: English

Rak-83.170 Postgraduate Special Assignment in Steel Structures (4-8 ocr) P

Autumn and Spring

Lecturer: Prof Pentti Mäkeläinen

Contents: Literature survey or experimental research work on postgraduate level topic.
Requirements: Written report.
Language: Finnish, English

Yhd-10 HIGHWAY ENGINEERING

Prof. N.N., tel. 451 3790, room R 335

Courses credited in ECTS

Yhd-10.2100 Earth works (3 cr)

First time in 2007-2008

Lecturer: prof. N.N.

Contents: Gives basic knowledge in earth works. Earth works, structures, planning.

Requirements: Examination, calculation exercises

Literature: O-P Hartikainen: Maarakennustekniikka, Otatieto 435

Prerequisites: Yhd-0.1110

Language: Finnish, individual study in English possible

Yhd-10.2200 Road and street design (7 cr)

First time in 2007-2008

Lecturer: prof. N.N.

Contents: Processes in road and street design, basics of geometric design of roads and streets. Formation line, road alignment, intersections, interchanges, computer aided design

Requirements: Examination, calculation exercises

Literature: O-P Hartikainen: Tien- ja kadunsuunnittelu

Prerequisites: Yhd-0.1110

Language: Finnish, individual study in English possible

Courses credited in ocr

Yhd-10.116 Road and Street Design (3 ocr)

(Period) spring

Lecturer: Prof. N.N., Jarkko Valtonen, teaching researcher

Contents: Road network design, planning the geometry of roads and streets, planning junctions on the same and different levels

Requirements: Taught as a period. Lectures, compulsory calculation and design exercises; examination.

Literature: O-P Hartikainen, H. Kuronen: Tien- ja kadunsuunnittelu, Espoo 1999

Prerequisites: Yhd-10.111

Language: Finnish; individual study in English possible.

Yhd-10.122 Road and Street Construction (3 ocr)

(Period) spring

Lecturer: Prof. N.N.

Contents: Introduces the student to structural designing of traffic routes, techno-economic comparing of alternative structures and designing and building asphalt pavements. Road and street structures, design methods, technical-economical decision making, pavement design, paving.

Requirements: Lectures, compulsory calculation and design exercises.

Literature: Esko Ehrola: Liikenneväylien rakennesuunnittelun perusteet, Rakennustieto 1996.

Prerequisites: Yhd-10.116

Language: Finnish; individual study in English possible.

Yhd-10.128 Road and Street Maintenance (3 ocr)

(Period) autumn term

Lecturer: Prof. N.N.

Contents: Maintenance and upkeep of roads and streets, project leading and planning of themaintenance works, working methods.

Requirements: Lectures, compulsory calculation and planning exercises.

Literature: Lecture notes.

Language: Finnish; individual study in English possible.

Yhd-10.131 Highway Engineering, laboratory course (2 ocr)

Autumn, spring (period)

Lecturers: N.N., lab.eng, Marja-Terttu Juurinen, assistant

Contents: Laboratory work on ground, mineral and surfaces.

Recommended for fourth year students.

Form of the course: Compulsory laboratory exercises.

Literature: to be announced later

Language: Finnish; individual study in English possible.

Yhd-10.133 Highway Engineering, laboratory research (2 ocr)

(Period) spring, autumn

Lecturers: N.N., lab.eng, Marja-Terttu Juurinen, assistant

Contents: To specialise in a particular subject and to prepare the students for their Master's theses.

Requirements: Small-scale laboratory research

Language: Finnish; individual study in English possible.

Yhd-10.141 Railway Engineering (3 ocr)

(Period) spring term (even years), next time spring 2008

Lecturer: Jukka Ronni, specialist teacher

Contents: The development of railways. Rolling stock. Geometrical design of track. Design of track structure. Special features of track construction work. Forces acting on rails and strength calculations for rails. Yards and their structures. Structure aspects of electrification. Maintenance of track and yards. Safety equipment and urban railways.

Requirements: Lectures. Exercises on design of rail track and yard.

Literature: Lecture notes.

Language: Finnish.

Yhd-10.160 Seminar on Highway Engineering (2 ocr)

Autumn + spring

Lecturers: Prof. N.N., Jarkko Valtonen, teaching researcher and Anja Valtonen, specialist teacher

Aims: To familiarise the student with meeting techniques and scientific research and to develop oral and writing presentation skills.

Recommended for fourth year students.

Contents: Based on student presentations. Excursions.

Requirements: Participation in seminars and carrying out the required work.

Language: Finnish; individual study in English possible.

Yhd-10.173 Highway Engineering, literature research (2 ocr)

Autumn, spring

Lecturer: Jarkko Valtonen, teaching researcher

Contents: To specialise in a particular subject and to prepare the students for their Master's theses.

Requirements: Literature study on given source materials.

Language: Finnish; individual study in English possible.

Yhd-10.175 Highway Engineering, special assignment (4 ocr)

Spring, autumn

Lecturer: Jarkko Valtonen, teaching researcher

Contents: To specialise in a particular subject and to prepare the students for their Master's theses.

Requirements: Literature study and laboratory research on a given subject.

Language: Finnish; individual study in English possible.

Yhd-10.181 Road Design (4ocr)

Spring + autumn

Lecturers: Prof. N.N., Jarkko Valtonen, teaching researcher, N.N., specialist teacher

Contents: Drawing up a road design complete with environmental impact assessment.

Requirements: Lectures and planning exercises
Prerequisites: Yhd-10.111, Yhd-10.116
Language: Finnish; individual study in English possible.

Yhd-10.300 Postgraduate Seminar on Highway Engineering (1-3 ocr) P

(Period) spring. This seminar takes place according to demand.
Lecturer: Prof. N.N.
Contents: In-depth study of topical issues in highway engineering to meet the needs of postgraduates.
Requirements: Lectures and seminars. Examinations will be arranged as necessary.
Literature: to be announced later
Language: Finnish; individual study in English possible.

Yhd-10.331 Road and Environment (2 ocr) P

(Period) autumn
Lecturer: Jarkko Valtonen, teaching researcher
Contents: Air protection, noise and vibration prevention, protection of the built environment, protection of flora and fauna. Use of waste materials and by-products.
Requirements: Lectures, planning exercises and examination.
Literature: to be announced at lectures
Language: Finnish

Yhd-10.341 Advanced Course in Highway Engineering (3 ocr) P V

(Period) autumn This course takes place according to demand.
Lecturer: Prof. N.N.
Contents: Subjects vary from year to year: for example, maintenance, exports, environmental matters, the aesthetics of roads and streets. Recommended primarily for students majoring in highway engineering and for postgraduates.
Literature: to be announced later
Language: Finnish; individual study in English possible.

Yhd-10.351 Automation in road construction (3 ocr)

spring term, every second year, is lectured 2007
Lecturer: Dos. Rauno Heikkilä, DI Mika Jaakkola
Contents: Automation in procurement of initial data, product planning, construction control, inspection of realization and management of maintenance and upkeep.
Requirements: Lectures, compulsory calculation and design exercises.
Language: Finnish

Yhd-12 WATER RESOURCES ENGINEERING

Prof. Pertti Vakkilainen, tel. 451 3810, Water Laboratory, room 275
Prof. Tuomo Karvonen, tel. 451 3811, Laboratory of hydraulic engineering, room L226

Courses credited in ECTS

Yhd-12.1020 Introduction to Water Resources Engineering (4 cr)

Spring (period IV)
Lectures: Prof. Pertti Vakkilainen, Tuomo Karvonen and NN
Contents: Introduction to water resources management, hydraulic engineering, water and waste water engineering.
Requirements: Examination. Assignments.
Language: Finnish

Yhd-12.2005 Applied Hydrology (5 cr)

Autumn (period I), first time in autumn 2007
Lecturer: prof. Pertti Vakkilainen
Contents: Hydrological cycle and its components: rainfall, snow melt, evaporation, runoff, soil- and groundwater hydrology.

Hydrological measurements. Statistical models. Deterministic models. Man's influence on hydrological cycle.
Requirements: Exam. Assignments.
Literature: Announced on lectures.
Language: Finnish

Yhd-12.2010 Hydraulics (5 cr)

Autumn, (period II), first time in autumn 2007
Teacher: prof. Tuomo Karvonen
Contents: Introduction to the basics of hydrostatics and hydrodynamics. Basic principles of open channel flow and pipe flow. Steady and unsteady flow in open channels and pipes. Pipe systems. Introduction to computational methods needed in hydraulics. Presentation of computer models used in hydraulic analysis of open channel flow and pipe flow. Hydraulic models and model laws. Introduction to sediment transport in open channels.
Requirements: Exam and exercises.
Language: Finnish

Yhd-12.2015 Quality of natural waters (5 cr)

Spring, (period III), first time in spring 2008
Lecturers: Jari Männynsalo (MSc), Maija Paasonen-Kivekäs (Lic.Tech)
Contents: Introduction to water quality: rain water, soil water, ground water. River water quality. Currents and stratification in lakes. Aquatic ecosystems. Eutrofication. Basic research methodology. Water hygiene.
Requirements: Exam. Assignments.
Literature: To be announced.
Language: Finnish

Yhd- 12.3080 State of the World and Development (5 cr)

Autumn (I)
Lecturer: Dr. Olli Varis, guest lecturers
Content: This course gives an introduction to the state of the world including population, urbanisation, inequality, gender, poverty, food production, famine, rural development, development countries, climate change, environmental problems and regional conflicts. The course highlights the environmental, social and economic aspects of development and explores the dilemma of sustainable development.
Requirements: Lectures, Assignments, Exam
Language: English

Yhd- 12.3085 Governance, Policies and Technologies for Development (3 cr)

Autumn (II)
Lecturer: Dr. Olli Varis, guest lecturers
Content: The course presents the history of technological development and introduces the role of technology in development and sustainability. The course elaborates the social, environmental and economic dimensions of technology and provides basic knowledge about international politics and agreements, governance, international laws and regulations, policies, development co-operation, global actors, regulators and NGOs.
Requirements: Lectures, Exam
Prerequisites: Yhd- 12.3080
Language: English

Yhd- 12.3090 Sustainable Technologies Studio: Facing Local and Global Challenges (10 cr)

Autumn and Spring (I, II, III and IV)
Lecturer: Dr. Olli Varis, guest lecturers
Contents: A learning studio for advanced students. The studio includes lectures and an extensive group work. The lecturers introduce factual experiences from international projects, research methods and challenges in the field of development. Group work is mentored by tutors.
Requirements: Group work, Visits and Excursions. Grade: Pass/Fail

Prerequisites: Yhd- 12.3080, Yhd- 12.3085, Vie-98.1222 (recommended to be taken simultaneously)
Language: English

Courses credited in ocr

Yhd-12.108 Introduction to Hydraulic Engineering (2 ocr)

Autumn, last time in autumn 2006

Lecturer: Terhi Helmiö, specialist teacher

Contents: Hydraulic engineering, dams, water power plants, waterways, harbours. Introduction to hydraulics: hydrostatics, pipe flow, open-channel flow, scale models, model laws.

Requirements: Exam and exercises.

Literature: Hamill, Les (2001): Understanding Hydraulics. Handouts.

Language: Finnish; individual study in English possible.

Yhd-12.112 Computational Methods in Water Resources Engineering (3 ocr)

Spring

Lecturer: Prof Tuomo Karvonen

Contents: Numerical solution of ordinary differential equations and partial differential equations. Parameter estimation in modelling. Basics of linear and dynamic programming. Optimal design of field experiments.

Prerequisites: Yhd-12.106

Language: Finnish; individual study in English possible.

Yhd-12.114 Applied Limnology (3 ocr)

Spring

Lecturer: Jari Männynsalo, M.Sc.

Contents: Introduction to surface water quality. Currents and stratification of lakes. Water chemistry. Aquatic ecosystems. Basic research methodology. Relations to water use.

Requirements: Examination. Laboratory assignments.

Literature: To be announced later.

Language: Finnish; individual study in English possible.

Yhd-12.116 Hydraulic Structures (4 ocr)

Spring

Lecturer: Juha Järvelä, teaching researcher

Contents: Functional and design of on key hydraulic structures. Special emphasis is put on dams, hydropower plants, waterways, and coastal engineering.

Examination: Autonomous course assignments. Two exams. Grade = (0.5 x grade of exams) + (0.5 x grade of assignments). Note: course runs from autumn to spring.

Literature: P.Novak, A.Moffat, C. Nalluri & R. Narayanan 2001. Hydraulic Structures. 3rd edition Spon Press. Other literature announced during lectures.

Prerequisites: Yhd-12.108, Yhd-12.121

Language: Finnish; individual study in English possible.

Yhd-12.118 Statistical Methods in Water Resources Engineering (2 ocr)

Spring (odd years)

Lecturers: Juhani Kettunen, Docent

Contents: Stochastic processes. Dynamic Systems. Modelling. Forecasting. Methods based on correlation structure. Applications.

Requirements: Exam. Assignments.

Literature: Handouts.

Prerequisites: Yhd-12.106

Language: Finnish; individual study in English possible.

Yhd-12.121 Hydraulics (3 ocr)

Spring

Lecturer: Prof Tuomo Karvonen

Contents: Basic principles of flow in open channels. Steady and unsteady flow in channels. Numerical solution methods in river hydraulics. Basic principles of pipe hydraulics.

Literature: To be announced later.

Language: Finnish; individual study in English possible.

Yhd-12.122 Subsurface Hydrology (3 ocr)

Autumn

Lecturer: Prof Tuomo Karvonen

Contents: Basic principles of flow in aquifers. One-dimensional and two-dimensional modelling of flow in confined and unconfined aquifers. Unsaturated flow in subsurface waters.

Literature: To be announced later.

Language: Finnish; individual study in English possible.

Yhd-12.124 Material Transport I (3 ocr)

Spring

Lecturer: Prof Tuomo Karvonen

Contents: Theory of mixing in rivers. Modelling the influence of hydrodynamic dispersion and advection in rivers. BOD-oxygen model in rivers. Transport of nitrogen in rivers. Sediment transport in rivers. Basic concepts of flow in lakes and estuaries.

Literature: To be announced later.

Prerequisites: Yhd-12.106, Yhd-12.112

Language: Finnish; individual study in English possible.

Yhd-12.126 Material Transport II (3 ocr)

Autumn

Lecturer: Prof Tuomo Karvonen

Contents: Theory of adsorption, dispersion and diffusion in soils. Phosphorus and nitrogen transport in soils. Transport, adsorption and degradation of organic compounds in soils. Adsorption of heavy metals in soils. Solute movement in groundwaters.

Literature: To be announced later.

Prerequisites: Yhd-12.106, Yhd-12.112, Yhd-12.122

Language: Finnish; individual study in English possible.

Yhd-12.130 Water Resources Systems Analysis and Planning (3 ocr)

Spring

Lecturers: Prof. Ari Jolma, Prof Pertti Vakkilainen

Contents: Flow forecasting and frequency analysis; synthetic flow timeseries, storage theory, planning and management of storage reservoirs, management of pollution and restoration of rivers and lakes.

Requirements: Literature survey. Assignments. Examination.

Literature: Announced on lectures.

Prerequisites: Yhd-102.112, Yhd-12.114 (recommended)

Language: Finnish; individual study in English possible.

Yhd-12.132 Drainage and Irrigation (3 ocr)

Autumn (odd years)

Lecturer: Prof Pertti Vakkilainen

Contents: Composition and structure of soil. Water content and potential. Water movement in soil. Plant-soil-water interaction. Design of drainage. Design of irrigation. Economic feasibility of soil conservation projects.

Requirements: Examination. Assignments.

Literature: To be announced later.

Prerequisites: Yhd-12.106

Language: Finnish; individual study in English possible.

Yhd-12.133 Environmental River and Wetland Engineering and Restoration (3 ocr)

(Period) autumn (even years).

Lecturers: Juha Järvelä, teaching researcher, and special teachers
Contents: Ecohydraulics, fluvial geomorphology, ecology, and landscape architecture from interdisciplinary point of view. Guiding principles for environmental river and wetland engineering. Rehabilitation and restoration of running waters. Wetlands and buffer zones. Urban hydrology. Hydraulic design of environmental channels. Bioengineering and environmentally preferable construction materials and .

Examination: Final exam. Course assignments.

Literature: Jormola, J. ym. 2003. Luonnonmukainen vesirakentaminen - Uusia näkökulmia vesistösuunnitteluun. SYKE, Suomen ympäristö 631; Järvelä, J. 1998. Luonnonmukainen vesirakennus. TKK-VTR-1 and other literature announced during lectures

Prerequisites: Yhd-12.106, Yhd-12.114, Yhd-12.121
Language: Finnish; individual study in English possible.

Yhd-12.135 Special Course in Hydrology (3 ocr)

Spring (odd years)

Lecturers: Prof Tuomo Karvonen, Harri Koivusalo Dr.Sc. (Tech.)

Contents: The hydrological cycle. Accumulation and melting of snow. Conceptual hydrological models. Semi-distributed and distributed hydrological models. Utilization of GIS and digital elevation data in hydrological models.

Literature: To be announced later.

Prerequisites: Yhd-12.106, Yhd-12.121

Language: Finnish; individual study in English possible.

Yhd-12.136 Global Water Problems (2 ocr)

Autumn (odd years)

Lecturers: Prof Pertti Vakkilainen, Olli Varis, Docent

Contents: Climate change and impacts on hydrological phenomena. Acidification. Sufficiency of world water resources. Relations between water and food production. Water problems in developing countries.

Requirements: Exam. Group assignment. Seminar.

Literature: To be announced later.

Prerequisites: Yhd-12.106

Language: Finnish; individual study in English possible.

Yhd-12.138 Offshore and Inshore Constructions in Arctic Environment (2ocr)

Autumn (odd years)

Lecturer: Esa Eranti, Dr.Sc. (Tech)

Contents: Cold and arctic hydraulic engineering. Ice as a loading factor. Design of offshore and inshore structures. Materials. Tide effects in arctic environment. Erosion due to waves and currents.

Requirements: Exam. Assignments.

Literature: Eranti E.& Lee C 1988 Cold Region Structural Engineering

Prerequisites: Yhd-12.108

Language: Finnish; individual study in English possible.

Yhd-12.145 Special Assignment in Hydraulic Engineering (2-6 ocr)

Autumn & spring

Lecturers: Prof Pertti Vakkilainen, Prof Tuomo Karvonen

Contents: Research assignment.

Requirements: Independent research report.

Language: Finnish; individual study in English possible.

Yhd-12.151 Assessment and Evaluation of Impacts of Water Resources Projects (3 ocr)

(Period) autumn

Lecturer: Prof Pertti Vakkilainen

Contents: Assessment of socio-economic and environmental impacts. Multi-objective decision making. Preference analysis of objectives. Risk analysis. Juridical procedures of water projects in Finland.

Requirements: Exam. Seminar assignment.

Literature: Äijö et al. 1992 Hyödyn ja vahingon arviointi. Handouts.

Prerequisites: Yhd-12.106

Language: Finnish; individual study in English possible.

Yhd-12.171 Special Assignment in Hydrology (2-6 ocr)

Autumn & spring

Lecturer: Prof Pertti Vakkilainen

Contents: Research assignment.

Requirements: Independent research report.

Language: Finnish or English

Yhd-12.173 Seminar on Water Resources Engineering (2 ocr)

Autumn + spring

Lecturer: Prof Pertti Vakkilainen

Contents: Literature study on topics chosen by students

Requirements: Written report and oral presentation.

Language: Finnish or English

Yhd-12.181 Postgraduate Seminar on Water Resources Engineering (2-6 ocr) P V

Autumn + spring

Lecturer: Prof Pertti Vakkilainen

Contents: Literature study on advanced topics chosen by graduate students

Requirements: Written report and oral presentation.

Language: Finnish or English

Yhd-33 GEOENVIRONMENTAL TECHNOLOGY (ENGINEERING GEOLOGY AND APPLIED GEOPHYSICS)

Prof: (Engineering Geology) Kirsti Loukola-Ruskeeniemi tel. 451 2720, room V 159

Prof: (Geophysics) Markku Peltoniemi, tel. 451 2730, room V 158

Courses credited in ECTS

Yhd-33.1600 Introduction to Engineering Geology (4 cr)

autumn

Lecturer: Eevaliisa Laine, Sr Lecturer; Prof Markku Peltoniemi and Tero Hokkanen, Lic Tech. and visiting lecturers

Contents: Identification of most common minerals, rock and soil types. Geological processes and their impact on rock and soil properties in civil and environmental engineering. Mapping of geological rock and soil formations, and rock and soil classification systems for civil engineering applications.

Requirements: Lectures, practicals, final examination.

Literature: Handouts; virtual-geology webpages; Press, Siever, Crotzinger and Jordan: Understanding Earth 2004; Mussett and Khan: An Introduction to Geological Geophysics 2000; Salonen, Eronen and Saarmisto: Käytännön maaperägeologia 2002; complementary literature.

Language: Finnish

Yhd-33.2110 Principles of Applied Geophysics (5 cr)

autumn

Lecturer: Prof Markku Peltoniemi

Contents: Introduction of techniques applied to geophysical surveys within minerals exploration, rock engineering and environmental studies. Basics on the theory, petrophysics, instrumentation, data acquisition, and processing and interpretation for the most commonly used geophysical techniques.

Requirements: Lectures, practicals, final examination.

Literature: Peltoniemi: Maa- ja kallioperän geofysikaaliset tutkimusmenetelmät, Otakustantamo 515, 1988; Bårs: Sovelletun geofysiikan laskuharjoituksia, TKK-IGE C16 1993; complementary literature.

Language: Finnish

Yhd-33.2290 Environmental geology (3 cr)

spring, will be lectured annually from spring 2008 onwards

Teacher: Prof. Kirsti Loukola-Ruskeeniemi

Contents: Principles and concepts in environmental geology. Influence from man's activities on groundwater and soil, and estimation of their economic consequences.

Requirements: Exercises, examination.

Literature: Handouts; with complementary literature.
Prerequisites: Yhd-33.1600.
Language: Finnish

Yhd-33.2550 Structural geology (4 cr)

autumn, will be lectured annually from autumn 2007
Teachers: Eevaliisa Laine, Sr Lecturer and visiting lecturers
Contents: Structures and deformations in bedrock. Presentation of tectonic observations using stereographic projections. Basics of statistical analysis of directional data. Application of structural geology in rock engineering, environmental geology, and hydrogeology.
Requirements: Learning diary or final exam, exercises.
Literature: Park: Foundations of Structural Geology, 2000; complementary literature.
Prerequisites: Yhd-33.1600.
Language: Finnish

Yhd-33.2580 Exercises in applied geology and geophysics (3 cr)

spring (period III-IV). Annually from spring 2008 onwards.
Teachers: Tero Hokkanen, Lic. Tech., senior lecturer Eevaliisa Laine and visiting lecturers
Contents: Identification of geological materials, conditions, and phenomena related to technical projects concerning the ground, managing and supervising necessary investigations, and presenting the results in accordance with the planning and execution of the project.
Requirements: Project report.
Literature: Articles from recent literature for the project topic in question.
Prerequisites: Yhd-33.1600.
Language: Finnish

Yhd-33.2610 Precambrian and Quaternary Geology (5 cr)

spring
Lecturer: Eevaliisa Laine, Sr Lecturer Prof Markku Peltoniemi and visiting lecturers
Contents: Precambrian and Quaternary geology of Finland. Geochemical and mineralogical composition, properties and surveying methods of Finnish rocks and soils, with methods of interpretation and display of results. Geological processes and their influence in engineering and environmental projects.
Requirements: lectures, practicals, final examination.
Literature: Handouts; virtual-geology webpages; Lehtinen-Nurmi-Rämö (toim.) Suomen kallioperä – 3000 vuosimiljoonaa 1998; complementary literature.
Language: Finnish

Yhd-33.3070 Theory of Geophysical Fields (4 cr)

autumn (every other year, will be lectured in autumn 2007)
Lecturer: Esko Eloranta, Docent
Contents: Electromagnetic and potential field theory as applied to geophysical fields.
Requirements: Exercises, and a learning diary or a final examination.
Literature: Eloranta: Geofysiikan kenttäteoria. STUK-A198, Säteilyturvakeskus 2003 chapters 1-7. (www.stuk.fi/julkaisut/stuk-a/stuk-a198.pdf)
Prerequisites: Undergraduate courses in physics and mathematics; Yhd-33.2110.
Language: Finnish

Yhd-33.3130 Airborne Geophysical Methods (3 cr)

spring
Lecturer: Prof Markku Peltoniemi
Contents: Planning of airborne geophysical surveys, utilisation of survey results. Aeromagnetic, airborne electromagnetic, and airborne gamma-ray spectrometric methods.
Requirements: Exercises, final examination.

Literature: Peltoniemi: Aerogeofysikaaliset menetelmät, TKK-IGE-C-20, 1998, 269 p; complementary literature.
Prerequisites: Yhd-2110 or Mak-33.110.
Language: Finnish

Yhd-33.3140 Geophysical Methods in Environmental Studies (4 cr)

autumn
Lecturer: Tero Hokkanen, Lic.Tech.
Contents: Planning, execution and utilisation of geophysical methods in environmental studies with emphasis on electrical and radiometric methods. Groundwater and landfill surveys with geophysical methods; radon in the soil and air.
Requirements: Exercises, final examination.
Literature: Peltoniemi: Maa- ja kallioperän geofysikaaliset tutkimusmenetelmät, Otakustantamo 515, 1988, 411 p; complementary literature.
Prerequisites: Yhd-2110 or Mak-33.110.
Language: Finnish

Yhd-33.3150 Geophysical Ground Survey Methods (5 cr)

spring
Lecturer: Prof Markku Peltoniemi
Contents: Planning and execution of geophysical ground surveys for bedrock mapping and minerals exploration, utilisation and interpretation of survey results. Gravity, magnetic, and electromagnetic methods.
Requirements: Exercises, final examination.
Literature: Parasnis: Principles of Applied Geophysics, 5th ed., Kluwer 1996, 429 s.; complementary literature.
Prerequisites: Yhd-2110 or Mak-33.110.
Language: Finnish

Yhd-33.3180 Geophysical Methods in Civil Engineering Studies (3 cr)

spring
Lecturer: Prof Markku Peltoniemi
Contents: Planning, execution and utilisation of geophysical methods in civil and rock engineering studies with emphasis on seismic, electrical, and electromagnetic methods.
Requirements: Exercises, final examination.
Literature: Manual on Subsurface Investigations, FHWA NHI-01-031, National Highway Institute 2001, 305 p.; Burger: Exploration Geophysics of the Shallow Subsurface. Prentice Hall 1992, 489 p.; complementary literature.
Prerequisites: Yhd-33.2110 or Mak-33.110.
Language: Finnish

Yhd-33.3265 Geophysical Inversion Methods (4 cr)

autumn, (period I); every other year; will be lectured in autumn 2007)
Lecturer: assistant prof. Norbert Szabo
Contents: Inverse problem types and solutions using linear and global optimization methods. Forward modelling, constructing and analysing inversion procedures, validation of inversion results. Independent and joint inversion of geophysical data sets. Potential field and borehole geophysical applications. Software implementation.
Requirements: Assignments, an examination.
Literature: Menke: Geophysical Data Analysis, Discrete Inverse Theory. Academic Press 1989; additional material and software from University of British Columbia, Geophysical Inversion Facility; additional articles from recent geophysical journals
Prerequisites: Yhd-33.2110/Mak-33.110 and Yhd-33.3070/Mak-33.107.
Language: English

Yhd-33.3330 Seminar on Applied Geophysics (4 cr)

autumn
Lecturer: Prof Markku Peltoniemi

Contents: Planning and implementation of geophysical survey projects. Combined interpretation methods for geophysical datasets.

Requirements: Seminar presentation and report, an obligatory one-week field training course.

Literature: Articles from recent geophysical literature.

Prerequisites: Mak-33.110 and Mak-33.112 or Mak-33.114.

Language: Finnish

Yhd-33.3710 Hydrogeology (3 cr)

spring (period III-IV) will be lectured annually from spring 2009 onwards

Teacher: Sirkku Tuominen, Lic. Tech., and visiting lecturers

Contents: Hydrological cycle. Geological factors affecting groundwater amount and flow. Groundwater in civil engineering projects, groundwater modelling basics.

Requirements: Practicals, seminar report including an oral presentation.

Literature: H. och S. Niini: Vesigeologia TKK-IGE-C-17, 2000; Sovellettu hydrologia, Vesiyhdistys, 1986; handouts with complementary literature.

Prerequisites: Yhd-33.2610 and Yhd-33.2550

Language: Finnish

Yhd-33.3860 Applied geochemistry (3 cr)

autumn, will be lectured annually from autumn 2008 onwards

Teacher: prof. Kirsti Loukola-Ruskeeniemi

Contents: Principles of geochemistry. Chemical composition of bedrock, soil and watercourses. Principles of environmental geochemistry. Geochemical sampling procedures. Analytical methods, their applicability and limitations. Processing and visualisation of geochemical data.

Requirements: Practicals and examination.

Literature: Lecture handouts and complementary literature.

Prerequisites: Yhd-33.2610

Language: Finnish

Yhd-33.3870 Geomathematical methods (4 cr)

spring, will be lectured annually from spring 2008 onwards

Teacher: Eevaliisa Laine, Sr Lecturer

Contents: Mathematical modelling in geosciences. Application of statistical methods, fuzzy logic, neural networks and geostatistical methods in hydrogeology, environmental geology and ore geology.

Requirements: Learning diary.

Literature: Handouts with complementary literature.

Prerequisites: Yhd-33.1600.

Language: Finnish

Yhd-33.3880 Geological 3D-modelling (3 cr)

autumn, will be lectured autumn 2006 and annually from autumn 2008.

Teachers: Eevaliisa Laine, Sr Lecturer, and visiting lecturers

Contents: Geological 3D modelling starting from geological observations in outcrops. Presentation of geological structures using geometrical objects. Interpretation of geological sections combining sections into 3D models both manually and using 3D software.

Requirements: Learning diary.

Literature: Handouts with complementary literature.

Prerequisites: Yhd-33.1600 and Yhd-33.2550.

Language: Finnish

Yhd-33.3890 Practical exercises in geoenvironmental technology (3 cr)

spring, periods III-IV. Annually from spring 2009.

Teachers: Tero Hokkanen, Lic. Sc. (Tech), Eevaliisa Laine, Sr Lecturer and visiting lecturers.

Contents: Geological, geophysical, geochemical and geomathematical research methods. Field exercises and project work in geoenvironmental technology.

Requirements: Geological and geophysical field work and project report.

Literature: Articles from recent literature in project topics in question.

Prerequisites: Yhd-33.2580.

Language: Finnish

Yhd-33.3910 Geostatistics (4 cr)

autumn (period I-II), will be lectured annually from autumn 2008 onwards

Teacher: Eevaliisa Laine, Docent

Contents: New geostatistical methods applied to geochemical data.

Requirements: Learning diary, examination.

Literature: Lecture notes.

Prerequisites: Yhd-33.3870

Language: English

Yhd-33.3920 Geochemistry (5 cr)

Spring, periods III-IV, will be lectured annually from spring 2009 onwards

Teacher: prof. Kirsti Loukola-Ruskeeniemi

Contents: Elements and isotopes. Principles of thermodynamics. Geochemical processes related to, for example, water-rock interaction, weathering, acid mine drainage. Geochemical sampling procedures. Analytical methods, their applicability and limitations. Processing and visualisation of geochemical data.

Requirements: Exam and exercises.

Literature: Selected articles and complementary literature

Prerequisites: Yhd-33.3860 (Sovellettu geokemia)

Language: English

Yhd-33.3930 Modelling in Applied Hydrogeochemistry (5 cr)

Autumn, periods I-II, will be lectured annually from autumn 2009 onwards

Teachers: Visiting lecturers

Contents: Introduction to groundwater geochemistry, flow and transport, minerals and water, introduction to modelling program PHREEQC-2, silicate weathering and redox processes.

Requirements: Exam and exercises.

Literature: Appelo, C.A.J. and Postma, D. 2005 (2nd edition) Geochemistry, Groundwater and Pollution.

Prerequisites: Yhd-12.xxxx Computational Methods in Hydrogeochemistry, Yhd-33.3920

Language: English

Yhd-33.3940 Special Assignment in Applied Hydrogeochemistry (3 cr)

Spring, periods III-IV, will be organized annually from spring 2010 onwards

Teachers: Visiting lectures, prof. Kirsti Loukola-Ruskeeniemi and prof. Tuomo Karvonen

Contents: Research assignment related to selected topics. Brief literature review, analysis of the problem, evaluation of data available, computational analysis, presentation of the results, conclusions and summary.

Requirements: Independent research report related to selected topic.

Prerequisites: Yhd-12.xxxx Computational Methods in Hydrogeochemistry, Yhd-33.3910, Yhd-33.3920, Yhd-33.3930

Language: English

Yhd-33.4350 Postgraduate Course in Applied Geophysics (2-6 cr) P V

autumn + spring

Lecturer: Prof Markku Peltoniemi and visiting lecturers

Contents: Review and study of current developments in a chosen research area in geophysics.

Requirements: Seminar presentation and report on a chosen topic.

Literature: A set of recent geophysical literature, varying annually according to the chosen course topic
Prerequisites: Studies completed in Applied Geophysics Major, or equivalent studies.
Language: Finnish or English

Courses credited in ocr

Yhd-33.170 Postgraduate Course in Geology (3 ocr) P V
spring (Period)
Lecturer: Prof Kirsti Loukola-Ruskeeniemi and visiting lecturers
Contents: The seminar course broadens and deepens the student's knowledge either in geoenvironmental technology, engineering geology, or economic geology.
Requirements: Seminar work.
Literature: Depending on the topic of the seminar.
Prerequisites: Mak-33.155 and Mak-33.197 or equivalent Rak- or Yhd- courses.
Language: Finnish or English

Yhd-71 TRANSPORTATION ENGINEERING

Prof: Timo Ernvall, tel. 451 3800, room R 339
Prof: Matti Pursula (on leave of absence)
Prof (pro tem): Tapio Luttinen, tel. 451 3801, room R 338

Courses credited in ECTS

Yhd-71.2115 Transportation Policy and Economics (4 cr)
Autumn, first time in autumn 2007
Lecturer: Prof. Tapio Luttinen
Contents: Economic importance of transportation. Goal setting and decision making in transportation policy. Assessment of time, traffic accidents and environmental impacts. Economic calculations of transport investments. Market of transport services, tendering and pricing. Regional economic impacts.
Requirements: Exam. Compulsory calculation exercises.
Literature: Quinet, Vickerman: Principles of Transport Economics; lecture notes.
Language: Finnish; individual study in English possible.

Yhd-71.2120 Transportation System Planning (6 cr)
Autumn, first time in autumn 2007
Lecturers: Prof. Timo Ernvall, Nina Karasmaa, specialist researcher
Contents: Interaction of transportation and land use. Transportation system planning. Properties and planning of car transportation, public transport, pedestrian and bicycle transportation, and parking. Accessibility of transportation facilities. Transportation planning process. Comparison of planning alternatives.
Requirements: Exam. Compulsory planning exercises.
Literature: Lecture notes.
Language: Finnish; individual study in English possible.

Courses credited in ocr

Yhd-71.117 Transportation Economics (2 ocr)
(Period) autumn, last time in autumn 2006
Lecturer: Prof Tapio Luttinen
Contents: Economic importance of transportation. Assessment of time, traffic accidents and environmental impacts. Economic calculations of transport investments. Fixing of prices of transport services. Cost correspondence of transport sector.
Requirements: Exam. Compulsory calculation exercises (15 h).
Literature: Quinet, Vickerman: Principles of Transport Economics; Lecture notes.
Language: Finnish; individual study in English possible.

Yhd-71.122 Transportation Planning (3 ocr)
(Period) spring, last time in spring 2007
Lecturer: Prof Timo Ernvall, Nina Karasmaa, specialist researcher
Contents: Properties and planning of systems of car transportation, public transport, pedestrian and bicycle transportation and parking. Transportation planning process. Comparison of planning alternatives. Transport policy. Interaction between transportation and land use.
Requirements: Exam. Compulsory planning exercises (25 h).
Literature: Strömmer: Taajamien liikennesuunnittelun perusteet; Lecture notes.
Language: Finnish; individual study in English possible.

Yhd-71.126 Traffic Safety (2 ocr)
(Period) autumn, alternate years: even years.
Lecturer: Prof Timo Ernvall
Contents: Traffic accident statistics. Traffic safety programmes. Human in traffic. Vehicle technology. Traffic safety in transportation planning and design. Traffic safety studies.
Requirements: Exam. Compulsory calculation exercises and planning exercises (20 h).
Literature: Lecture notes.
Language: Finnish; individual study in English possible.

Yhd-71.128 Environmental Impacts of Transportation (2 ocr)
(Period) Autumn, alternate years: odd years.
Lecturer: Prof Timo Ernvall
Contents: Health effects and environmental impacts of traffic emissions and noise. Emission and noise sources. Emission reduction and noise prevention. Environmental aspects of different transport modes. Assessment of environmental and social impacts.
Requirements: Exam. Compulsory calculation exercises and planning exercises (20 h).
Literature: Lecture notes.
Language: Finnish; individual study in English possible.

Yhd-71.135 Traffic Studies and Forecasting (2 ocr)
(Period) autumn
Lecturer: Nina Karasmaa, specialist researcher
Contents: Mobility and origin-destination surveys. Sampling surveys. Trip generation, trip distribution and modal split modelling. Traffic assignment methods.
Requirements: Exam. Compulsory calculation exercises and forecast model making exercises (20 h).
Literature: Lecture notes; Ortuzar, Willumsen: Modelling Transport.
Language: Finnish; individual study in English possible.

Yhd-71.145 Traffic Flow Characteristics (2 ocr)
(Period) spring
Lecturer: Prof Tapio Luttinen
Contents: Traffic flow theories and models. Speeds. Time headway distributions. Principles of queueing theory. Calculation methods of capacity and delays.
Requirements: Exam. Compulsory calculation exercises and assignment (15 h).
Literature: Luttinen, Pursula, Innamaa: Liikennevirran ominaisuudet; Lecture notes.
Language: Finnish; individual study in English possible.

Yhd-71.148 Traffic Simulation (2 ocr) P
(Period) spring, alternate years: odd years
Lecturer: Isakki Kosonen, teaching researcher.
Contents: Basic concepts. Microscopic and macroscopic traffic flow simulation. Simulation of traffic control. Simulation of traffic demand. Computer programs and hardware.
Requirements: Exam. Compulsory simulation exercises (20 h).
Literature: Kosonen: HUTSIM - Simulation tool for traffic signal control planning; Pursula: Niittymäki, Ojala (ed.): Liiken-

netekniikan seminaari 1999-2000, Liikenteen simulointi; Lecture notes.

Language: Finnish; individual study in English possible.

Yhd-71.150 Traffic Control (2 ocr)

(Period) spring

Lecturer: prof. Tapio Luttinen, Kari Sane, specialist teacher.

Contents: Basic concepts of traffic control. Road traffic legislation. Driver information systems. Traffic signal control. Public transport priorities. Traffic management. Transport telematics in control and management.

Requirements: Exam. Compulsory calculation exercises and planning exercises (15 h).

Literature: Traffic laws and statutory regulations; Lecture notes.

Language: Finnish; individual study in English possible.

Yhd-71.152 Public Transport (2 ocr)

Spring, alternate years: even years

Lecturer: Prof. Tapio Luttinen

Contents: Legislation and organisations. Level of service. System and line structure planning. Operation of transport and costs. Terminals and rolling stock. Public transport telematics.

Requirements: Exam. Compulsory calculation exercises and planning exercises (20 h).

Literature: Ojala, Pursula: Taajamien joukkoliikenteen suunnittelu ja hoito. Lecture notes.

Language: Finnish; individual study in English possible.

Yhd-71.161 Freight Transportation Systems (4 ocr)

(Period) Autumn

Lecturer: Prof Timo Ernvall

Contents: Freight transportation system of Finland. Demand of freight transportation. Technical characteristics and cost structures of freight transportation systems. Special features of different transport modes. Intermodal and multimodal transportation. Planning and operation of freight transportation.

Requirements: Exam. Compulsory exercises.

Literature: Lecture notes and literature announced during lecture period.

Language: Finnish; individual study in English possible.

Yhd-71.166 City Logistics (2 ocr)

(Period) Spring, alternate years: even years

Lecturer: Prof Timo Ernvall, Markku Haikonen, specialist teacher

Contents: Delivery systems and rolling stock. Goods delivery. Transport of waste. Freight transport and city planning. Transportation in restricted areas. Taxi and other service transportation. Route optimisation.

Requirements: Exam. Compulsory exercises.

Literature: Lecture notes and literature announced during lecture period.

Prerequisites: TU-22.201, Yhd-71.161

Language: Finnish; individual study in English possible.

Yhd-71.171 International Freight Transport (2 ocr)

(Period) spring, alternate years: odd years

Lecturer: Prof Timo Ernvall, Markku Haikonen, specialist teacher

Contents: Special features of Finnish international freight transport. Freight transport and related regulations in EU. Planning of international freight transport. Expediting.

Requirements: Exam. Compulsory exercises.

Literature: Lecture notes and literature announced during lecture period.

Prerequisites: TU-22.201

Language: Finnish; individual study in English possible.

Yhd-71.177 Transport Telematics (2 ocr)

(Period) autumn

Lecturer: Iisakki Kosonen, teaching researcher.

Contents: Traffic management. Traffic and travel information. Vehicle telematics. Booking and payment. Freight and fleet management. Public transport telematics. Information systems and techniques of transport telematics.

Requirements: Exam. Compulsory exercises. Individual literature survey.

Literature: Pursula, Karasmaa, Ojala (ed.): Liikennetekniikan seminaari 1998-1999, Liikenteen telematikka; Lecture notes.

Language: Finnish; individual study in English possible.

Yhd-71.180 Transportation Engineering, current topics (1 ocr)

P V

(Period) autumn

Lecturer: Prof Timo Ernvall, N.N., specialist teacher

Contents: Advanced topical issues. Contents and teachers change annually.

Requirements: Exam.

Literature: Lecture notes, lecture hand-outs.

Language: Finnish; individual study in English possible.

Yhd-71.185 Transportation Engineering, special assignment (4 ocr)

(4 ocr) autumn + spring

Lecturer: Prof Timo Ernvall, Prof Tapio Luttinen

Contents: Research and planning assignments in the field of transportation engineering

Requirements: Individual assignment.

Language: Finnish, English

Yhd-71.190 Seminar on Transportation Engineering (2 ocr)

Autumn + spring

Lecturer: Prof Timo Ernvall, Prof Tapio Luttinen

Contents: Basics of technical writing. Presentation, professional discussion, meeting and conference techniques.

Requirements: Preparing a written paper and giving an oral presentation. Participation in seminars and accomplishment of tasks (presentation, opponent, chairman and secretary).

Language: Finnish; individual study in English possible.

Yhd-71.196 Postgraduate Seminar on Transportation Engineering (2-4 ocr) P V

Autumn + spring

Lecturer: Prof Timo Ernvall, Prof Tapio Luttinen

Contents: Education for degrees of licentiate and doctor by lessons and seminar presentations.

Requirements: Case dependent, either exam, literature survey or literary and oral presentation.

Language: Finnish; individual study in English possible.

Yhd-73 ENVIRONMENTAL ENGINEERING

Prof: Heikki Kiuru, tel. 451 3840, Water Laboratory, room 278

Courses credited in ECTS

Yhd-73.2110 Fundamentals of water and wastewater treatment (5 cr)

(period) Lectured first time in 2007-2008

Lecturer: prof Heikki Kiuru

Contents: Fundamentals in water chemistry. Water quality in relation to purification: potable water and wastewater. Fundamental phenomena in water and wastewater purification

Requirements: laboratory and calculation exercises, examination.

Yhd-73.3205 Varying course on environmental engineering (1-6 cr) V

(1-6 cr) V

Content: The topic will change on each semester.

Requirements: seminar or examination or learning tasks depending on the topic

Yhd-73.3210 Basics of Environmental Engineering (5 cr)

Autumn

Lecturer: act. prof. Markku Pelkonen

Contents: Tasks of environmental technology. Municipal material and energy balances, waste minimization and waste material recovery. Management and handling of emissions and basics of restoration.

Requirements: learning tasks and examination.

Yhd-73.3215 Natural Resources and Environmental Impacts (6 cr)

Period, not lectured in 2006-2007

Lecturer: act. prof. Markku Pelkonen and guest lecturers

Contents: Natural resources and their use and the environmental problems. Natural material cycles. Movement and fate of contaminants, risk assessment and fundamentals of environmental toxicology.

Requirements: learning and calculation tasks and examination.

Yhd-73.3220 Social steering - environmental policy and legislation 4 cr

Period, not in program 2006-2007

Lecturer: Mari Pajunen and Helena Mälkki

Contents: Society's control system, legislation and agreements. Environmental permits and economic instruments, BAT. Fundamentals of environmental legislation (national, EU).

Requirements: learning tasks and examination

Yhd-73.3222 Design for Environment (5 cr) P

Autumn

Lecturer: Helena Mälkki

Contents: Consideration of environmental aspects in product design. Management of product chain and reduction of environmental impact. Material and energy use, optimization of product life cycle and costs. Management tools.

Requirements: learning tasks and examination

Yhd-73.3225 Life Cycle Techniques of Products Production Systems (5 cr)

Period, not in program 2006-2007

Lecturer: Helena Mälkki

Contents: Holistic management of products and productions systems. Life cycle thinking and assessment, life cycle utilization and application.

Requirements: seminar and learning tasks/ project work

YYhd-73.3227 Environmental business (4 cr)

Autumn

Lecturer: act. prof. Markku Pelkonen and specialist teachers

Contents: Environmental knowledge as a success factor in business. Quality thinking and environmental quality systems. Realization of development project.

Requirements: learning tasks and examination

Yhd-73.3230 Environmental engineering in production systems (4 cr)

Autumn

Lecturer: Prof. Olli Dahl, Helena Mälkki

Contents: Fundamentals of environmental technology in production. Energy production and emission management. Emissions from production systems and their handling. Utilization of byproducts and waste materials in processes.

Requirements: learning tasks and examination

Yhd-73.3240 Solid waste management I (4 cr)

Autumn

Lecturer: act. prof. Markku Pelkonen

Contents: Waste management systems and their applications. Fundamentals of waste treatment and their applications and disposal.

Requirements: learning tasks and examination

Yhd-73.3245 Solid waste management II (4 cr)

Spring

Lecturer: act. prof. Markku Pelkonen

Contents: Deepened questions about waste management systems and waste treatment processes.

Requirements: learning tasks and examination

Yhd-73.3250 Material recovery and recycling (3 cr)

Autumn

Lecturer: act. prof. Markku Pelkonen and specialist teachers

Contents: material recovery processes and their application in municipal and production waste management

Requirements: learning tasks and examination

Yhd-73.3255 Remediation of contaminated soil and groundwater (4 cr)

Spring

Lecturer: act. prof. Markku Pelkonen

Contents: Common contaminants and their properties. Characterization of contaminated soil and groundwater. Principles of remediation and treatment methods. Planning and life cycle questions.

Requirements: learning tasks, project work, examination

Yhd-73.3260 Wastewater systems and engineering (4 cr)

Spring

Lecturer: act. prof. Markku Pelkonen

Contents: Characteristics of wastewaters and wastewater systems. Treatment methods and their application. Modelling of biological processes.

Requirements: learning and calculation tasks, examination

Yhd-73.3270 Special assignment in solid waste and life cycle management (5 cr)

Spring

Lecturer: act. prof. Markku Pelkonen, Helena Mälkki

Contents: independent research task by student, assignment by the teachers

Yhd-73.3275 Master seminar course in environmental engineering and life cycle techniques (5 cr)

Autumn, in program 2007-2008

Lecturer: act. prof. Markku Pelkonen, Helena Mälkki

Contents: Scientific writing and information search. Seminar presentations by students in environmental engineering and life cycle techniques.

Requirements: own seminar presentation, acting as opponent and participation in seminars.

Yhd-73.3277 Experimental methods in environmental engineering (5 cr) P

Spring, in program 2007-2008

Lecturer: act. prof. Markku Pelkonen

Contents: application of experimental methods in questions related to environmental engineering.

Requirements: exercises and examination. Course is organised in Lahti and in Otaniemi main campus.

Yhd-73.3280 Postgraduate varying course in environmental engineering (1 – 6 cr) P V

Period

Lecturer: act. prof. Markku Pelkonen

Content: The course topic will change on each semester and is related to important actual questions.

Requirements: seminar or examination or research task depending on the topic

Courses credited in ocr

Yhd-73.107 Basics of Water and Wastewater Engineering (4 ocr)

(Period) autumn, last time in autumn 2006

Lecturer: prof Heikki Kiuru

Contents: Municipal water use, its variations, dimensioning and structures of water distribution system. Estimating waste water quantity, dimensioning and structures of sewerage. Water treatment processes and plants. Waste water treatment processes and plants. Regional design of water supply and sewerage.

Structure: Lecture and exercise period.

Literature: Hammer & Hammer: Water and Wastewater Technology, 1996

Language: Finnish.

Yhd-73.113 Applied Water Chemistry (3 ocr)

(Period) autumn, last time in autumn 2006

Lecturer: Anne-Mari Aurola, specialist teacher

Contents: Review of basic definitions. Special features of water chemistry. Analyses and procedures applied in evaluating the quality of surface, ground- and treated water. Physical, chemical and biochemical research methods for waste water. Accuracy, precision and interpretation of analyses.

Structure: Lecture and exercise period. Obligatory laboratory exercises.

Study materials: McCarthy, Sawyer: Chemistry for environmental engineering, McGraw-Hill 1994.

Prerequisites: Kem-35.109

Language: Finnish.

Yhd-73.115 Microbiology of Water and Waste Water Engineering (2 ocr)

(Period) autumn, last time in autumn 2006

Lecturer: Anne-Mari Aurola, specialist teacher

Contents: Basics of microbiology and microbial ecology. Microbiology of potable and waste water and treatment processes. Basics and methods of microbiological analyses.

Structure: Lectures.

Literature: Bitton: Wastewater Microbiology, Wiley-Liss 1994.

Language: Finnish.

Yhd-73.121 Environmental Hygiene (2 ocr)

Autumn (odd years)

Lecturer: Erkki Vuori, PhD

Contents: The physiological and other impacts of polluted environment on humans. The principles of defining the acceptable levels of harmful factors, limit values of noise and water and air pollution, viewpoints on the importance of the visual environment.

Structure: Lectures

Literature: Announced during lecture period.

Language: Finnish.

Yhd-73.133 Fundamentals of Water and Wastewater Treatment (3 ocr)

(Period) Spring, last time in spring 2007

Lecturer: Prof. Heikki Kiuru

Contents: Introduction to water and wastewater treatment. The physical properties of water and its physical behaviour – hydraulics and hydrodynamics. Chemistry of water: The most important chemical properties and impurities of water, as well as the chemical basic phenomena taking place in water and exploitation of these. Microbiology of water: the microbes living in water and their metabolism, as well as the microbial basic phenomena taking place in water and exploitation of these.

Structure: Lectures and exercises

Literature: Will be given during the lectures.

Language: Finnish.

Yhd-73.137 Water and Wastewater Treatment Processes and Plants (2 ocr)

(Period) Spring

Lecturer: Prof. Heikki Kiuru

Contents: Ground water intake and treatment processes, as well as plants for these activities. Surface water treatment processes and plants. Wastewater treatment processes and plants. Planning of water and wastewater treatment plants: Process design, general design and detailed design. Improvement: Subscribing and contracting. Using and operation of water and wastewater treatment plants.

Structure: Lectures.

Literature: Will be given during the lectures.

Prerequisites: Yhd-73.139

Language: Finnish.

Yhd-73.138 Water Supply and Distribution Systems as well as Sewerage Systems (3 ocr)

(Period) Autumn

Lecturer: Prof. Heikki Kiuru

Contents: Local drinking water and sewer networks. Raw water intake pipes and lines, disposal sewers, water and sewer lines. Water reservoirs, pressure increasing stations and wastewater pumping stations. Regional water supply and distribution, as well as sewerage systems. Long water and wastewater transfer lines. Chemical and biological activities in wastewater and their influence on water quality. Biological activities of wastewater taking place in sewers and taking it into account in wastewater treatment.

Structure: Lectures and exercises

Literature: Will be given during the lessons.

Language: Finnish.

Yhd-73.139 Unit Operations of Water and Wastewater Treatment (4 ocr)

(Period) Spring

Lecturer: Prof. Heikki Kiuru

Contents: Removal of solid wastes from water: screening and straining. Removal of suspended solids from water: Settling, flocculation, and filtration. Conversion of colloids to suspended solids or chemical coagulation. Chemical precipitation: Precipitation of dissolved metals and oxidised chemical compounds. Addition of substances and chemical compounds to water and wastewater, as well as changing of their chemical quality. Biological treatment of water and wastewater: Treatment of water and wastewater in the conditions containing oxygen – aerobic biological treatment. Treatment of wastewater in the conditions containing no oxygen – anaerobic biological treatment. Treatment of wastewater in the conditions containing oxygen bound to nitrate – anoxic biological treatment. Slow sand filtration and granular activated carbon filtration. Membrane technology in water and wastewater treatment. Disinfection of water and wastewater. Improving the quality of water.

Implementation of teaching: lectures and exercises

Literature: American Water Works Association: Water Quality and Treatment, 6. painos, 2000: Metcalf & Eddy, Wastewater Engineering, Treatment, Disposal, Reuse, 3. painos, 1991

Prerequisites: Yhd-73.113, Yhd-73.133

Language: Finnish; individual study in English possible.

Yhd-73.146 Design of Water and Wastewater Treatment Plants (3 ocr)

(Period) autumn + spring

Lecturer: Tommi Fred and Mari Heinonen, specialist teachers

Contents: General design of water and waste water treatment plants. Choice of process, dimensioning, hydraulic and structural design, principal design of automation, estimation of costs.

Structure: Design exercise.

Prerequisites: Yhd-73.139, Yhd-73.137

Language: Finnish.

Yhd-73.147 Organising Water and Wastewater Services (2 ocr)
(Period) Spring, (even years)

Lecturer: Teemu Vehmaskoski, specialist lecturer and guest lecturers

Content: Water and wastewater services in context and as a value chain. Efficiency and opening markets. Developments in other infrastructure branches. Waterworks as a business unit. Alternative ways to organise the service provision. The birth of the international water industry. Organisational modes in the Finnish water and wastewater services.

Requirements: Lectures, seminar assignment.

Literature: Vehmaskoski, Pietilä, Seppälä: Vesihuollon alueellinen operointi. Relevant English literature available upon request.

Prerequisites: Obligatory courses in Environmental Engineering major recommended.

Language: Finnish or English.

Yhd-73.161 Ground Water Technology (2 ocr)

(Period) spring (even years)

Lecturer: Unto Tanttu, specialist teacher

Contents: The necessary field examinations for evaluating the yield and quality of a ground water source. Hydraulic and structural design of wells, taking water from bedrock. Changes in the quality of water in soil both in natural conditions and in the production of artificial ground water. Artificial ground water plants, use of the ground as a unit operation of water treatment and for water storage. Ground water protection.

Structure: Obligatory exercise. No examination.

Literature: Announced during lecture period.

Prerequisites: Yhd-73.113, Yhd-73.115, Yhd-73.139).

Language: Finnish.

Yhd-73.165 Remediation of Contaminated Soil and Ground Water (2 ocr)

Spring (odd years)

Lecturers: prof. Markku Pelkonen and guest speakers

Contents: A general review of remediation situation in Finland. Common contaminants and their properties. Characterisation of contaminated soil and ground water. The principles and special features of the remediation of contaminated ground water, pump and treat- and in situ-methods. Remediation and treatment of contaminated soil. How to prepare a remediation plan.

Structure: lectures (in Finnish), excursion, project task.

Literature: Announced during lecture period.

Prerequisites: Yhd-73.113 (obligatory), (Yhd-73.115, Yhd-73.133 and Yhd-73.139)

Language: Finnish.

Yhd-73.170 Introduction to Municipal Solid Waste Management (2 ocr)

Autumn

Lecturer: prof. Markku Pelkonen

Contents: Development of municipal solid waste systems. Waste material flows, objectives of their management. Principal alternatives in waste collection, transport, treatment, recycling and disposal.

Structure: lectures (in Finnish), excursions and learning tasks

Literature: Tchobanoglous G. et al: Integrated Solid Waste Management. Mc-Graw-Hill 1994 (partly) and other material

Prerequisites: Yhd-73-121

Language: Finnish.

Yhd-73.172 Treatment and Disposal of Solid Wastes (2 ocr)

Spring (odd years)

Lecturer: prof. Markku Pelkonen

Contents: The recyclable components of municipal waste, their recovery and economics. Treatment and utilisation of organic waste. MSW as an energy source, technical and economical alternatives, environmental impacts. Alternatives for final disposal, environmental impacts of landfills.

Structure: Lecture period, laboratory/field exercise.

Literature: Tchobanoglous G. et al: Integrated Solid Waste Management. Mc-Graw-Hill 1994 (partly) and other material

Prerequisites: Yhd-73.170, (Yhd-73.115, Yhd-73.133 and Yhd-73.139)

Language: Finnish; individual study in English possible.

Yhd-73.173 Waste Management Systems (2 ocr)

(Period) spring (even years)

Lecturer: prof. Markku Pelkonen,

Contents: Background of system evaluation. Analysis and comparison of alternatives in waste collection and transport/transfer. Selection criteria for location of treatment facilities and disposal sites. Introduction to analysis of emissions and energy balances and costs of waste systems. Application of life cycle inventory and analysis.

Structure: Lecture period, exercises

Literature: Tchobanoglous G. et al: Integrated Solid Waste Management. Mc-Graw-Hill 1994 (partly) and other material

Prerequisites: Yhd-73.170

Language: Finnish; individual study in English possible.

Yhd-73.184 Special Assignment in Environmental Engineering (4 ocr)

Autumn + spring

Lecturers: prof Heikki Kiuru, prof. Markku Pelkonen,

Objectives: An introduction to the special problems of environmental engineering. Development of the student's skills of independent research work.

Contents: Research and design tasks in the field of environmental engineering. The assignments will be given by the Laboratory of Environmental Engineering.

Structure: The assignment will be carried out according to a research plan made by the student. The work consists of literature or experimental research. Written report.

Prerequisites: Depending on the assignment.

Yhd-73.185 Seminar on Environmental Engineering (2 ocr)

(Period) spring

Lecturer: prof Heikki Kiuru, prof. Markku Pelkonen

Contents: Presentations and discussions on chosen topics. The course has a different restricted topic each year.

Structure: Each participant writes a paper on a subject previously agreed upon. The course may content additional presentations held by guest speakers. To pass the course each participant shall give a presentation and be present at 3/4 of seminars.

Literature: The supervisor will aid in the choice of source material.

Prerequisites: All obligatory courses of water and waste water treatment or waste management.

Yhd-73.191 Postgraduate Seminar on Environmental Engineering (3-9 ocr) P V

(Period) autumn + spring

Lecturer: Prof Heikki Kiuru

Contents: Presentations and discussions on chosen topics.

Structure: The duration of the seminar is three terms. The themes of the terms are water treatment, waste water treatment, water distribution and collection systems and general topics of environmental engineering (organisation, administration, economy, etc.). Each participant gives a presentation on each theme.

Literature: The supervisor will aid in the choice of source material.

Prerequisites: M.Sc. degree with environmental engineering as main subject.

Yhd-73.195 Water Supply and Sanitation in Developing Countries (2 ocr)

(Period) spring (odd years)

Lecturer: Osmo Seppälä, specialist teacher

Contents: The particular problems of hygiene and public health in tropical and subtropical countries; technical solutions of environmental engineering suitable for developing countries; construction, operation, maintenance and administration of water and wastewater treatment plants; viewpoints on the impact of social structures and culture on water supply and sanitation. Structure: Lecture period. Obligatory exercise. No examination. Literature: Announced during lecture period. Prerequisites: Sufficient knowledge of the basics of environmental engineering.

Yhd-102 ENVIRONMENTAL PROTECTION

Prof.: Janne Hukkinen, tel. 451 3975, Otakaari 8, room 225

Courses credited in ECTS

Yhd-102.1104 Introduction to Environmental Management
(3 cr)
Autumn

Lecturer: Prof. Janne Hukkinen and guest lecturers
Contents: The course aims at motivating new students to understand environmental issues relating to technology. Themes include (1) global environmental changes and (2) interactions between technology, society and the environment. Specific themes in the course include climate change, population growth and the environment, global water issues, international environmental law, environmental management, environmental policy instruments, environmental impact assessment and sustainable development.

Requirements: Exam.

Literature: Miller, G.T. jr.: Living in the environment, 8th or later edition, International Thomson Publishing. Lecture material

Prerequisites: General studies in chemistry and physics recommended.

Language: Finnish, literature and lecture notes in English.

Courses credited in ocr

Yhd-102.118 Industrial Ecology (2-4 ocr)
Spring

Lecturer: Prof. Janne Hukkinen and guest lecturers
Contents: Introduction to ecological concepts, introduction to technological systems, introduction to industrial ecology, examples of industrial ecosystems, possibilities to apply industrial ecology in planning, institutional and organisational dimensions of industrial ecology.

Requirements: Web-based assignments.

Literature: Announced before lecture. Lecture material (in English).

Prerequisites: Yhd-102.104 Introduction to Environmental Management.

Language: Finnish, literature and lecture notes in English.

Yhd-102.125 Environmental Strategies (4 ocr) P
Autumn

Lecturer: Prof. Janne Hukkinen and guest lecturers
Contents: Ecological structural change and incremental environmental improvement, environmental policy in public and private sector, command and control regulation in environmental protection, environmental agreements, economic instruments in environmental policy, institutional design in environmental management, strategic environmental impact assessment, environmental auditing, life cycle assessment, environmental management systems.

Requirements: Assignments, exam.

Literature: Hukkinen, J., Institutions in Environmental Management, Routledge, 1999. Lecture material (in English).

Prerequisites: Yhd-102.104 Introduction to environmental management.

Language: Finnish, literature and lecture notes in English.

Yhd-102.127 Social and Environmental Implications of Technology (4 ocr) P

Spring

Lecturer: Prof. Janne Hukkinen and guest lecturers

Contents: Technology as an ecosocial phenomenon, perspectives on technology studies, structure and functioning of organisations, institutions and technological systems, traditional and modern institutions in environmental management, high risk technologies, high reliability management, adaptive environmental management, high reliability ecosystem management, technological and social innovations.

Requirements: Assignments, exam.

Literature: Bijker, W.E., Hughes, T.P. and Pinch, T., The Social Construction of Technological Systems, MIT Press, 1987. Hukkinen, J., Institutions in Environmental Management, Routledge, 1999. Lecture material (in English).

Prerequisites: Yhd-102.104 Introduction to environmental management.

Language: Finnish, literature and lecture notes in English.

Yhd-102.128 Advanced Studies in Environmental Strategies and Technology Assessment (4 ocr)

Autumn and spring

Lecturer: Prof. Janne Hukkinen

Contents: Comprehensive independent research or planning project in the field of environmental strategies or technology assessment. The project is reported in writing. Topic as agreed with the lecturer.

Requirements: Written report.

Literature: As per agreed with the lecturer.

Prerequisites: Yhd-102.125 and Yhd-102.127 or equivalent knowledge.

Language: Finnish.

Yhd-102.133 Postgraduate Studies in Environmental Strategies (6 ocr) P

Autumn and spring

Lecturer: Prof. Janne Hukkinen

Contents: Postgraduate studies in environmental strategies. Detailed content agreed with the lecturer.

Requirements: Exam.

Literature: As agreed with the lecturer.

Prerequisites: Yhd-102.125 and Yhd-102.127 or equivalent knowledge.

Yhd-102.135 Postgraduate Studies in Technology Assessment (6 ocr) P

Autumn and spring

Lecturer: Prof. Janne Hukkinen

Contents: Postgraduate studies in social and environmental implications of technology. Detailed content agreed with the lecturer.

Requirements: Exam.

Literature: As agreed with the lecturer.

Prerequisites: Yhd-102.125 and Yhd-102.127 or equivalent knowledge.

Yhd-102.138 Postgraduate Seminar in Environmental Strategies (4-8 ocr) P

Autumn and spring

Lecturer: Prof. Janne Hukkinen, Prof. Yrjö Haila and Prof. Raimo Lovio

Contents: Interdisciplinary postgraduate seminar in environmental protection, environmental strategies, environmental policy, and environmental management, organized in collaboration with postgraduate students in environmental policy at the University of Tampere and postgraduate students in environmental

management at the Helsinki School of Economics and Business Administration.

Requirements: Written and oral seminar presentation and participation in seminar. Guest lecturers possible.

Literature: As agreed with the lecturers.

Prerequisites: Yhd-102.125 and Yhd-102.127 or equivalent knowledge.

Yhd-102.140 Individual Postgraduate Studies in Environmental Strategies (5 - 10 ocr) P

Autumn and spring

Lecturer: Prof. Janne Hukkinen

Contents: Individual postgraduate studies in environmental strategies or technology assessment. Content as agreed with the postgraduate advisors.

Requirements: As agreed (e.g. exam, research paper, literature analysis).

Literature: As agreed with postgraduate advisors.

Prerequisites: Yhd-102.125 and Yhd-102.127 or equivalent knowledge.

Yhd-102.311 Introduction to Futures Studies (5 ocr) P

Autumn

Lecturer: Mikko Rask

Contents: Course by the Finnish Futures Studies Academy at HUT. Fundamentals of futures research, including history, key concepts and theories, research methods and directions. Key economic, social, technological, environmental and political questions from the viewpoint of the future.

Requirements: Guided self study, participation in study groups, and assignment.

Literature: Material provided by Finnish Futures Studies Academy and related literature.

Yhd-102.312 Methods of Futures Studies (2-5 ocr) P

(Period) spring

Lecturer: Mikko Rask

Contents: Advanced course in methods of futures studies. Conducted primarily in English.

Requirements: To be announced.

Literature: Material provided by Finnish Futures Studies Academy and related literature (in English).

Prerequisites: Yhd-102.311.

Yhd-102.313 Methods of Futures Studies in Practice (5 ocr) P

Lecturer: Mikko Rask

Contents: Comprehensive individual assignment.

Requirements: Written report.

Literature: Material provided by Finnish Futures Studies Academy and related literature.

Prerequisites: Yhd-102.311 and Yhd-102.312

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Head of Department: Prof Olli Simula, room B324, tel. 451 3271
 Administrative Manager: Ilse Koskinen, room C214, tel. 451 4800
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 Planning Officer (Degree Programme of Computer Science and Engineering): Tiina Kerola, room C213, tel. 451 3007
 Planning Officer (Degree Programme of Information Networks): Outi Hölttä, room C215, tel. 451 5188
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<http://www.tkk.fi/Units/CSE/>

Chairs:

T-61 Computer and Information Science
 T-76 Software Business and Engineering
 T-79 Theoretical Computer Science
 T-86 Information Technology
 T-93 Knowledge Engineering
 T-106 Software Techniques
 T-109, T-110 Telecommunications Software and Applications
 T-111 Interactive Digital Media, Contents Production
 T-121 Usability Research
 T-124 Information Networks
 T-128 Software Business

How to read the course codes: The courses are arranged by laboratories and they have a course code and name. The codes are of the form T-PRO.VNNN, where T comes from the Finnish name of the department (Tietotekniikan osasto = Department of Computer Science and Engineering), PRO is the professorship of the laboratory, V tells about the module (level of studies) and NNN identifies the individual courses. The bigger the number V of the module is (1-7), the more advanced the course is: 1=P module, 2=O module, 3=A1 module, 4=A2 module, 5=A3 module, 6=special course, 7=post-graduate course.

Please pay attention to the language of the instruction

Courses credited in ECTS

Please note that 1ocr = 1,5 ECTS credits

T-0 GENERAL STUDIES

T-0.1001 Orientation course in Computer Science and Engineering (2 cr)

Autumn

Lecturer: Lecturers from the Department of Computer Science and Engineering

Contents: Studying computer science at TKK. Planning of studies and goal-oriented studies, the structure of the degree, using the library, introduction of the department, using essential applications in Unix-, WWW- and MS Windows environments.

Requirements: Active participation, completed study plan, library use training, attendance on lectures and tutor meetings, compulsory assignments.

Literature: Please see course homepage.

Prerequisites: -

Additional information: Replaces the course T-0.020. Course homepage <http://www.hut.fi/Yksikot/Tieto/Opinnot/T-0.1001/Nyt/english.html>

Language: Finnish

T-0.3123 Computer and Operating System (6 cr)

Spring

Teacher: Aura Paloheimo

Contents: Basics on computer system and their parts, from processor architecture to system level and SW/HW interface.

Requirements: Exam and exercises.

Literature: Patterson & Hennessy: Computer Organization and Design. The Hardware/Software Interface, Third Edition, The Morgan Kaufmann. Lecture notes.

Prerequisites: S-88.1110/S-88.110

Language: Finnish

T-0.7050 Introduction to Postgraduate Studies in Computer Science (2 cr) P

Spring

Lecturer: Professors and researches from the Department of Computer Science and Engineering

Contents: Basic research skills. The publishing process. Scientific presentations. Research areas in computer science.

Requirements: Tutorial assignments and presentations, incl. design and presentation of personal research plan.

Additional: <http://www.tkk.fi/Yksikot/Tieto/Opinnot/T-0.7050/index.htm>

T901-K Bachelor's thesis seminar (10 cr)

T901-M Methodological principles (10 cr)

T-61 COMPUTER AND INFORMATION SCIENCE

Prof Erkki Oja, room B328, tel. 451 3265

Prof Olli Simula, room B324, tel. 451 3271

Prof Juha Karhunen, room B327, tel. 451 3270

Prof Heikki Mannila (on leave of absence), room B322

Prof Samuel Kaski, room A334, tel. 451 8203

Emer Prof Academician Teuvo Kohonen, room C315, tel. 451 3268

For complete descriptions of all courses and actual information, please refer to <http://www.cis.hut.fi/teaching/>.

Courses credited in ECTS

T-61.2010 From data to knowledge (4 cr)

Autumn (Period II)

Lecturer: Prof Heikki Mannila, Prof Erkki Oja

Contents: Introduction to the methods that can be used to obtain information from large data sets. Digital signal, speech and image processing, fundamentals of estimation and pattern recognition, neural networks and web-search methods and the structure of sequences.

Requirements: Examination and exercise work.

Literature: Announced later.

Prerequisites: Basic mathematics.

Language: Finnish. Individual study in English possible.

T-61.2020 From Data to Knowledge Exercise Project (1 cr)

Spring (Period III)

Lecturer: Prof Heikki Mannila, Prof Erkki Oja

Contents: Exercise project on the topics of course T-61.2010 From Data to Knowledge.

Requirements: Exercise work.

Literature: Announced later.

Prerequisites: T-61.2010

Language: Finnish. Individual study in English possible.

T-61.3010 Digital Signal Processing and Filtering (6 cr)

Spring

Lecturer: Prof Olli Simula

Contents: Principles of digital filtering: difference equations, transfer functions, and realization forms; digital filter design: FIR and IIR filters, finite word length effects, multirate systems.

Requirements: Examination (or part exam) and exercise work.

Literature: Mitra, 2005. Digital Signal Processing, 3rd edition. McGraw-Hill.

Prerequisites: Basic course in signal processing, e.g. T-61.2010, T-61.140 or S-72.1110/S-72.060.

Additional information: Replaces study period T-61.246 Digital Signal Processing and Filtering.

Language: Finnish. Individual study in English possible.

T-61.3020 Principles of Pattern Recognition (4 cr)

Spring (Period III)

Lecturer: Prof Erkki Oja

Contents: The course provides basic knowledge about statistical and neural network methods for pattern recognition and their applications.

Requirements: Examination and exercise work.

Literature: S Theodoridis, K. Koutroumbas, 2003. Pattern Recognition, 2nd edition. Academic Press.

Prerequisites: Basic mathematics and probability courses.

Language: Finnish. Individual study in English possible.

T-61.3030 Principles of Neural Computing (5 cr)

Spring (Period IV)

Lecturer: Kimmo Raivio, lecturing researcher

Contents: Introduction to neural networks, learning processes, single-layer networks, multi-layer perceptron networks and back-propagation algorithm, radial-basis function networks, self-organizing maps and learning vector quantization.

Requirements: Examination and exercise work.

Literature: S. Haykin, 1998. Neural Networks - A Comprehensive Foundation, 2nd edition. Prentice-Hall; Lecture Notes.

Prerequisites: Basic mathematics and probability courses.

Additional information: Replaces study period T-61.261 Principles of Neural Computing. The exercise work should preferably be completed before taking the examination.

Language: Finnish. Course material available in English. Individual study in English possible.

T-61.3040 Statistical Signal Modeling (5 cr)

Autumn

Lecturer: Petteri Pajunen, lecturing researcher

Contents: Modeling and filtering random processes, power spectrum, linear time-series models, and introduction to adaptive filtering.

Requirements: Examination and exercise work.

Literature: M. Hayes, 1996. Statistical Digital Signal Processing and Modeling. Wiley.

Prerequisites: Basic mathematics and probability courses.

Additional information: Replaces study period T-61.238 Statistical Signal Modeling.

Language: Finnish. Individual study in English possible.

T-61.5010 Information visualization (5 cr) P

Spring (Period III)

Lecturer: Kai Puolamäki, lecturing researcher

Contents: The course teaches how to visualize information effectively by using the statistical methods, combined with knowledge of the human perception and the basics of data graphics.

Requirements: Examination and exercise work.

Literature: Announced later; lecture notes.

Prerequisites: Basic mathematics courses.

Additional information: Replaces study period T-61.271 Information visualization.

Language: English.

T-61.5020 Statistical Natural Language Processing (5 cr) P

Spring

Lecturer: Krista Lagus, lecturing researcher

Contents: The course gives an overview of the application of statistical and adaptive methods for analysis of natural language, for example, the organization and search from text collections, language modeling for natural language recognition, syntactic and semantic analysis, probabilistic grammars and parsing, and statistical machine translation.

Requirements: Examination and exercise work.

Literature: C. Manning, H. Schütze, 1999. Foundations of Statistical Natural Language Processing. The MIT Press; Lecture notes.

Prerequisites: Basic mathematics and probability courses.

Additional information: Replaces study period T-61.281 Statistical Natural Language Processing

Language: Finnish. Individual study in English possible.

T-61.5030 Advanced Course in Neural Computing (5 cr) P

26 + 26 (2 + 2) Autumn

Lecturer: Prof Juha Karhunen

Contents: Theory of neural learning, committee machines, principal component networks, independent component analysis, methods based on statistical physics, neurodynamic programming, temporal feedforward networks, recurrent networks.

Requirements: Examination.

Literature: S. Haykin, 1998. Neural Networks - A Comprehensive Foundation, 2nd edition. Prentice-Hall.

Prerequisites: T-61.3030/T-61.261 and basic mathematics courses.

Additional information: Replaces study period T-61.263 Advanced Course in Neural Computing.

Language: Finnish. Course material available in English. Individual study in English possible.

T-61.5040 Learning Models and Methods (5 cr) P

Spring

Lecturer: Petteri Pajunen, lecturing researcher
 Contents: Basics on learning theories, support vector machine, Bayesian modeling, and basics on decision theory.
 Requirements: Examination and exercise work.
 Prerequisites: Basic mathematics and probability courses.
 Additional information: Replaces study period T-61.256 Learning Models and Methods.
 Language: English.

T-61.5050 High-Throughput Bioinformatics (5 or 7 cr) P
 Spring

Lecturer: Janne Nikkilä, lecturing researcher
 Contents: The course introduces computational and statistical methods for analyzing modern high-throughput biological data, in particular microarray data, and their use in systems biology. Necessary biological background is reviewed briefly.
 Requirements: Examination and exercise work.
 Literature: Announced later.
 Prerequisites: The basic mathematics courses; and S-114.2510 Computational Systems Biology or equivalent background.
 Additional information: The course has two variants, 5 or 7 cr. The longer contains exercise work.
 Language: English.

T-61.5060 Algorithmic methods of data mining (5 cr) P

Autumn (Lectured every other year; will be lectured 2007-2008)
 Lecturer: Prof Heikki Mannila
 Contents: The course covers general topics in data mining, such as pattern discovery, clustering of data, and approximation of probability distributions. A special emphasis is put on algorithmic techniques to analyze discrete data.
 Requirements: Examination and exercise work.
 Literature: Announced later.
 Prerequisites: T-106.1220/T-106.250 and basic mathematics courses.
 Additional information: Replaces the course T-122.103 Algorithmic Methods of Data Mining.
 Language: Finnish. Course material available in English. Individual study in English possible.

T-61.5070 Computer Vision (5 cr) P

Spring
 Lecturer: Jorma Laaksonen, docent
 Contents: Image forming, image geometry, low-level vision, motion perception, feature extraction, 2D area and 3D object representation, forming and recognition of structural patterns. The course gives an introduction to the use of computers in analysis of visual data.
 Requirements: Examination and exercise work.
 Literature: M. Sonka, V. Hlavac, R. Boyle, 1998. Image Processing, Analysis and Machine Vision, Second edition. Thomson; Lecture notes.
 Prerequisites: Basic mathematics courses, T-61.3020/T-61.231, T-61.5100/T-61.247.
 Additional information: Replaces study period T-61.233 Computer Vision.
 Language: Finnish. Individual study in English possible.

T-61.5080 Signal Processing in Neuroinformatics (5 cr) P

Autumn
 Lecturer: Ricardo Vigario, docent
 Contents: The goal of the seminar is to give an overview of some of the main biomedical signal processing techniques, with clear emphasis to EEG and MEG. There, we should see something about modeling, artifact identification and removal, nonparametric and model-based spectral analysis, segmentation and joint time-frequency analysis. Some closer attention will be given as well to the analysis of event related data. Additional topics include independent component analysis, biorhythms and sleep and synchrony. The material for these extra topics in the form of several journal papers.

Requirements: Announced later.
 Literature: Announced later.
 Prerequisites: Basic mathematics courses.
 Language: English.

T-61.5090 Image Analysis in Neuroinformatics (5 op) P

26 + 26 (2 + 2) III-IV
 Lecturer: Ricardo Vigario, docent
 Contents: The goal of the course is to give an overview of some of the main biomedical image processing techniques, with clear emphasis to neuronal data. Topics range from artifact removal and image enhancement to pattern classification and diagnostic decision.
 Requirements: Announced later.
 Literature: Announced later.
 Prerequisites: Basic mathematics courses.
 Language: English.

T-61.5100 Digital Image Processing (5 cr) P

Autumn
 Lecturer: Jorma Laaksonen, docent
 Contents: Basics of digital image processing, image transformations, image enhancement, restoration, encoding, segmentation, and analysis.
 Requirements: Examination and exercise work.
 Literature: Gonzalez-Woods, 2002. Digital Image Processing, 2nd edition. Addison-Wesley; Lecture notes.
 Prerequisites: Basic mathematics, T-61.3010/T-61.246.
 Additional information: Replaces study period T-61.247 Digital Image Processing.
 Language: Finnish. Individual study in English possible.

T-61.5110 Modeling biological networks (5-7 cr) P

Autumn (in academic year 2006-2007 arranged only according to agreement)
 Lecturer: Prof Samuel Kaski
 Contents: Models of biological cellular-level networks: gene regulation, signaling, metabolism. Methods for inference of networks from data, and prediction using the models. Mainly probabilistic and machine learning models.
 Requirements: To be agreed individually with the lecturer. First lecture course in 2007.
 Literature: Announced later
 Prerequisites: Basic mathematics courses; preferably also T-61.5050
 Additional information: The course has two variants, 5 or 7 cr. The longer contains exercise work.
 Language: English

T-61.5120 Computational genomics (4-7 cr) P

Autumn (in academic year 2006-2007 arranged only according to agreement)
 Lecturer: Prof Heikki Mannila, Prof Samuel Kaski
 Contents: Algorithms and models for biological sequences
 Requirements: To be agreed individually with the lecturer.
 Literature: Announced later
 Prerequisites: Basic mathematics courses, T-106.1220/T-106.250
 Language: English

T-61.5900 Computer and Information Science, Special Assignment (5-10 cr) V

Autumn (Period I) & Autumn (Period II) & Spring (Period III) & Spring (Period IV)
 Lecturer: Petteri Pajunen, lecturing researcher
 Contents: The purpose of this course is to prepare the student for individual work. The special assignment can be a laboratory work, design project, or literary survey from any of the fields of Computer and Information Science.
 Requirements: Approval of the work by the supervisor. Instructions will be provided by the supervisor.

Additional information: Replaces study periods T-61.195 Computer and Information Science, Special Assignment I and T-61.196 Computer and Information Science, Special Assignment II.

Language: Finnish or English.

T-61.6010 Special Course in Computer and Information Science I (3-7 cr) P V

Autumn

Lecturer: Prof Erkki Oja, Prof Olli Simula, Prof Juha Karhunen, Prof Heikki Mannila, Prof Samuel Kaski

Contents: Postgraduate level knowledge from one of the fields of computer and information science. The actual contents of the course vary from year to year. The course can be lectured, or arranged in seminar form.

Requirements: Announced later.

Literature: Usually some new study book or collection of articles.

Additional information: Replaces study period T-61.181 Special Course in Computer and Information Science I.

Language: English.

T-61.6020 Special Course in Computer and Information Science II (3-7 cr) P V

Spring

Lecturer: Prof Erkki Oja, Prof Olli Simula, Prof Juha Karhunen, Prof Heikki Mannila, Prof Samuel Kaski

Contents: Postgraduate level knowledge from one of the fields of computer and information science. The actual contents of the course vary from year to year. The course can be lectured, or arranged in seminar form.

Requirements: Announced later.

Literature: Usually some new study book or collection of articles.

Additional information: Replaces study period T-61.182 Special Course in Computer and Information Science II.

Language: English.

T-61.6030 Special Course in Computer and Information Science III (3-7 cr) P V

Spring

Lecturer: Prof Erkki Oja, Prof Olli Simula, Prof Juha Karhunen, Prof Heikki Mannila, Prof Samuel Kaski

Contents: Postgraduate level knowledge from one of the fields of computer and information science. The actual contents of the course vary from year to year. The course can be lectured, or arranged in seminar form.

Requirements: Announced later.

Literature: Usually some new study book or collection of articles.

Additional information: Replaces study period T-61.183 Special Course in Computer and Information Science III.

Language: English.

T-61.6040 Special Course in Computer and Information Science IV (3-7 cr) P V

Autumn

Lecturer: Prof Erkki Oja, Prof Olli Simula, Prof Juha Karhunen, Prof Heikki Mannila, Prof Samuel Kaski

Contents: Postgraduate level knowledge from one of the fields of computer and information science. The actual contents of the course vary from year to year. The course can be lectured, or arranged in seminar form.

Requirements: Announced later.

Literature: Usually some new study book or collection of articles.

Additional information: Replaces study period T-61.184 Special Course in Computer and Information Science IV.

Language: English.

T-61.6050 Special Course in Computer and Information Science V (3-7 cr) P V

Autumn

Lecturer: Prof Heikki Mannila

Contents: Postgraduate level knowledge from one of the fields of computer and information science, especially computational methods within data analysis. The actual contents of the course vary from year to year. The course can be lectured, or arranged in seminar form.

Requirements: Announced later.

Literature: Usually some new study book or collection of articles.

Additional information: Replaces study period T-122.101 Special Course in Computer and Information Science V.

Language: English.

T-61.6060 Special Course in Computer and Information Science VI (3-7 cr) P V

Spring

Lecturer: Prof Heikki Mannila

Contents: Postgraduate level knowledge from one of the fields of computer and information science, especially computational methods within data analysis. The actual contents of the course vary from year to year. The course can be lectured, or arranged in seminar form.

Requirements: Announced later.

Literature: Usually some new study book or collection of articles.

Additional information: Replaces study period T-122.102 Special Course in Computer and Information Science VI.

Language: English.

T-61.6070 Special course in bioinformatics I (3-7 cr) P V

Spring

Teacher: Prof Samuel Kaski, Prof Heikki Mannila, Prof Jaakko Hollmén (pro tem)

Contents: The purpose of this course is to give postgraduate level knowledge on bioinformatics or a related field. The actual contents of the course vary from year to year. The course can be lectured, or arranged in seminar form.

Requirements: To be announced later.

Literature: Usually some new study book or collection of articles.

Additional: Replaces the course T-61.188 Special Course in Bioinformatics I.

Language: English

T-61.6080 Special course in bioinformatics II (3-7 cr) P V

Autumn

Lecturer: Prof Samuel Kaski, Prof Heikki Mannila

Contents: The purpose of this course is to give postgraduate level knowledge on bioinformatics or a related field. The actual contents of the course vary from year to year. The course can be lectured, or arranged in seminar form.

Requirements: Announced later.

Literature: Usually some new study book or collection of articles.

Language: English.

T-61.6090 Special Course in Language Technology (3-7 cr) P V

Autumn

Lecturer: doc. Timo Honkela

Contents: The purpose of this course is to give postgraduate level teaching in some subfield of language technology. The precise topics of the course vary yearly. The course can be lectured or arranged in seminar form.

Requirements: The requirements are determined yearly

Literature: Usually some new study book or a collection of articles.

Additional information: Replaces study period T-61.186 Special Course in Language Technology.
Language: English.

T-61.6900 Individual Studies (1-10 cr) P V
Autumn (Period I) & Autumn (Period II) & Spring (Period III) & Spring (Period IV)
Lecturer: Prof Erkki Oja, Prof Olli Simula, Prof Juha Karhunen, Prof Heikki Mannila, Prof Samuel Kaski
Contents: The contents and extent of the course are to be agreed with the Professors before commencing the course. The contents may for instance include a postgraduate level exam on a text book in the field.
Requirements: According to agreement.
Additional information: Replaces study period T-61.190 Individual Course.
Language: Finnish or English.

Courses credited in ocr

For complete descriptions of all courses and actual information, please refer to <http://www.cis.hut.fi/teaching>

T-61.152 Seminar on Computer and Information Science (2 cr) V
Spring
Lecturer: Prof N.N.
Contents: The purpose of this seminar is to broaden the students ability to prepare, present and criticize presentations. The subjects concern some questions in modern computer and information science. The contents vary.
Requirements: Seminar presentation, written version of the presentation and active participation in the seminar.
Prerequisites: Other courses in the major. A suitable time for participation in the seminar is the 4th year of studies.
Language: Finnish

T-76 SOFTWARE BUSINESS AND ENGINEERING

Prof Reijo Sulonen, tel. 451 3223
Prof Juha Laine, tel. 451 6269
Prof Tomi Männistö (pro tem), tel. 451 3373

Note that the number of participants for the courses within the professorship T-76 can be limited. For complete descriptions of all courses and actual information, please refer to <http://www.soberit.hut.fi/english/Studies.html>.

Courses credited in ECTS

T-76.1143 Database Management (5 cr)
Spring (Period III)
Lecturer: Juha Puustjärvi, Docent
Contents: Basic concepts and methods in database systems. Special attention is paid to the design and implementation of databases based on the relational and object oriented models.
Requirements: Final examination and programming assignment.
Literature: To be announced later.
Prerequisites: T-106.250/253.
Additional information: Replaces former course T-76.143 Database Management.
Language: Lectured in Finnish. Weekly exercises also in English.

T-76.3601 Introduction to Software Engineering (5 cr)
Spring
Teacher: Teaching researcher Casper Lassenius

Contents: The course provides a broad, but practical view of major areas in software realization. Among others, the course deals with project specification, cost estimation and guidance, quality and quality control, software metering, process estimation and development. The course consists of lectures and exercises during which topics discussed during lectures are realized.
Requirements: Examination and exercises.
Literature: Roger S. Pressman: Software Engineering: A Practitioner's Approach, 6th edition. McGrawHill 2005.
Prerequisites: Basics in programming.
Additional information: Replaces former course T-76.601 Introduction to Software Engineering.
Language: English.

T-76.4115 Software Development Project I (5-6 cr)
Autumn + Spring (Period I-III)
Lecturer: researcher Jari Vanhanen
Contents: Studying software engineering tools and practices in the context of a software development project done as a team for a real customer. The project includes project planning, requirements specification, technical design, coding, quality assurance, system delivery and producing documentation related to the previous activities. Course participants generally work in activities related to the technical implementation of the system.
Requirements: project work
Literature: -
Prerequisites: T-76.3601 (mandatory), T-76.4602 (recommended)
Additional information: Students from the T-76.5115 course take the managerial roles in the projects. Together with T-76.5158 Special assignment (2 cr) replaces former course T-76.115.
Language: Finnish. Course material available in English.

T-76.4602 Software development methods (6 cr)
Autumn
Teacher: Marjo Kauppinen
Contents: The course provides basic understanding to software development methods in different development phases. After the course, the student will have a broad understanding of software development methods as a whole and can effectively participate in software development projects. The detailed topics will be announced later. The course consists of lectures and exercises during which topics discussed during lectures are realized.
Requirements: Examination and exercises.
Literature: To be announced later.
Prerequisites: T-76.3601.
Additional information: Replaces former course T-76.611 Software Design and Specification Methods, T-76.614 Software Product Management.
Language: Finnish. Course material available in English.

T-76.5050 Methods for Software Engineering Research (3-5 cr) P V
Arranged according to agreement
Lecturer: Prof (pro tem) Tomi Männistö
Contents: The goal is to introduce the participants to research methods, approaches and processes in software engineering. In addition, the course provides students practice on formulating research questions and planning empirical studies.
Literature: is announced later.
Prerequisites: T-0.1001
Additional information: Replaces former course T-76.050 Methods for software business and engineering research.
Language: Finnish. Course material and exams available in English

T-76.5115 Software Development Project II (6 cr)
Autumn + Spring (Period I-III)
Lecturer: researcher Jari Vanhanen
Contents: Studying software engineering tools and practices in the context of a software development project done as a team for

a real customer. The project includes project planning, requirements specification, technical design, coding, quality assurance, system delivery and producing documentation related to the previous activities. Course participants generally work as a project manager or in some other managerial role.

Requirements: project work

Literature: -

Prerequisites: T-76.4115 (mandatory), other software engineering courses at SoberIT (recommended).

Additional information: Students from the T-76.4115 course take the roles related to the technical implementation work.

Language: Finnish. Course material available in English.

T-76.5144 Managing data in the semantic web (4 cr)

Spring IV

Lecturer: Juha Puustjärvi, Docent

Contents: Basic concepts and methods of semantic web.

Requirements: Final examination.

Literature: To be announced later.

Prerequisites: T-76.2143

Language: Finnish. Course material available in English.

T-76.5150 Software Architectures (5 cr) P

Spring

Lecturer: Prof (pro tem) Tomi Männistö

Contents: The goal of the course is to introduce the students with software architectures. The course addressed the main rationale behind the use of software architectures, their design and the mechanism for describing and evaluating software architectures. The mechanisms are related to the different needs, such as qualities of the system, arising from stakeholders of the system.

Requirements: Exam and assignments.

Literature: To be announced later.

Prerequisites: T-76.3601, T-76.4602.

Additional information: Replaces former course T-76.150 Software Architectures.

Language: Finnish. Course material and exams available in English.

T-76.5158 Special Assignment in Software Engineering (2-10 cr) P V

Arranged according to agreement

Teacher: Prof Reijo Sulonen, Prof N.N, Prof N.N

Contents: Independent scientific essay on an assigned problem from the field of Software Engineering.

Additional information: Replaces former course T-76.158 Special Assignment in Software Engineering.

Language: according to agreement

T-76.5273 Seminar on Database Management (2-6 cr) P V

Autumn (Period I)

Lecturer: Juha Puustjärvi, Docent

Contents: The content of the course vary.

Additional information: Replaces former course T-76.273 Seminar on Database Management.

Language: Finnish

T-76.5612 Software Project Management (3 cr) P

Spring (Period III)

Teacher: Maria Paasivaara, researcher

Contents: Software project planning and management. Project organization, project/process models, different project types (bespoke, software product and distributed projects), communication and informing, planning, control and quality management. Subcontracting.

Requirements: Examination and assignments.

Literature: To be announced later.

Prerequisites: T-76.3601, TU-22.1120.

Additional information: Replaces former course T-76.612 Software Project Management

Language: Finnish. Course material available in English.

T-76.5613 Software testing and quality assurance (5 cr)

Autumn

Lecturer: Juha Itkonen

Contents: Basics of software testing, concepts, testing techniques and reviews. Test planning, management and tools. The role of testing in quality assurance and quality assurance as part of software process.

Requirements: Exam, exercises

Literature: Ilene Burnstein, "Practical Software Testing", Springer-Verlag, 2003.

Prerequisites: T-76.3601, T-76.4602

Additional information: Replaces former course T-76.613 Software Testing and Validation.

Language: Finnish. Course material available in English.

T-76.5615 Requirements engineering (2-4 cr) P

Autumn (Period I)

Lecturer: Sari Kujala

Contents: The goal of the course is to introduce requirements engineering, its processes and methods.

Literature: Sommerville, Ian, Software Engineering, 2001 (6th Ed.), pp. 98-145, articles.

Prerequisites: -

Additional information: Replaces former course T-76.652 Seminar on Requirements Engineering.

Language: Lectured in Finnish, course material available in English

T-76.5631 Software processes (3-5 cr) P

Spring (Period IV)

Lecturer: Kristian Rautiainen, researcher

Contents: The course presents in-depth areas of software process research, such as process modelling and process models, as well as process assessment and improvement. Some lectures are held by visitors from industry, who share their practical experiences.

Requirements: Exam

Literature: A collection of articles to be ordered separately + lecture slides

Prerequisites: T-76.3601

Additional information: Replaces former course T-76.631 Software processes. See Language below

Language: Lectured in Finnish, course material in English.

T-76.5632 Legal Issues in Computing (3-6 cr) P

Autumn (Period II)

Teacher: Prof. Juha Laine, researcher Ville Oksanen

Contents: The topics of this course will include legal issues in software engineering: IT-contracts, copyright and other intellectual property rights, legal problems with Internet, computer crimes etc.

Requirements: Examination and exercises

Literature: To be announced later.

Prerequisites: T-76.3601

Additional information: Replaces former course T-76.632 Legal Issues in Computing.

Language: Finnish. The lectures and most of the materials will be in Finnish. So it is hardly possible to pass this course without thorough knowledge of Finnish language.

T-76.5633 Special Course in Software Engineering (3-10 cr) P V

Teacher: Prof Reijo Sulonen, Prof N.N, Prof N.N

Contents: The contents of this course vary.

Additional information: Replaces former course T-76.633 Special Course in Software Engineering.

T-76.5650 Seminar in Software Engineering (3-5 cr) P V

Teacher: Prof Reijo Sulonen, Prof N.N

Contents: The contents of this course vary.

Additional information: Replaces former course T-76.650 Seminar in Software Engineering.

T-76.5651 Seminar on Distributed Software Development (3-5 cr) P V

Teacher: Maria Paasivaara, researcher

Contents: The contents of this course vary.

Additional information: Replaces former course T-76.651 Seminar on Distributed Product Development
Language: English.

T-76.5652 Seminar in requirements engineering (2-3 cr) P V

Autumn (Period II)

Lecturer: Sari Kujala

Contents: Independent scientific essay on an assigned problem from the field of requirements engineering.

Prerequisites: T-76.5615

Language: Finnish. Course material and assignments available in English

T-76.5653 Seminar in software product families (3-5 cr) P V

Teacher: Prof (pro tem) Tomi Männistö

Contents: The contents of this course vary.

Language: Finnish. Individual study in English possible only according to agreement

T-76.5699 Individual Studies in Software Engineering (2-10 cr) P V

Autumn + Spring

Teacher: Prof Reijo Sulonen, Prof N.N

Contents: The contents and extent of the course are to be agreed with a professor before commencing the course.

Additional information: Replaces former course T-76.656 Individual Studies.

Language: Finnish. Individual study in English possible only according to agreement.

T-76.5750 Seminar on Law and Technology (3 cr) P V

Autumn (Period II)

Teachers: Professor Juha Laine

Contents: Seminar on varying topics on Law and Technology.

Literature: To be announced later.

Examination: To be announced later.

Additional information: Replaces former course T-76.750 Seminar on Law and Technology.

Language: Finnish

T-76.5751 Special Writing Work on Law and Technology (3-6 cr) V

Teacher: Prof Juha Laine.

Contents: Independent writing work on Law and Technology. The subject and the extent of the work are to be agreed separately.

Literature: Agreed separately.

Examination: Thesis.

Additional information: Replaces former course T-76.751 Special Writing Work on Law and Technology.

Language: Finnish. Individual study in English possible only according to agreement.

T-76.5752 Legal Aspects of Electronic Commerce (3 cr) P

Autumn (Period II)

Teacher: Prof Juha Laine

Contents: Electronic commerce covers selling goods or services by electronic means. During the course different legal aspects of electronic commerce will be discussed, e.g. Internal Markets of information society services in the EU, consumer protection, electronic marketing, electronic contracts, electronic payment methods and dispute settlement.

Literature: Laine, Juha (edit.), Verkkokauppoikeus 2000 and other materials specified by the lecturer.

Examination: Lectures, assignment and exam.

Additional information: Replaces former course T-76.752 Legal Aspects of Electronic Commerce.

Language: Finnish.

T-76.5753 Law in Network Society (4-6 cr) P

Spring (Period III)

Teacher: Mikko Välimäki, university teacher

Contents: The course focuses on the legal and economic foundations of software industry, the philosophy of open source and the relation between user rights and new models of digital content distribution. Legal aspects of information society policy will also be discussed.

Requirements: Lectures, exercises and examination

Literature: Will be announced later

Additional information: Replaces former course T-76.753 Law in Network Society.

Language: Lectured in English.

T-76.5754 Law and Technology -book examination 1 (3 cr) P

Teacher: Prof Juha Laine

Contents: Legal informatics and media law.

Literature: 1. Saarenpää, Ahti., Oikeusinformatiikka s. 1-60 teoksessa Oikeusjärjestys 2000 (2p.) 2. Kulla, Heikki ym., Viestintäoikeus 2002 3. Nyblin, Klaus, Työelämän sähköposti 2002

Examination: Arranged according to agreement

Additional information: Replaces former course T-76.754 Law and Technology -book examination 1.

Language: Finnish

T-76.5758 Law and Technology - book examination 2 (3 cr) P

Teacher: Mikko Välimäki, university teacher

Contents: The object of the course is to get familiar with recent discourse of information society from legal point of view.

Literature: Choose two of the following three books (unless otherwise agreed) 1. Stallman, Richard M., Free Software, Free Society 2002. 2. The Digital Dilemma, Intellectual property in the Information Age, Computer Science and Telecommunication Board, National Research Council, 2000. 3. Lessig, Lawrence, Free Culture, How big media uses technology and law to lock down Culture and control creativity, 2004.

Examination: Arranged according to agreement

Additional information: Replaces former course T-76.758 Law and Technology -book examination 2.

Language: Finnish. Course material and examinations available in English.

T-76.5759 Individual Studies (3-12 cr) P V

Teacher: Prof Juha Laine

Contents: The content and the extent of the course are to be agreed with the teacher before commencement.

Additional information: Replaces former course T-76.759 Individual Studies.

Language: Finnish. Individual study in English possible only according to agreement.

T-76.7656 Doctoral Seminar (3 cr) P V

Autumn + Spring

Teacher: Professor Reijo Sulonen

Contents: The seminar is intended for post graduate students.

Examination: Participation in seminars and seminar presentations.

Additional information: Replaces former course T-76.656 Research Seminar.

Language: Finnish. Individual study in English possible only according to agreement.

T-79 THEORETICAL COMPUTER SCIENCE

Prof Ilkka Niemelä, room B337, tel. 451 3290
 Prof Hannu H. Kari, room B253, tel. 451 2918
 Prof Kaisa Nyberg, room B255, tel. 451 3976
 Prof Pekka Orponen, room A348, tel. 451 5246
 Emer Prof Leo Ojala, room B359, tel. 451 3253

For complete descriptions of all courses and actual information, please refer to <http://www.tcs.hut.fi/>.

Courses credited in ECTS

T-79.1001 Introduction to theoretical computer science T (4 cr)

Autumn

Teacher: Harri Haanpää, Teaching Research Scientist
 Contents: Finite automata and regular languages. Context-free grammars and pushdown automata. Context-sensitive and unrestricted grammars. Turing machines and computability.
 Requirements: Exam and four compulsory home assignments.
 Literature: Lecture notes; M. Sipser: Introduction to the Theory of Computation.
 Prerequisites: First semester's mathematics courses. Basic familiarity with computer programming an asset.
 Additional information: Replaces former course T-79.148 Introduction to theoretical computer science.
 Language: Finnish. Sufficient course material is available in English on request. Exams and assignments can be taken in English.

T-79.1002 Introduction to theoretical computer science Y (2 cr)

Autumn (Period I)

Teacher: Harri Haanpää, Teaching Research Scientist
 Contents: Finite automata and regular languages. Context-free grammars.
 Requirements: Exam and four compulsory home assignments.
 Literature: Lecture notes; M. Sipser: Introduction to the Theory of Computation.
 Prerequisites: First semester's mathematics courses. Basic familiarity with computer programming an asset.
 Language: Finnish. Sufficient course material is available in English on request. Exams and assignments can be taken in English.

T-79.3001 Logic in computer science: foundations (4 cr)

Spring

Teacher: Tomi Janhunen, Docent
 Contents: Propositional and predicate logic, their syntax, semantics and proof theory. Applications of logic in computer science.
 Requirements: Exam and compulsory home assignments.
 Literature: Lecture notes.
 Prerequisites: T-79.1001/T-79.148.
 Additional information: Replaces former course T-79.144 Logic in computer science: foundations.
 Language: Finnish. Sufficient course material is available in English on request. Exams and assignments can be taken in English.

T-79.4001 Seminar on theoretical computer science (3 cr) V

Spring

Teacher: Prof Pekka Orponen
 Contents: Current research topics in theoretical computer science. The topic in Spring 2007 will be distributed computation.
 Requirements: Seminar.
 Additional information: Replaces former courses T-79.192 Special course in theoretical computer science and T-79.194 Seminar on theoretical computer science.

Language: Finnish. Sufficient course material is available in English on request. Exams and assignments can be taken in English.

T-79.4201 Search problems and algorithms (4 cr)

Autumn

Teacher: Prof Ilkka Niemelä, Prof Pekka Orponen
 Contents: Search spaces and search methods. Backtracking, local and heuristic search. Representing and solving search problems using propositional satisfiability, constraint programming and integer programming techniques.
 Requirements: Exam and programming assignments.
 Literature: Lecture notes.
 Prerequisites: T-79.1001/T-79.148, T-79.3001/T-79.144, T-106.1220/T-106.250; also T-106.3100/T-106.237 recommended.
 Language: English.

T-79.4301 Parallel and distributed systems (4 cr)

Spring

Teacher: Keijo Heljanko, Docent
 Contents: Modelling of systems. Computer-aided verification of properties.
 Requirements: Exam and project assignments.
 Prerequisites: T-79.1001/T-79.1002/T-79.148, T-79.3001/T-79.144, and the compulsory mathematics studies of the study programme.
 Additional information: Replaces former courses T-79.179 Parallel and distributed digital systems and T-79.231 Parallel and distributed digital systems.
 Language: English.

T-79.4501 Cryptography and data security (4 cr)

Autumn (Period I)

Teacher: Prof Kaisa Nyberg
 Contents: Data and communications security. Principles of cryptographic security. Symmetric cryptosystems. Stream ciphers. Block ciphers: DES, IDEA, AES. Modes of operation. Asymmetric cryptosystems. Digital signatures. Authentication and key agreement. Applications of cryptography: SSL, TLS, IPsec, GSM, Bluetooth.
 Requirements: Exam.
 Literature: W. Stallings: Cryptography and Network Security, Principles and Practices, third ed., Pearson Education, 2003.
 Prerequisites: Basic knowledge in discrete mathematics and some computer or communication network recommended.
 Additional information: Replaces former course T-79.159 Cryptography and data security.
 Language: Finnish. Sufficient course material is available in English on request. Exams and assignments can be taken in English.

T-79.5001 Student project in theoretical computer science (5 cr)

Autumn (Period I) & Autumn (Period II) & Spring (Period III) & Spring (Period IV)

Teacher: T-79 professors and teaching research scientists
 Contents: Independent student project on a subject from the field of theoretical computer science.
 Requirements: The project is done in groups of up to three people.
 Prerequisites: Level 2 module in theoretical computer science.
 Additional information: Replaces former course T-79.189 Student project in theoretical computer science.
 Language: Finnish. Sufficient course material is available in English on request. Exams and assignments can be taken in English.

T-79.5101 Advanced course in computational logic (4 cr) P

Spring

Teacher: Prof Ilkka Niemelä

Contents: Basics of modal logic. Current applications in computer science and engineering.
 Requirements: Exam and home assignments.
 Literature: Lecture notes and articles.
 Prerequisites: T-79.3001/T-79.144.
 Additional information: Replaces former course T-79.146 Logic in computer science: special topics I.
 Language: English.

T-79.5102 Special course in computational logic (4 cr) P V
 Autumn

Teacher: Tomi Janhunen, Docent
 Contents: Knowledge representation, reasoning and decision-making. Automated reasoning.
 Requirements: Exam, project work and/or seminar talk.
 Prerequisites: T-79.3001/T-79.144.
 Additional information: Replaces former courses T-79.154 Logic in computer science: special topics II and T-79.230 Foundations of agent-based computing.
 Language: Finnish. Sufficient course material is available in English on request. Exams and assignments can be taken in English.

T-79.5103 Computational complexity theory (5 cr) P

Autumn
 Teacher: Prof Ilkka Niemelä
 Contents: NP-completeness. Randomized algorithms. Cryptography. Approximation algorithms. Parallel algorithms. Polynomial hierarchy. PSPACE-completeness.
 Requirements: Home assignments and seminar talk.
 Literature: C. Papadimitriou: Computational Complexity, Addison-Wesley, 1994.
 Prerequisites: T-79.1001/T-79.148.
 Additional information: Replaces former course T-79.240 Special course in computational complexity.
 Language: English.

T-79.5201 Discrete structures (4 cr) P V
 Autumn

Teacher: Prof Pekka Orponen
 Contents: Annually varying topics concerned with the basic structures and methods of computer science theory. The course in Autumn 2006 will be concerned with enumerative combinatorics, i.e. the counting of combinatorial objects by means of their complex-valued generating functions.
 Requirements: Tutorials and examination.
 Prerequisites: First two year's mathematics courses including introductory discrete mathematics (Mat-1.2991/Mat-1.128) and complex analysis (Mat-1.1131/Mat-1.413). Familiarity with algorithm design (T-106.4100/T-106.410) an asset.
 Additional information: Replaces former course T-79.149 Discrete Structures.
 Language: Finnish. Sufficient course material is available in English on request. Exams and assignments can be taken in English.

T-79.5202 Combinatorial algorithms (4 cr) P

Spring
 Teacher: Harri Haanpää, Specialist Teacher
 Contents: Basic algorithms and computational methods for combinatorial problems. Combinatorial structure generation (e.g. permutations). Search methods. Graph algorithms and combinatorial optimization. Symmetries of combinatorial structures.
 Requirements: Exam and obligatory home assignments.
 Literature: D. L. Kreher and D. R. Stinson: Combinatorial Algorithms; Generation, Enumeration and Search, CRC Press, 1998.
 Prerequisites: Basic knowledge in discrete mathematics and programming.

Additional information: Replaces former course T-79.161 Combinatorial algorithms.
 Language: English.

T-79.5203 Graph theory (5 cr) P

Spring (Period IV)
 Teacher: Petteri Kaski, Specialist Teacher, Prof Patric Östergård
 Contents: Introduction to graph theory. Trees, planar graphs and digraphs. Graph coloring. Random graphs. Algorithms for central graph problems. Applications.
 Requirements: Exam and special project/home assignments.
 Literature: D. B. West: Introduction to Graph Theory, second ed., Prentice Hall, 2001; D. Jungnickel: Graphs, Networks and Algorithms, second ed., Springer, 2005.
 Prerequisites: Compulsory mathematics studies of the study programme and basic knowledge in programming.
 Additional information: Replaces former course T-79.165 Graph theory. The course also occurs with the code S-72.2420.
 Language: Finnish. Sufficient course material is available in English on request. Exams and assignments can be taken in English.

T-79.5204 Combinatorial models and stochastic algorithms (6 cr) P

Spring, lectured every other year, lectured 2006-2007
 Teacher: Prof Pekka Orponen
 Contents: Combinatorial system models: random graphs, spin glasses, NK-systems. Fitness landscapes of combinatorial optimization problems. Markov chains and MCMC sampling. Stochastic algorithms: MCMC-based approximation algorithms, simulated annealing, evolutionary algorithms. Special topics: structure of fitness landscapes, combinatorial phase transitions.
 Requirements: Tutorials, programming assignment and exam.
 Literature: Lecture notes.
 Prerequisites: First two year's mathematics courses including introductory probability theory (e.g. Mat-1.2600/Mat-2.090), and programming skills (e.g. T-106.1200/T-106.230). Familiarity with stochastic processes (Mat-2.111), discrete mathematics (Mat-1.2991/Mat-1.128), algorithm design (T-106.4100/T-106.410) and computational complexity theory (T-79.5103/T-79.240) an asset.
 Additional information: Replaces former course T-79.250 Combinatorial models and stochastic algorithms.
 Language: English.

T-79.5301 Reactive systems (4 cr) P

Spring
 Teacher: Heikki Tauriainen, Specialist Teacher
 Contents: Specification and verification of reactive systems with temporal logic. Basics of computer-aided verification methods and algorithms.
 Requirements: Seminar talks, home exercises, and a project.
 Prerequisites: T-79.3001/T-79.144, T-79.4301/T-79.179/T-79.231, and the compulsory mathematics studies of the study programme.
 Additional information: Replaces former courses T-79.186 Reactive systems and T-79.193 Formal description techniques for concurrent systems.
 Language: English.

T-79.5302 Symbolic model checking (4 cr) P

Autumn, lectured every other year, not lectured 2006-2007
 Teacher: Tommi Junntila, Specialist Teacher
 Contents: Symbolic methods for efficient qualitative analysis of parallel and distributed systems. Binary decision diagrams. Bounded model checking.
 Requirements: Seminar presentations and project assignments.
 Prerequisites: T-79.1001/T-79.1002/T-79.148, T-79.3001/T-79.144, T-79.4301/T-79.179/T-79.231, and the compulsory mathematics studies of the study programme.

Additional information: Replaces former courses T-79.185 Verification and T-79.193 Formal description techniques for concurrent systems.
Language: English.

T-79.5303 Safety critical systems (4 cr)

Spring

Teacher: Ilkka Herttua, Specialist Teacher, Teemu Tynjälä, Specialist Teacher

Contents: Safety-critical systems. The use of formal methods in the specification, modelling and verification of systems.

Requirements: Compulsory home assignments.

Literature: N. Leveson: Safeware: System Safety and Computers; N.

Prerequisites: T-79.1001/T-79.148.

Additional information: Replaces former course T-79.232 Safety-critical systems.

Language: English.

T-79.5304 Formal conformance testing (4 cr) P

Autumn, lectured every other year, lectured 2006-2007

Teacher: Antti Huima, Specialist Teacher

Contents: Introduction to conformance testing. Formal conformance testing and its automatization. On testing timed and infinite-state systems. Estimation of testing coverage.

Requirements: Exam.

Literature: Lecture notes.

Prerequisites: T-79.5301/T-79.186.

Additional information: Replaces former course T-79.190 Testing of concurrent systems.

Language: English.

T-79.5305 Formal Methods (4 cr) P V

Autumn, lectured every other year, lectured 2006-2007

Teacher: Tommi Junttila, Specialist Teacher

Contents: Annually varying topics on formal methods.

Requirements: Seminar.

Prerequisites: T-79.3001/T-79.144, T-79.4301/T-79.179/T-79.231 and the compulsory mathematics studies of the study programme.

Additional information: Replaces former course T-79.157 Formal description and verification of computing systems.

Language: English.

T-79.5401 Special course in mobility management (2-10 cr) P V

Autumn & Spring

Teacher: Prof Hannu H. Kari

Contents: Special problems of mobility management in wireless networks.

Requirements: Seminar.

Prerequisites: T-79.1001/T-79.148.

Language: English.

T-79.5501 Cryptology (5 cr) P

Spring

Teacher: Prof Kaisa Nyberg

Contents: Mathematical properties of modern cryptographic methods. Information theory of encryption. Basic building blocks for stream ciphers and block ciphers and their analysis. Hash-functions. Information theory of authentication. Message authentication. Public key cryptosystems.

Requirements: Exam.

Literature: D. R. Stinson: Cryptography: Theory and Practice, third ed., CRC Press, 2005; and additional material (in English, available on the course homepage).

Prerequisites: Recommended courses Mat-1.2991/Mat-1.128 Discrete mathematics and Mat-1.3081/Mat-1.146 Algebra I.

Additional information: Replaces former course T-79.503 Foundations of cryptology.

Language: English.

T-79.5502 Advanced course in cryptology (5 cr) P

Autumn (Period II), lectured every other year, not lectured 2006-2007

Teacher: Prof Kaisa Nyberg

Contents: Cryptographic security models and provable security.

Requirements: Exam and seminar.

Literature: W. Mao: Modern Cryptography: Theory and Practice, Prentice-Hall, 2004.

Prerequisites: T-79.5501/T-79.503 required.

Additional information: Replaces former courses T-79.513 Seminar on cryptography and security protocols, T-79.514 Special course on cryptology, and T-79.515 Cryptology: special topics.

Language: English.

T-79.7001 Postgraduate course in theoretical computer science (2-10 cr) P V

Autumn & Spring

Teacher: Prof Kaisa Nyberg, Prof Hannu H. Kari

Contents: Current research problems in theoretical computer science. The contents of the course vary from term to term.

Requirements: Seminar and home assignments.

Prerequisites: Level 3 module in theoretical computer science.

Additional information: Replaces former course T-79.300 Postgraduate course in theoretical computer science. Prof Nyberg is responsible for the course in Autumn 2006 and prof Kari is in charge in Spring 2007. In Autumn 2006 the course is arranged in cooperation with the course T-110.7290 Research seminar on network security, with Prof Asokan.

Language: English.

T-79.7002 Individual studies (1-10 cr) P V

Autumn (Period I) & Autumn (Period II) & Spring (Period III) & Spring (Period IV)

Teacher: T-79 professors

Contents: The contents and extent of the course are to be agreed with a professor before commencing the course.

Additional information: Replaces former course T-79.295 Individual studies.

Language: Finnish. Sufficient course material is available in English on request. Exams and assignments can be taken in English.

T-79.7003 Research course in theoretical computer science (1-10 cr) P V

Autumn (Period I) & Autumn (Period II) & Spring (Period III) & Spring (Period IV)

Teacher: T-79 professors

Contents: Courses given by visiting lectures on current research topics in theoretical computer science.

Language: English

T-86 INFORMATION TECHNOLOGY

Prof Juha Laine, Innopoli 2, room E414, tel. 451 6269

Prof Martti Mäntylä (on leave of absence)

Prof (pro tem) Matti Hämäläinen, Innopoli 2, room E425, tel. 451 5451

Note that the number of participants for the courses within the professorship T-86 can be limited. For complete descriptions of all courses and actual information, please refer to <http://www.soberit.hut.fi/english/Studies.html>.

Courses credited in ECTS

T-86.5141 Enterprise Systems Architecture (4 cr)

Autumn (Period I)

Teacher: Paavo Kotinurmi, Prof (pro tem) Matti Hämäläinen

Contents: Big picture of the information systems architecture of an enterprise. Designing and implementing the enterprise systems architecture. Concepts of service orientation. The main

information system components in the architecture supporting the core business processes and core business services. Integrating the information system components. The course is intended as a prerequisite for more advanced T-86 courses, but also for more general audience interested in enterprise applications of information technology. Each topic covered by the course is presented through relevant literature and through real world cases from various enterprises. Workshops will be included.
Requirements: Examination, lecture assignments, and course feedback.

Literature: Articles, book chapters

Prerequisites: T-76.3601, TU-22.1101. Also recommended: TU-22.1115 and T-76.4602.

Additional information: Replaces former course T-86.141 Enterprise Systems Integration
Language: English

T-86.5150 Special Assignment on Enterprise Information Systems (3-10 cr) P V

According to agreement

Teachers: Prof (pro tem) Matti Hämäläinen, Emer Prof. Hans Andersin.

Contents: Independent essay on a chosen subject from the field of information technology.

Requirements: Preparation of the essay

Prerequisites: Ohter major studies

Additional: Replaces former course: T-86.150 Special Assignment in Information Technology, T-86.155 Individual Studies
Language: According to agreement.

T-86.5160 Special Topics in CIM I (5-10 cr) P V

Lectured according to agreement

Teacher: Kristian Rautiainen, Prof (pro tem) Matti Hämäläinen, Emeritus Prof Hans Andersin

Contents: One or more technical, strategic, methodological, or industrial topics is discussed and analysed in detail. Guest lecturers include experts in the fields and guests from industry.

Requirements: Active participation in the seminar, presentation and written report.

Literature: Agreed upon separately.

Additional information: Replaces former course T-86.160 Special Topics in CIM I

Language: Swedish and English, course material available in English.

T-86.5161 Special Course in Information Systems Integration (6-10 cr) P

Autumn (Period I-II)

Lecturer: Paavo Kotinurmi

Contents: The most important applications and standards in information systems integration. Through the project, students get to know some current topic related to information systems integration in detail. They also get to practice scientific reporting and presenting their accomplishments to others. After this course, the students should be able to start e.g. their mastersthesis.¹

Requirements: Pre-exam, participation in lectures, project and its reporting.

Literature: Agreed separately.

Prerequisites: T-86.5141

Additional information: Replaces former course T-86.160 Special Topics in CIM II, T-86.301 Project Course on ICT Enabled Commerce.

Language: Lectured in Finnish, course material available in English.

T-86.5165 Seminar on Enterprise Information Systems (3-8 cr) P V

Arranged according to agreement

Teacher: Prof (pro tem) Matti Hämäläinen

Contents: One or more problem areas in product data technology is discussed and analysed in detail.

Requirements: Active participation in the seminar, presentation and written report.

Literature: Agreed upon separately.

Prerequisites: Either T-86.5141 or T-76.3601 and T-76.56xx / T-76.5150.

Additional information: Replaces former course T-86.165 Seminar on Product Data Technology.

Language: Finnish and English

T-86.5300 Information and Communication Enabled Commerce ICTEC (4-6 cr) P

Spring (Period IV)

Lecturer: Prof (pro tem) Matti Hämäläinen, other contributors: Professor Juha Laine, Researcher Mikko Puhakka

Contents: The goal of the ICTEC-program is to give theoretical and practical insight in how to build the bridge from business ideas and models to functional and integrated information systems. Guest lecturers include both Finnish and international academic experts and guests from industry. The course is open for all students, including outside the Helsinki University of Technology.

Requirements: Lectures, assignments and exam.

Literature: Will be announced later.

Additional information: Replaces former course T-86.300 Information and Communication Enabled Commerce ICTEC

Language: Lectured in English

T-86.5750 Seminar on Venturing in Digital Economy (3 cr) P V

According to agreement

Teachers: Dr. Marko Turpeinen and Dr. Sami Jokela

Contents: The seminar focuses on computer mediated communities. The primary language of the course is English but Finnish can be optionally used.

Requirements: Will be announced later.

Literature: Will be announced later.

Prerequisites: None

Additional information: Replaces former course T-86.750 Seminar on Venturing in Digital Economy

Language: English

T-93 KNOWLEDGE ENGINEERING

Prof Markku Syrjänen, room A207 tel. 451 3220

Note that the number of participants for the courses within the professorship T-93 can be limited. For complete descriptions of all courses and actual information, please refer to <http://www.cs.hut.fi/Studies/>.

Courses credited in ECTS

T-93.4400 Introduction to Artificial Intelligence (5 cr)

Spring (Period III)

Lecturer: Prof Markku Syrjänen

Contents: Basics of problem solving in artificial intelligence. Problem solving based on heuristic search in a state-space. Knowledge representation. Planning.

Requirements: Final examination and programming assignment.

Literature: Russel S. & Norvig P.: Artificial Intelligence – A Modern Approach, Second Edition, Prentice Hall, 2003.

Prerequisites: T-79.3001/T-79.144, T-106.4100/T-106.410, and T-106.3100/T-106.237

Additional information: assignments can also be done in English. Replaces the course T-93.440 Introduction to Knowledge Engineering.

Language: Finnish

T-93.5100 Functional Programming (5 cr)

Autumn

Lecturer: N.N.

Contents: The principles of functional programming languages. Lambda calculus. Programming with different types of functional programming languages (Scheme, Haskell). Special issues in functional programming: evaluation orders, functional I/O models, functional data structures, concurrency, type systems, and continuations.

Requirements: Examination, assignments, and programming project.

Literature: To be announced later.

Prerequisites: T-79.1001/T-79.148 and (T-106.3100/T-106.237 or equivalent skills).

Additional information: Will be organized for the first time on autumn 2008.

Language: Finnish

T-93.5350 Principles of Programming Languages (5 cr)

Autumn

Lecturer: N.N.

Contents: The interpretation of the typical mechanisms of programming languages. The concepts, structure, and implementation of interpreters. Definition and implementation of domain specific languages.

Requirements: Examination, assignments, and programming project.

Literature: Shriram Krishnamurthi: Programming Languages: Application and Interpretation.

Prerequisites: T-93.5100 and T-106.4200/T-106.550.

Additional information: Will be organized for the first time on spring 2009.

Language: Finnish

T-93.5500 Logic and Constraint Programming (5 cr)

Autumn

Lecturer: Risto Lahdelma, visiting senior lecturer

Contents: Basics of logic programming, Prolog-programming methodology and applications.

Requirements: Final examination and a compulsory programming assignment.

Literature: Leon Sterling, Ehud Shapiro: The Art of Prolog.

Prerequisites: T-79.3001/T-79.144, T-106.4100/T-106.410, and T-106.3100/T-106.237.

Additional information: assignments can also be done in English. Replaces the course T-93.540 Logic Programming.

Language: Finnish

T-93.5700 Project in Artificial Intelligence (5–12 cr)

Autumn & Spring

Teacher: N.N.

Contents: A learning project on a separately agreed technical topic in the area of knowledge engineering. The topic should include both learning goals and constructive work.

Requirements: Project is done in a group of 3 to 4 students. The group completes a common project work aimed at learning a particular topic and whose results are documented in a set of technical/scientific reports. In addition, each member of a group prepares a personal learning portfolio about his or her work and studying.

Prerequisites: Bachelor degree and preferably also courses from module A3.

Additional information: The course is intended only for students studying Programming languages A3 -module. Will replace the course T-93.720. Will be organized for the first time during study year 2008–2009.

T-93.5800 Seminar on Artificial Intelligence (3–10 cr) P V

Teacher: Prof Markku Syrjänen

Contents: The contents of this course vary. Lectured according to agreement.

Additional information: Replaces the course T-93.850.

T-93.6100 Supplementary Course (1–8 cr) V

Autumn & Spring

Teacher: Prof Markku Syrjänen

Contents: The contents and extent of the course must be discussed with the teacher. The course is intended for situations, for example, when a student has transferred to Helsinki University of Technology from some other university.

Additional information: More information from the WWW page <http://www.cs.hut.fi/Studies/T-93.6100>.

T-93.6200 Special Course on Artificial Intelligence (1–8 cr) P V

Autumn

Teacher: Prof Markku Syrjänen

Contents: The course treats special topics in Artificial Intelligence. The contents of the course vary yearly, and the course is lectured only according to agreement.

Prerequisites: T-93.4400/T-93.440.

Additional information: Replaces the course T-93.810.

T-93.6300 Special Assignment in Artificial Intelligence (5–8 cr) P V

Autumn & Spring

Teacher: Prof Markku Syrjänen

Contents: Independent scientific essay on an assigned problem from the field of Artificial Intelligence.

Requirements: Essay.

Prerequisites: Courses of module T222-3.

Additional information: Will replace the course T-93.830. Will be organized for the first time during study year 2008–2009.

T-93.6400 Individual Studies (1–15 cr) P V

Teacher: Prof Markku Syrjänen

Contents: The contents and extent of the course are to be agreed with the professor before commencing the course.

Additional information: Replaces the course T-93.870.

T-106 SOFTWARE TECHNOLOGY

Prof Eljas Soisalon-Soininen, room A204, tel. 451 3224

Prof Heikki Saikkonen, room A205, tel. 451 3880

Prof Jorma Tarhio, room A206, tel. 451 3226

Prof Lauri Malmi, room B207, tel. 451 3236.

Note that the number of participants for the courses within the professorship T-106 can be limited. For complete descriptions of all courses and actual information, please refer to <http://www.cs.hut.fi/Studies/>.

Courses credited in ECTS

T-106.1001 Computer as a Tool (2 cr)

Autumn (period I)

Teacher: Maija Toikkanen

Additional information: Equivalent course in English T-106.1003, and in Swedish T-106.1002. Replaces the course T-106.001

Language: Finnish

T-106.1002 Computer as a Tool (2 cr)

Autumn (period I)

Teacher: Kenneth Oksanen, researcher

Additional information: Equivalent course in English T-106.1003, and in Finnish T-106.1001. Replaces the course T-106.002

Language: Swedish

T-106.1003 IT services at TKK (2 cr)

Autumn (Period I)

Teacher: Maija Toikkanen; Jenni Stenman, assistant

Contents: Basic computer terminology. Use of common applications in Unix, WWW and MS Windows environments.

Requirements: Participation in the compulsory exercises, examination.

Literature: Lecture notes, manuals.

Prerequisites: None.

Additional information: Replaces the course T-106.003.

Language: English.

T-106.1041 Information Technology - Basic course (3 cr)

Autumn

Teacher: Maija Toikkanen

Contents: Information technology basics

Requirements: Home works and examination

Prerequisites: T-106.1001/T-106.001

Additional information: Equivalent course in English T-106.1043. Replaces the course T-106.041

Language: Finnish

T-106.1043 Information Technology – Basic Course (3 cr)

Autumn

Teacher: Maija Toikkanen

Contents: Information technology basics.

Requirements: Home works and examination.

Literature: To be announced later in course's web page. Please see: <http://www.cs.hut.fi/Studies/T-106.1043/english.html>

Form of course: Lectures, introductions and small exercises made in classes or at home.

Prerequisites: T-106.1001/T-106.1003/T-106.001/T-106.003 or equivalent.

Additional information: Equivalent course in Finnish

T-106.1041. Replaces the course T-106.043

Language: English

T-106.1061 Information Technology - Laboratory course (3 cr)

Spring

Teacher: Aura Paloheimo, researcher

Literature: To be announced on the course's web page

Additional information: Equivalent course in English T-106.1063. Note that the number of participants for the course can be limited. Replaces the course T-106.061.

Language: Finnish

T-106.1063 Information Technology – Laboratory Course (3 cr)

Spring

Teacher: Aura Paloheimo, researcher

Contents: Training of basic information technology tools to support engineering work as well as studies.

Requirements: Exercises and final project.

Literature: To be announced on course's web pages. Please see: <http://www.cs.hut.fi/Studies/T-106.1063/english.html>

Prerequisites: T-106.1001/T-106.1003/T-106.001/T-106.003 or equivalent.

Additional information: Equivalent course in Finnish: T-106.1061. Replaces the course T-106.063.

Language: English

T-106.1200 Basics of Programming T (Java) (5 cr)

Autumn

Teacher: Juha Sorva

Contents: Basics of object-oriented programming in Java, structured programming, general programming concepts. Good programming style. The course is intended only for students of the Degree Programme of Computer Science and Engineering.

Requirements: Exam and home exercises.

Literature: See course web site.

Prerequisites: T-106.1001/T-106.001 or equivalent.

Additional information: Lectures only in Finnish. Exercises and exam available in English. Replaces the course T-93.211.

Language: Finnish

T-106.1203 Basics of Programming L (Java) (5 cr)

Autumn

Teacher: Juha Sorva

Contents: Programming in Java, basics of object-oriented programming and program design. Good programming style. This course is intended for students of the Degree Programmes AS, TF, and S/TLT.

Requirements: Examination and exercises.

Literature: See course web site.

Prerequisites: T-106.1001/T-106.001 or equivalent.

Additional information: Lectures only in Finnish. Exercises and exam available in English.

Language: Finnish

T-106.1206 Basics of Programming Y (Java) (5 cr)

Spring

Teacher: Kerttu Pollari-Malmi, lecturer

Contents: Programming in Java, basics of object-oriented programming and program design. Basic data structures and algorithms. Good programming style. This course is intended for students other than those of Degree Programmes T, AS and TF.

Requirements: Examination and independent exercises.

Literature: To be announced later.

Prerequisites: T-106.1001/T-106.001 or equivalent.

Language: Finnish.

T-106.1207 Basics of Programming (Java) (5 cr)

Autumn

Teacher: Kenneth Oksanen, researcher

Prerequisites: T-106.1002/T-106.002 or equivalent.

Additional information: Equivalent course in Finnish T-106.1203, and T-106.1206.

Language: Swedish.

T-106.1220 Data Structures and Algorithms T (5 cr)

Spring

Lecturer: Ari Korhonen, lecturing researcher

Contents: The most important data structures and algorithms manipulating them. Linear data structures, trees, graphs. Searching and sorting methods. Principles of algorithm analysis and understanding of how and when to apply an algorithm to solve a given problem. The course is intended only for students of the Degree Programme of Computer Science and Engineering.

Requirements: Examination, personal home exercises and project work.

Literature: To be announced later.

Prerequisites: T-106.1200 or T-93.211.

Additional information: Replaces the course T-106.250.

Language: Lectures in Finnish only. Exercises and examination available in English, too.

T-106.1223 Data Structures and Algorithms Y (5 cr)

Spring

Teacher: Ari Korhonen, lecturing researcher

Contents: The most important data structures and algorithms manipulating them. Linear data structures, trees, graphs. Searching and sorting methods. Principles of algorithm analysis and understanding of how and when to apply an algorithm to solve a given problem. This course is intended for students other than those of the Degree Programme in Computer Science and Engineering.

Requirements: Examination, personal home exercises and project work.

Literature: To be announced later.
 Prerequisites: T-106.1203/1206/1207 or T-106.213/216/217.
 Additional information: Replaces the course T-106.253.
 Language: Lectures in Finnish only. Exercises and examination available in English, too.

T-106.1225 Project Work of Data Structures and Algorithms (1–5 cr)
 Spring
 Lecturer: Ari Korhonen, lecturing researcher
 Contents and Requirements: Personal home exercises and/or project work
 Prerequisites: T-106.1200/1203/1206/1207 or T-93.211 or T-106.213/216/217.
 Language: Finnish

T-106.1240 Intermediate Course in Programming T1 (Java) (6 cr)
 Autumn
 Teacher: Otto Seppälä
 Contents: Object-oriented programming in Java, introduction to program design, basic data structures and algorithms. Good programming style. Programming methodology. The course is intended only for students of Degree Programme of Computer Science and Engineering.
 Requirements: Home exercises and project work.
 Literature: To be announced later.
 Prerequisites: T-106.1220/1223/T-106.250/253 and T-93.211 / T-106.1200 or equivalent.
 Additional information: Replaces the course T-106.235.
 Language: Lectures in Finnish only. Exercises and examination available in English, too.

T-106.1243 Intermediate Course in Programming L1 (Java) (6 cr)
 Autumn
 Teacher: Otto Seppälä
 Contents: Object-oriented programming in Java, introduction to program design, basic data structures and algorithms. Good programming style. Programming methodology.
 Requirements: Home exercises and project work.
 Literature: To be announced later.
 Prerequisites: T-106.1220/1223/T-106.250/253 and T-106.1203/1206 or equivalent.
 Additional information: Combined with T-106.1203/1206 the two courses replace the course T-106.213/216.
 Language: Lectures in Finnish only. Exercises and examination available in English, too.

T-106.3100 Intermediate Course in Programming T2 (the C language) (5 cr)
 Spring
 Teacher: Prof Lauri Malmi
 Contents: Programming language C, low level programming, execution model of the program. Implementation of data structures and algorithms. Version management, programming as team work.
 Requirements: Home exercises and project work.
 Literature: To be announced later.
 Prerequisites: T-106.1240/1243 ja T-106.1220/1223.
 Language: Lectured in Finnish. Course material available in English,

T-106.3105 Project Work of Programming (1–5 cr)
 Spring
 Lecturer: Prof Lauri Malmi
 Contents and Requirements: Personal home exercises and/or project work
 Prerequisites: T-106.1240/1243 ja T-106.1220/1223.

Additional information: Arranged according to agreement with course T-106.3100.
 Language: Finnish

T-106.4000 Laboratory Course in Software Techniques (3–8 cr)
 Spring
 Teacher: Prof Lauri Malmi
 Contents: Introduction to experimental research, test planning and writing scientific reports. Project assignments deal, for example, with efficiency evaluation of complex data structures and algorithms, programming languages or software systems. The course is intended only for students of the Degree Programme in Computer Science and Engineering.
 Requirements: Project work.
 Literature: Lecture notes.
 Prerequisites: T-106.1220/T-106.250, T-106.1240/T-106.235, T-106.3100 and Mat-1.2600/Mat-1.2620/Mat-2.090/Mat-2.091.
 Additional information: Replaces the course T-106.290.
 Language: Lectured in Finnish. Course material available in English.

T-106.4100 Design and Analysis of Algorithms (5 cr)
 Autumn (Period II)
 Teacher: Kerttu Pollari-Malmi, lecturer
 Contents: The course is designed to answer questions of the following type: How does one find an efficient algorithm to solve a given computational problem. How can one estimate the efficiency of an algorithm. During the course the students will acquire knowledge of some fundamental algorithms, and of the design and analysis techniques of algorithms.
 Requirements: Examination and compulsory exercises. Possibility to get extra credits from exercises.
 Literature: Cormen, Leiserson, Rivest, Stein: Introduction to Algorithms, The MIT Press, 1996 or 2nd Edition 2001.
 Prerequisites: T-106.1220/1223/T-106.250/253 and T-106.1240/T-106.235.
 Additional information: exercises are also in English. Replaces the course T-106.410.
 Language: Finnish

T-106.4150 Operating Systems and Concurrent Programming (5 cr)
 Autumn (Period I)
 Teacher: Vesa Hirvisalo, lecturing researcher
 Contents: Operating system structure, processes, memory management, file system, parallel programming.
 Requirements: Examination.
 Literature: William Stallings: Operating Systems: Internals and Design Principles, 5th edition, 2005.
 Prerequisites: T-0.3123 and T-106.3100
 Additional information: Replaces the course T-106.430 Operating Systems.
 Language: Finnish

T-106.4200 Introduction to Compiling (5 cr)
 Autumn (Period I)
 Teacher: Prof Jorma Tarhio
 Contents: Translation of high-level languages to machine code. Lexical analysis, syntax analysis, syntax-directed compilation, type checking, naive code generation. The students construct a compiler producing executable code.
 Requirements: Examination, exercises and programming assignment.
 Literature: To be announced later.
 Prerequisites: T-79.1001/T-79.148 and T-106.1240/T-106.235/T-93.270.
 Additional information: exercises are also in English. Will be organized for the first time during study year 2007–2008.
 Language: Finnish

T-106.5150 Operating Systems Project (5 cr)

Spring

Teacher: Vesa Hirvisalo, lecturing researcher

Contents: The aim is to extend a small operating system.

Requirements: Assignments.

Literature: Handout.

Prerequisites: T-0.3123, T-106.3100, T-106.4150

Additional information: Replaces the course T-106.435. Participation can be restricted.

Language: English.

T-106.5200 Database Algorithms (5 cr) P

Spring

Lecturer: Prof Eljas Soisalon-Soininen

Contents: Internal structure of database management systems. Implementation of database operations. Query processing and optimization. Recovery from failure and concurrency control of transactions.

Requirements: Examination.

Literature: Lecture notes.

Prerequisites: T-76.2143/T-76.143 and T-106.1220/1223/T-106.250/253.

Additional information: Replaces the course T-106.510.

Language: Finnish. English course material and exercises are available.

T-106.5250 Distributed Systems (5 cr)

Autumn (Period II)

Lecturer: Esko Nuutila, lecturing researcher

Contents: Architecture and implementation techniques of distributed systems.

Requirements: Examination.

Literature: George Coulouris, Jean Dollimore, Tim Kindberg: Distributed Systems: Concepts and Design, 4th edition, 2005.

Prerequisites: T-106.4150/T-106.430.

Language: Finnish

T-106.5300 Embedded Systems (5 cr)

Spring

Lecturer: Olli Seppälä, M.Sc.(Tech.)

Contents: Development of embedded systems, their hardware, solutions and application areas. Programming with real-time, fault-tolerance, and correctness requirements. A somewhat extensive team project is required to pass the course.

Requirements: Mandatory team project, examination.

Literature: Lecture notes. Books on the subject recommended during the course.

Prerequisites: (T-106.3100/T-106.237 or AS-0.1101/AS-0.101 or some other course on programming with C) and T-106.4150/T-106.430.

Additional information: Replaces the course T-106.530.

Language: English.

T-106.5400 String Algorithms (5 cr) P

Spring (Not lectured during study year 2006-2007)

Lecturer: Prof Jorma Tarhio

Contents: Exact and approximate string matching. Indexing. Text compression.

Requirements: Examination, exercises and programming assignment.

Literature: Handout.

Prerequisites: T-106.4100/T-106.410.

Additional information: Replaces the course T-106.540.

Language: Finnish

T-106.5450 Advanced Course on Compilers (5 cr) P

Spring

Teacher: Vesa Hirvisalo, lecturing researcher

Contents: Programming language translation, static program analysis, program manipulation, optimization and applications.

Requirements: Examination.

Prerequisites: T-106.4200 and T-79.3001/T-79.144.

Additional information: Will be organized for the first time during study year 2007–2008.

Language: Finnish

T-106.5550 Research methods (5–8 cr) P V

Spring

Teacher: Päivi Kinnunen, Lic.A.(Educ.)

Contents: Various research processes and methods which relate to research made in different areas of information technology. Methods that can be applied to study learning in the area of information technology are one central area of the course. Course content varies yearly.

Requirements: To be announced separately.

Prerequisites: Course is intended for PhD students who are planning or just starting their research. Graduate students who are planning their masters thesis may benefit from this course, also.

Language: Finnish

Additional information: Replaces the course T-106.420.

T-106.5600 Concurrent Programming (5 cr) P

Autumn

Lecturer: Prof Heikki Saikkonen

Contents: Principles of concurrent programming, synchronization and communication mechanism. Concurrent and distributed algorithms. Concurrent and distributed systems.

Requirements: Examination and programming exercises.

Literature: Handout; Ben-Ari: Principles of Concurrent and Distributed Programming; Goetz, Peierls, Bloch, Bowbeer: Java Concurrency in Practice.

Prerequisites: T-106.3100/T-106.233/T-93.270, T-0.3123/T-61.123, T-106.4150/T-106.430, Java programming

Additional information: Replaces the course T-106.420.

Language: English.

T-106.5700 Project in Software Techniques (5–12 cr) V

Autumn & Spring

Teacher: N.N.

Contents: A learning project on a separately agreed technical topic in the area of software technology. The topic should include both learning goals and constructive work.

Requirements: Project is done in a group of 3 to 4 students. The group completes a common project work aimed at learning a particular topic and whose results are documented in a set of technical/scientific reports. In addition, each member of a group prepares a personal learning portfolio about his or her work and studying.

Prerequisites: Bachelor degree and preferably also courses from module A3.

Additional information: The course is intended only for students with major in Software Techniques. Will be organized for the first time during study year 2008–2009. Will replace the course T-106.720.

T-106.5800 Seminar on Software Techniques (3–10 cr) P V

Teacher: Prof Heikki Saikkonen, Prof Eljas Soisalon-Soininen, Prof Jorma Tarhio, and Prof Lauri Malmi

Contents: The contents of this course vary. Please see <http://www.cs.hut.fi/Opinnot/T-106.5800> for the information about seminar sessions.

Additional information: Will be organized for the first time during study year 2008–2009. Will replace the course T-106.850.

T-106.6100 Supplementary Course (1–8 cr) V

Teacher: Prof Heikki Saikkonen, Prof Eljas Soisalon-Soininen, Prof Jorma Tarhio, and Prof Lauri Malmi

Contents: The contents and extent of the course must be discussed with the teacher. The course is intended for situations, for example, when a student has transferred to Helsinki University of Technology from some other university.

Additional information: More information from the WWW page <http://www.cs.hut.fi/Studies/T-106.6100>

T-106.6200 Special Course in Software Techniques (1–8 cr) P V

Teacher: Prof Jorma Tarhio

Contents: The contents of this course vary. Lectured according to agreement.

Additional information: Will replace the course T-106.810.

T-106.6300 Special Assignment in Software Techniques (5–8 cr) P V

Teacher: Prof Jorma Tarhio

Contents: Independent exercise.

Prerequisites: Courses of module A3.

Additional information: Will be organized for the first time during study year 2008–2009. Will replace the course T-106.830.

T-106.6400 Individual Studies (1–15 cr) P V

Teacher: Prof Heikki Saikkonen, Prof Eljas Soisalon-Soininen, Prof Jorma Tarhio, and Prof Lauri Malmi

Contents: The contents and extent of the course are to be agreed on with a professor before commencing the course.

Additional information: Replaces the course T-106.870.

T-106.6500 Special course in Computing Education Research (1–10 cr) P V

Arranged by agreement

Teacher: Prof Lauri Malmi

Contents: The course discusses varying themes, literature, systems and research, which are related to computing education research. Contents and requirements vary each year.

Literature: Announced separately

Prerequisites: Announced separately

T-106.6520 Personal assignment in Computing Education Research (1–10 cr) P V

Teacher: Prof Lauri Malmi

Contents: In this course students study specific themes related to computing education research. The requirements are agreed on personally with the teacher. Contents and requirements vary each year.

Literature: Announced separately

Prerequisites: Announced separately

T-106.6540 Seminar in computing education research (3–10 cr) P V

Teacher: Prof Lauri Malmi

Contents: The seminar discusses varying themes related to computing education research. Contents and requirements vary each year.

Literature: Announced separately

Prerequisites: Announced separately

T-106.6560 Research seminar in computing education research (1–5 cr) P V

Teacher: Prof Lauri Malmi

Contents: In this seminar researchers present their own work and current research themes are discussed.

Courses credited in ocr

T-106.550 Compilers (4 ocr) P

Autumn

Lecturer: Prof Jorma Tarhio

Contents: Translation of high-level languages to machine code. Lexical analysis, syntax analysis, syntax-directed compilation, type checking, run-time system, modern methods of code optimization. Working in pairs, the students write a compiler producing executable code.

Requirements: Examination, exercises and programming assignment.

Literature: A. Appel: Modern Compiler Implementation in Java. Cambridge University Press, 2nd ed., 2002.

Prerequisites: T-79.1001/T-79.148 and T-106.1240/T-106.235/T-93.270.

Additional information: exercises are also in English. Will be organized for the last time during study year 2006–2007

Language: Finnish.

T-109, T-110 DATA COMMUNICATIONS SOFTWARE AND APPLICATIONS

Prof.: (pro tem) N. Asokan, A110, tel. 451 4795

Prof.: (pro tem) Jukka Manner, A104, tel. 451 4161

Prof Antti Ylä-Jääski, A107, tel. 451 4718

For complete descriptions of all courses and actual information, please refer to <http://www.tml.tkk.fi/Studies/courses.html>.

Courses credited in ECTS

T-109.4300 Network Services Business Models (3 cr)

Spring

Lecturer: Lecturing researcher Sakari Luukkainen

Contents: The goal of the course is to describe the challenges service providers face in offering new mobile services taking into consideration both the business aspects and the fast developing technology requirements and possibilities. The course focuses on theoretical models of the network services commercialization process as well as practical case examples related to mobile multimedia services.

Requirements: Exam

Literature: Eylert: The Mobile Multimedia Business, 2005.

Language: English

T-109.5410 Technology Management in the Telecommunications Industry (3 cr)

Autumn

Lecturer: Lecturing researcher Sakari Luukkainen

Contents: The goal of the course is to describe technology management as a part of the business process of a telecommunications company. The course handles the structure of the telecommunications industry and its innovation characteristics, technology choices, R&D financing, standardization and product strategy.

Requirements: Exam.

Literature: Varian: Information Rules, A Strategic Guide to the Network Economy, 1999, McGrath: Product Strategy for High Technology Companies, 2001.

Prerequisites: TU-91.2005

Additional information: Replaces the course T-109.410

Language: Finnish

T-109.7510 Research Seminar on Telecommunications Business (5 cr) P V

Spring

Lecturer: Lecturing researcher Sakari Luukkainen

Contents: The goal of the course is to learn scientific writing and how to make a research study as an introduction for the Masters or PhD thesis. The participants will make a study related to telecommunications business and present it during the seminar.

Requirements: Active participation, preparation and presentation of a research report during the seminar, acting as opponent, written summary of all presentations.

Literature: To be announced later.

Prerequisites: T-109.5410

Additional information: Replaces the course T-109.501

Language: English.

T-109.7553 Individual Studies in Telecommunications Business (2-15 cr) P V

Autumn + Spring

Lecturer: Lecturing researcher Sakari Luukkainen

Contents: The content and extent of the course has to be decided with the responsible teacher. The student can for example take an examination on a suitable book or make a literature study related to telecommunications business and postgraduate studies.

Additional information: Replaces the course T-109.553

Language: English.

T-110.1100 Introduction to Datacommunications and Multimedia Technology (5 cr)

Spring

Lecturer: Ursula Holmström, Timo Kiravuo

Contents: Introductory course on data communications and digital media. Networking and communications in data and telecommunication networks. Security: basic concepts and meaning. Overview of digital media technology and production. Requirements: Exam and home assignments

Literature: see course homepage

Prerequisites: Computer as a tool or equivalent skills.

Additional information: Replaces the course T-110.250

Language: Finnish. Exercises and material available in English.

T-110.2100 Introduction to Datacommunications (5 cr)

Spring

Lecturer: Lecturer Timo Kiravuo

Contents: Basics of modern telecommunications systems: layer architectures, communication protocols and their general properties, structure and workings of telecommunications networks, general data transfer networks and services, local area networks and service networks. Computer security: basic concepts and their meaning. Concepts and principal standards.

Requirements: Final exam or mid-term exams, homework.

Literature: Will be announced later.

Additional information: Replaces the course T-110.250 or T-110.300

Language: Finnish

T-110.2105 Introduction to Datacommunications (5 cr)

Spring

Lecturer: Lecturing researcher Ursula Holmström

Contents: Basics of modern telecommunications systems: layer architectures, communication protocols and their general properties, structure and workings of telecommunications networks, general data transfer networks and services, local area networks and service networks. Computer security: basic concepts and their meaning. Concepts and principal standards.

Requirements: Final exam or mid-term exams, homework.

Literature: Will be announced later.

Additional information: Replaces the course T-110.250 or T-110.300

Language: Swedish

T-110.4100 Computer Networks (4 cr)

Autumn

Lecturer: Lecturing researcher Sanna Suoranta

Contents: Implementation principles of telecommunications software and fundamental principles of computer networks, especially IP networks. Routing, name service, network administration, protocol development and network programming.

Requirements: Exam and programming assignment.

Literature: Please see course homepage.

Prerequisites: T-110.2100 and T-106.3100

Additional information: Replaces the course T-110.350

Language: Finnish

T-110.4206 Information Security Technology (3 cr)

Autumn (Period II)

Lecturer: Lecturer Timo Kiravuo

Contents: The course covers basic methods for implementing security and applying them. Building safe systems. Identification, authentication and access control. Possibilities offered by cryptography. Security models. Security of operating systems and services.

Requirements: Final exam and mandatory homework.

Literature: Please see course homepage.

Prerequisites: T-110.2100 equivalent skills.

Additional information: Replaces T-110.403.

Language: English

T-110.4400 Datacommunications Software Project (5 cr)

Not lectured 2006-2007

Lecturer: N. N.

Contents: In this course, a large software system is implemented as a group work; a full project from the planning and requirements to documentation and delivery is done.

Requirements: group assignment

Prerequisites: T-110.4100 and T-110.4200

Language: Finnish

T-110.5100 Laboratory Works in Datacommunications Software (4 cr)

Autumn

Lecturer: Seppo Äyräväinen, M.Sc (Tech)

Contents: The course consists of laboratory works related to using, managing and designing telecommunications software and networks. On the course, you will familiarize yourself with popular networking solutions and analysis tools.

Requirements: laboratory works

Literature: RFCs, software documentation

Prerequisites: T-110.2100, T-110.4100

Additional information: Replaces the course T-110.400

Language: Finnish and English

T-110.5116 Computer Networks II - Advanced Features (4 cr) P

Autumn

Lecturers: Janne Lindqvist, M.Sc. (Tech) and Harri Toivanen, M.Sc. (Tech)

Contents: Advanced features of Internet Protocol based computer networks. Focus is on mobility management, authentication, authorization and accounting services, session management and quality of service architectures. The group work consists of designing data communication and service architectures for a given setting.

Requirements: exam, group work and presentation of the group work

Literature: RFCs and scientific publications

Prerequisites: T-110.2100, T-110.4100, T-110.4200

Additional information: This English version of T-110.5110 will be held during Autumn 2006 if requested.

Language: English

T-110.5120 Next Generation Wireless Networks (4 cr) P

Autumn (Period II)

Lecturer: Bengt Sahlin

Contents: This seminar will provide advanced knowledge about the next generation of wireless networks (UMTS, WLAN, Bluetooth etc.) The course will cover network architectures, basics of the radio technologies, core network, services and security issues. The relevant protocols are discussed including respectively the transmission network, radio network and system network.

Requirements: Presentation and/or a written study.

Literature: Please see course homepage.

Prerequisites: T-110.2100 or equivalent skills and a seminar like T-110.5190 or T-110.5290.

Additional information: The number of participants is limited. Replaces T-110.456

Language: English

T-110.5130 Mobile Systems Programming (5 cr)

Spring

Teacher: Prof. Antti Ylä-Jääski

Contents: The course covers the general properties of mobile systems. In addition, you will familiarize yourself with the special features and most useful design patterns of mobile system programming. Special attention will be given to J2ME and Symbian environments.

Requirements: Assignments, exam

Literature: Tommi Mikkonen: *Mobiiliohjelmointi*, Talentum, ISBN: 951-762-844-7 (in Finnish)

Prerequisites: T-106.3100

Additional information: Lectured via videoconference from Tampere.

Language: Finnish

T-110.5140 Network Application Frameworks (4 cr) P

Spring

Lecturer: Sasu Tarkoma

Contents: The course covers the fundamentals of modern distributed application and service programming with the focus on current and emerging topics in IETF and W3C. Topics include the Internet Architecture, Web Services and middleware, and mobile middleware.

Requirements: Pre-exam, final exam and assignments.

Literature: Please see course homepage.

Prerequisites: T-110.4100 and T-110.5100.

Additional information: The number of participants is limited.

Replaces the course T-110.455

Language: English

T-110.5190 Seminar on Internetworking (4 cr) P V

Spring

Lecturer: Prof. Antti Ylä-Jääski

Contents: The course addresses current issues concerning the Internet. The topical area varies year to year covering research questions in Internet network architectures, protocols, network middleware, applications, services and service management.

Requirements: Preparing a written article and making a seminar presentation of it. Acting as a referee and opponent. Active participation in the seminar.

Literature: Please see course homepage.

Prerequisites: T-110.4100

Additional information: The number of participants is limited.

Replaces the course T-110.551

Language: English

T-110.5200 Laboratory Works on Information Security (4 cr)

Autumn

Teacher: Seppo Äyräväinen, M.Sc (Tech)

Contents: The course consists of laboratory works related to security in telecommunications software and networks. On the course, you will familiarize yourself with popular security solutions and analysis tools.

Requirements: laboratory works

Literature: RFC:s, software documentation

Prerequisites: T-110.2100, T-110.4100, T-110.4200

Additional information: Replaces the course T-110.400

Language: Finnish and English

T-110.5210 Cryptosystems (4 cr)

Autumn

Lecturer: Sami Vaarala, M.Sc. (Tech.)

Contents: Applying cryptology in practical information systems to improve system security. Covers basics of cryptosystems but emphasizes the practical aspects of cryptosystem implementation. Course assignment is a practical implementation of a cryptosystem.

Requirements: Final exam and assignment

Literature: See the course homepage

Prerequisites: Basic skills in programming and system design

Additional information: Corresponding course T-79.4501.

Replaces the course T-110.470.

Language: English

T-110.5220 Information Security and Usability (3 cr)

Spring (Period I)

Lecturer: Ursula Holmström

Contents: Security from a users point of view. The role of usability in secure information systems. Special properties in usability of security.

Requirements: To be announced later.

Prerequisites: T-110.4200

Language: Finnish, material available in English

T-110.5230 Special course in Practical Security of Information Systems (4 cr) P

Spring

Lecturer: Sami Vaarala, M.Sc. (Tech.)

Contents: Threats and vulnerabilities of information systems. Performing practical attacks in groups to learn about information security in practice. The course aims at teaching practical ways of identifying assets, threats, vulnerabilities, and attacks, but also how to protect against attacks in practice.

Requirements: Assignments

Prerequisites: T-110.350, T-110.400, T-110.402 and programming skills in C language, T-79.159 is also recommended

Additional information: Replaces the course T-110.452. Presentation can also be given in Finnish

Language: English

T-110.5290 Seminar on Network Security (4 cr) P V

Autumn

Lecturer: Prof. (pro tem) Jukka Manner

Contents: The course addresses varying issues in communications networks security. Every participant must prepare a written presentation and present their work during a two day seminar.'

Requirements: Active participation, preparation of a written presentation, and its presentation during the seminar. Acting as referee and opponent.

Literature: See course homepage

Prerequisites: T-110.4200

Additional information: Replaces the course T-110.501

Language: English

T-110.5600 Introduction to Corporate Security (3 cr)

Spring

Lecturer: D.Sc. (Tech.) Teemupekka Virtanen

Contents: The course presents a general overview of security in corporations and gives information useful in working life. Topics include security management, personnel, physical and information security, security standards and legislation.

Requirements: Final exam

Literature: Handouts

Additional information: Replaces the course T-110.260

Language: Finnish

T-110.5610 Personnel and Premises Related Security (3 cr)

Spring (Period IV)

Lecturer: Harri Koskenranta and Ilkka Kouri

Contents: Course addresses such traditional methods within corporate security that are necessary also for information security. Securing the trustworthiness of the personnel and related legal issues in different stages of the career. Developing of the security of the organizations premises.'

Requirements: Exam

Literature: Handouts and WWW-material

Prerequisites: T-110.5600

Additional information: Replaces the course T-110.460

Language: Finnish

T-110.5620 Developing Process for Information Security (4 cr) P

Autumn (Period I)

Lecturer: Tuija Kyrölä M.Sc (Econ.)

Contents: Development of information security in an organisation. Defining key processes. Defining requirements of information security. Building information security for an organisation. Subareas of information security and developing them.

Requirements: Final exam and assignment

Literature: See homepage of the course

Prerequisites: T-110.5600

Additional information: Replaces the course T-110.454

Language: Finnish

T-110.5690 Seminar on Corporate Security (4 cr) P V

Autumn

Lecturer: Teemupekka Virtanen

Contents: Current topics in corporate security.

Requirements: Seminar

Prerequisites: T-110.5600, T-110.5610

Additional information: Replaces the course T-110.554

Language: Finnish only

T-110.6100 Special Assignment in Datacommunications Software (2-10 cr) P V

Autumn & Spring

Lecturer: Prof. Antti Ylä-Jääski

Contents: In the special work, the student will independently implement a solution to a programming assignment related to telecommunications software. Possible topics are Internet technologies, computer network applications, service frameworks, service management or network interworking. The special work offers a good means for learning some special telecommunications software topic in depth and for practicing the implementation and reporting of an individual programming project.

Requirements: Planning, implementation and testing of a software solution, presentation and analysis of the results and a written report.

Literature: Agreed upon separately.

Prerequisites: T-110.4100 and T-110.5100.

Additional information: Topics will be given on the course web page. The student can also suggest an own topic. Group work possible if agreed upon separately. Replaces the course T-110.552

Language: Finnish, Swedish or English

T-110.6110 Individual Studies in Datacommunications Software (2-10 cr) P V

Autumn & Spring

Lecturer: Prof. Antti Ylä-Jääski

Contents: In the individual work, the student will independently make a study on a topic related to telecommunications software. Possible topics are Internet technologies, computer network applications, service frameworks, service management or network interworking. The study can be based on professional literature or scientific articles. The individual work offers a good means for learning some special telecommunications software topic in depth and for practicing the writing of a scientific thesis, especially in the doctoral studies.

Requirements: Presentation or a written academic study.

Literature: Agreed upon separately.

Additional information: Topics will be given on the course web page. The student can also suggest an own topic. Group work possible if agreed upon separately. Replaces the course T-110.553

Language: Finnish, Swedish or English

T-110.6200 Special Assignment in Information Security (2-10 cr) P V

Autumn (Period I) & Autumn (Period II) & Spring (Period III) & Spring (Period IV)

Lecturer: Prof. (pro tem) Jukka Manner

Contents: Independent scientific research or software desing project in the field of information security. Can also be literary research. With a prior agreement the work can also be carried out in groups.

Requirements: Preparation and presentation of the research work or software project.

Additional information: Replaces the course T-110.552

Language: Finnish, Swedish or English

T-110.6210 Individual Studies in Information Security (2-10 cr) P V

Autumn (Period I) & Autumn (Period II) & Spring (Period III) & Spring (Period IV)

Lecturer: Prof. (pro tem) Jukka Manner

Contents: The content and scope of the individual course must be agreed beforehand with the lecturer. The subject may be a study of a particular book on the subject or literary research work on the subject belonging to the study area of postgraduate studies.

Additional information: Replaces the course T-110.553

Language: Finnish, Swedish or English

T-110.6600 Special Assignment in Corporate Security (2-10 cr) P V

Autumn (Period I) & Autumn (Period II) & Spring (Period III) & Spring (Period IV)

Lecturer: Prof. (pro tem) Jukka Manner

Contents: Independent scientific research project in the field of corporate security. Can also be literary research. With a prior agreement the work can also be carried out in groups.

Requirements: Preparation and presentation of the research work.

Additional information: Replaces the course T-110.552, No longer in studyprogram after 2006-2007.

Language: Finnish, Swedish or English

T-110.6610 Individual Studies in Corporation Security (2-10 cr) P V

Autumn (Period I) & Autumn (Period II) & Spring (Period III) & Spring (Period IV)

Lecturer: Prof. (pro tem) Jukka Manner

Contents: The content and scope of the individual course must be agreed beforehand with the lecturer. The subject may be a study of a particular book on the subject or literary research work on the subject belonging to the study area of postgraduate studies.

Requirements: To be agreed with the professor.

Additional information: Replaces the course T-110.553, No longer in studyprogram after 2006-2007.

Language: Finnish, Swedish or English

T-110.7100 Applications and Services in Internet (4 cr) P V

Autumn

Lecturer: Prof. Antti Ylä-Jääski

Contents: The course focuses on current issues concerning the design, development, deployment and management of applications and services in Internet. The topical areas vary yearly covering system architectures, service architectures, service management and related technical development issues. Some of the focal areas are peer-to-peer technologies, systems and services in comparison to more traditional client-server systems.

Requirements: Preparing own seminar presentations and reports.

Active participation in the discussions of the interactive lectures.

Literature: Announced on the homepage.

Prerequisites: T-110.4100

Additional information: The course is intended for postgraduate students.

Language: English

T-110.7110 Internet Technologies for Mobile Computing (4 cr) P V

Spring (Not lectured 2006-2007)

Lecturer: Docent Kimmo Raatikainen

Contents: Variable content course addressing advanced, current issues in the mobile computing domain. The topical areas vary yearly covering research questions in mobile technologies, mobile networking, applications and services in mobile networks and standardisation forums for mobile computing.

Requirements: Preparing own seminar presentations and reports.

Active participation in the discussions of the interactive lectures.

Literature: Announced on the homepage.

Prerequisites: T-110.4100

Additional information: The course is intended for postgraduate students.

Language: English

T-110.7190 Research Seminar on Datacommunications Software (3-5 cr) P V

Autumn & Spring

Lecturer: Prof. Antti Ylä-Jääski

Contents: The course addresses advanced issues concerning the Internet. The topical area varies yearly covering research questions in Internet network architectures, protocols, network middleware, applications, services and service management.

Requirements: Preparing a written conference article and presenting it in a seminar. Acting as a referee and opponent.

Literature: Announced on the homepage.

Prerequisites: T-110.5190 or T-110.5290

Additional information: The course is intended for postgraduate students. The number of participants is limited. Replaces the course T-110.557

Language: English

T-110.7200 Special Course in Operating System Security (3-8 cr) P V

Autumn & Spring (not arranged 2006-2007)

Lecturer: N. N.

Contents: This course has a varying topic and is arranged subject to availability of a lecturer. When arranged, the course may be given in English. Information about the arrangement and the beginning of the course will be published in the webpages.

Requirements: Announced later.

Additional information: The course is not arranged 2006-2007.

Language: English

T-110.7210 Special Course in Communication Security (3-8 cr) P V

Autumn & Spring (not arranged 2006-2007)

Lecturer: N. N.

Contents: This course has a varying topic and is arranged subject to availability of a lecturer. When arranged, the course may be given in English. Information about the arrangement and the beginning of the course will be published in the webpages.

Requirements: Announced later.

Additional information: The course is not arranged 2006-2007.

Language: English

T-110.7220 Special Course in Security Evaluation (3-8 cr) P V

Autumn & Spring (not arranged in 2006-2007)

Lecturer: N. N.

Contents: This course has a varying topic and is arranged subject to availability of a lecturer. When arranged, the course may be given in English. Information about the arrangement and the beginning of the course will be published in the webpages.

Requirements: Announced later.

Additional information: The course is not arranged 2006-2007.

Language: English

T-110.7290 Research Seminar on Network Security (3-5 cr) P V

Autumn & Spring

Lecturer: Prof. (pro tem) N. Asokan

Contents: The course addresses varying issues in communications network security. Every participant must prepare a scientific article and present their work during a conference. In autumn 2006 the course is arranged in cooperation with the course T-79.7001 Postgraduate course in theoretical computer science by Prof. Nyberg.

Requirements: Active participation, preparation of a written article and its presentation during a conference. Acting as a referee and opponent.

Prerequisites: T-110.5290

Additional information: Replaces the course T-110.557

Language: English

T-111 INTERACTIVE DIGITAL MEDIA CONTENTS PRODUCTION

Prof. Tapio Takala, room A137, tel. 451 3222

Prof. Petri Vuorimaa, room B121, tel. 451 4794

Prof. Lauri Savioja, room A135, tel. 451 3237

Prof. Juha Tuominen, room B134, tel. 451 3375

Courses credited in ECTS**T-111.2350 Multimedia Technology** (4 cr)

Spring

Lecturer: Prof. Petri Vuorimaa.

Contents: Basic concepts of multimedia, application areas, and convergence of digital media. Multimedia systems both at hardware and software level. Audio and video coding and compression. Interchange formats, basics of XML markup language, and content production tools. Quality of service, multicast, multimedia communications, and access networks.

Requirements: Exam and laboratory exercise.

Literature: Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, Pearson Prentice Hall, 2004.

Prerequisites: T-106.1200 Basics of Programming.

Additional information: One can get either half (1.5 points) or full (3 points) extra grade from the laboratory exercise to the final grade. The exam has to be passed with minimum grade of one (1), though. Replaces the course T-111.350

Language: Finnish and English

T-111.4003 Multimedia Tools (4 cr)

Autumn

Lecturer: Vesa Kantola

Contents: The aim is to learn to use effectively different types of multimedia programs and become familiar with common avdesign problematics. Topics are image editing, graphic design, digital video, sound editing and multimedia authoring.

Requirements: Exercises and a final project.

Additional information: Replaces course T-111.003

Language: Finnish

T-111.4300 Fundamentals of Computer Graphics (3 cr)

Autumn (Period II)

Lecturer: prof. Lauri Savioja

Contents: Graphic devices, 2- and 3-dimensional drawing, geometric modeling, use of colors, algorithms of computer graphics

Requirements: Exam and assignment

Literature: Hearn & Baker: Computer Graphics with OpenGL

(3rd Edition)

Prerequisites: Basics of programming

Additional information: Replaces course T-111.301

Language: Finnish

T-111.4360 Design of WWW Services (4 cr)

Spring

Lecturer: Professor Petri Vuorimaa, teacher Risto Ranta-aho
 Contents: The course deals with designing and implementing WWW sites and interactive services on the web. Some of the topics covered are web service implementation techniques, usability, web service life span, graphic design and information security. The project work consists of designing and implementing a WWW service.

Requirements: A project work done in groups

Literature: online material

Additional information: All lectures are held during period III.

Replaces courses T-111.361, T-111.362

Language: Finnish

T-111.5005 Conceptualization and scriptwriting (3 cr)

Autumn

Lecturer: Vesa Kantola

Contents: The goal is to learn how to write a script and plan for multimedia. During the course students will write a script for their own multimedia product. The course deals with concept design and dramaturgy. The audio-visual field and different projects are studied widely to become familiar with different genres of new media. A ready script and a demo is made during the course.

Requirements: Lectures exercises and a script.

Additional information: Replaces course T-111.005

Language: Finnish

T-111.5007 Multimedia Project (5 cr)

Spring

Lecturer: Vesa Kantola

Contents: Scripts and ideas are turned to real productions. Students work in small groups and learn how to handle a projects, work with each other and learn about different types of audiovisual professions.

Requirements: A project work

Prerequisites: T-111.4003 and T-111.4005

Additional information: Replaces course T-111.007

Language: Finnish

T-111.5015 Film Narrative (5 cr)

Autumn

Lecturer: Vesa Kantola

Contents: Learn the narrative basics of moving imagery and digital video. Scriptwriting, production, equipment, shooting, lighting, editing and post production.

Requirements: Lectures, exercises, a script and a short film done in groups.

Additional information: Replaces courses T-111.015 and T-111.016

Language: Finnish

T-111.5020 Visual Expression (3 cr)

Spring

Lecturer: Vesa Kantola

Contents: Aim is to learn the basics of graphic design and visual expression: analysis, graphic design, photography, image manipulation, color theory, composition, typography and layout.

Requirements: Lectures, exercises and final work exhibition

Prerequisites: T-111.4003

Additional information: Replaces course T-111.020

Language: Finnish

T-111.5025 Sound Design (3 cr)

Spring

Lecturer: Vesa Kantola

Contents: The goal is to learn the basics of audial expression. What are the possibilities to use audio narratively, how to record, what is audio dramaturgy, and how to make audio in practice?

How to use music and the basics of making it, history of electronic music, midi, samplers, field recording, dialog etc.

Requirements: Lectures, exercises and an individual final work

Language: Finnish

T-111.5030 3D Production (5 cr)

Autumn (lectured every other year, lectured in 2006-07)

Lecturer: Prof. Tapio Takala

Literature: Isaac Victor Kerlow: The Art of 3-D Computer Animation and Imaging.

Prerequisites: T-111.4300 and in addition either T-111.5005 or T-111.5015

Additional information: Replaces course T-111.030

Language: Finnish

T-111.5070 Special Course in Content Production (2-6 cr) V

Autumn (Period I) & Autumn (Period II) & Spring (Period III) & Spring (Period IV)

Lecturer: Prof. Tapio Takala

Contents: Course content varies from year to year.

Requirements: Announced later

Additional information: Replaces course T-111.070

Language: Finnish

T-111.5077 Special Project on Content Production (6-9 cr) P

Autumn + Spring

Lecturer: Prof. Tapio Takala

Additional information: Replaces course T-111.077

Language: Finnish

T-111.5080 Seminar on Content Production (4-8 cr) P V

Autumn & Spring

Lecturer: Prof. Tapio Takala

Additional information: Replaces course T-111.080

Language: Finnish

T-111.5300 Advanced Course in Computer Graphics (4 cr)

Spring

Lecturer: prof. Lauri Savioja

Contents: Programming oriented course that goes deeper in computer graphics algorithms and their implementation with OpenGL API.

Requirements: Several assignments

Literature: Hearn & Baker: Computer Graphics with OpenGL (3rd Edition)

Prerequisites: T-111.4300

Additional information: Replaces the course T-111.300 together with T-111.4300.

Language: Finnish

T-111.5350 Multimedia Programming (4 cr)

Autumn

Lecturer: Prof. Petri Vuorimaa

Contents: The topic of the course is multimedia terminal application development. Key topics include, for example, embedded operating systems and most important application programming interfaces.

Requirements: The course is composed of lectures, student presentations and small case programming assignment.

Literature: To be announced later.

Prerequisites: T-111.2350 Multimedia Technology.

Language: English

T-111.5360 WWW Applications (4 cr) P

Spring

Lecturer: Prof. Petri Vuorimaa

Contents: The topic of the course is XML markup language and its use in www-applications. The objective is to get familiar with different XML based markup languages under development and how they are used together. In addition, the course will study the use of XML languages in the implementation of WWW services.

Requirements: The course is composed of lectures and student presentations. To pass the course one has to follow lectures, give a presentation, and do a small exercise.

Literature: On-line material.

Prerequisites: T-111.4360

Language: English

T-111.5370 3D modeling and virtual prototypes (6 cr)

Autumn

Lecturer: Prof. Juha Tuominen, M.Sc. (Tech.) Antti Nurminen

Contents: The course covers topics in virtual prototyping and models, their visualisation and dynamic simulation. Foundation of 3-dimensional modeling and the description process of virtual environments. Creation, design, modeling and technical implementation of the process. Managing and applying the event environment for an interactive evaluation in the target environment. The course includes an extended laboratory exercise where 3-dimensional models are created and visualised/simulated.

Requirements: Extended group exercise.

Literature: To be announced.

Prerequisites: T-111.4300

Additional: Replaces the course T-126.100 or T-126.101.

Language: ?

T-111.5400 Virtual Reality (4 cr) P

Spring (Period III)

Lecturer: Lecturing researcher Tapio Lokki

Contents: Learning the tools and concepts for simulation and manipulation of 3D virtual worlds. Topics include physiology of sensing and immersive (visual, aural, and haptic) I/O-devices, and applications of virtual reality.

Requirements: Exam and a brief written report.

Literature: W.R. Sherman and A.B. Craig, Understanding Virtual reality, Morgan Kaufman, 2003.

Prerequisites: T-111.4300 recommended.

Additional information: Replaces the course T-111.400

Language: Finnish

T-111.5500 Seminar on Computer Graphics (4-8 cr) P V

Spring

Lecturer: prof. Lauri Savioja, prof. Tapio Takala

Contents: Varying topics in computer graphics and its applications (modelling, animation, visualization, virtual reality).

Requirements: Seminar

Prerequisites: T-111.5300

Additional information: Replaces course T-111.500

Language: Finnish

T-111.5550 Seminar on Multimedia (4-8 cr) P V

Autumn

Lecturer: prof. Petri Vuorimaa

Contents: Varying seminar on current topics in multimedia, hypermedia or interaction technology.

Requirements: Participation on seminar sessions and seminar presentation.

Prerequisites: T-111.2350

Additional information: Replaces course T-111.550

Language: English

T-111.5600 Special Assignment in Digital Media (2-4 cr) P

Spring (Period II)

Lecturer: Lecturing researcher Tapio Lokki

Contents: An assignment is done in small groups (2-4 students). The topic of the assignment is related to the courses lectured in period III. This work is planned, implemented, and reported scientifically, so that scientific research work and reporting of the research results are learned at the same time.

Requirements: An assignment and report

Prerequisites: T-111.5360 or T-111.5400

Additional information: Replaces the course: T-111.595

Language: Finnish

T-111.6595 Individual Studies in Digital Media (2-10 cr) P V

Autumn & Spring

Lecturer: prof. Lauri Savioja, prof. Tapio Takala, prof. Petri Vuorimaa

Contents: Contents and requirements are to be agreed with the professor.

Prerequisites: T-111.5300

Additional information: Replaces the course T-111.595

Language: Finnish

T-111.7590 Research Seminar on Digital Media (4-8 cr) P V

Autumn / Spring

Lecturer: prof. Lauri Savioja, prof. Tapio Takala, prof. Petri Vuorimaa

Contents: The course aims to familiarize the students with modern computer graphics and multimedia research fields.

Requirements: Seminar

Prerequisites: T-111.5300

Additional: Replaces the course T-111.590

Language: Finnish

T-121 USABILITY RESEARCH

Prof Marko Nieminen (pro tem), Innopoli 2, room E416, tel. 451 3973

Senior lecturer Mika P. Nieminen, Innopoli 2, room E418, tel. 451 3383

Senior lecturer N:N.

University teacher Sakari Tamminen, Innopoli 2, room E415, tel. 4516042

<http://www.soberit.hut.fi/>

Note that the number of participants for the courses within the professorship T-121 can be limited. For complete descriptions of all courses and actual information, please refer to <http://www.soberit.hut.fi/english/Studies.html>.

Courses credited in ECTS

T-121.2100 Introduction to User-Centred Product Development (2 cr)

Spring (Period III)

Teacher: Prof (pro tem) Marko Nieminen

Contents: Basics in user interfaces, usability and user-centred product development.

Requirements: Lectures and examination

Prerequisites: None

Additional information: Replaces T-121.100 Introduction to User-Centred Product Development.

Language: Finnish.

T-121.3110 Exercises on User-Centred Product Development (3 cr)

Spring

Teacher: Prof (pro tem) Marko Nieminen

Contents: Exercises for different phases of user-centred product development.

Requirements: Exercise sessions and exercises.

Prerequisites: T-121.2100, can be taken simultaneously.

Additional information: Restricted number of participants. Replaces T-121.110 Exercise in User-Centred Product Development.

Language: Finnish.

T-121.5150 Methods for user-centred product development (2 cr)

Period IV

Teacher: University teacher Sakari Tamminen, senior lecturer Mika P. Nieminen

Contents: Literature based exam of the methods for user-centred product development, user research and usability evaluation.

Requirements: Exam.

Literature: Nielsen J., 1993, Usability Engineering, Academic Press. Other materials are presented in the course web pages.

Prerequisites: T-121.2100

Additional information: The course is a prerequisite for courses T-121.5400 and T-121.5600. The exams are given during the last (May) and first (September) examination periods.

T-121.5200 Human Characteristics and User Interfaces (3 cr)

Spring (Period II)

Teacher: Petri Mannonen

Contents: Basics in human perception and characteristics; senses and memory. Applying human models and theories to user interface design.

Requirements: Assignments and examination.

Prerequisites: T-121.2100

Additional information: Replaces T-121.200 User interface and psychology. Restricted number of participants (30).

Language: Finnish. Course material available in English.

T-121.5300 User Interface Construction (3-4 cr)

Autumn

Teacher: Prof (pro tem) Marko Nieminen, Prof Petri Vuorimaa

Contents: The design and construction of user interface. Use of basic user interface elements and style guides.

Requirements: Lectures and examination, assignment.

Prerequisites: T-121.2100

Additional information: Restricted number of participants (100). The course will be arranged together with the course Interactive technology. Replaces T-121.300 User Interface Construction and T-121.310 User Interface Construction Project, and the course T-111.310 Interactive Technology.

Language: Finnish. Course material available in English.

T-121.5400 User Research (3 cr)

Autumn (Period I)

Teacher: university teacher Sakari Tamminen

Contents: Planning and executing a user research, analyzing gathered data and reporting results. Basic methods for conducting user research during early product development phases.

Requirements: Lectures and assignments.

Prerequisites: T-121.3110, T-121.5150.

Additional information: Restricted number of participants (30). Together with T-121.5150 and T-121.5700 replaces T-121.700 User-centred Concept Design.

Language: Finnish.

T-121.5500 Special Assignment in User-Centred Product Development (1-8 cr) V

Autumn + Spring

Teacher: Prof (pro tem) Marko Nieminen, senior lecturer Mika P. Nieminen.

Contents: To be defined individually in advance with teacher.

Requirements: Exercise.

Prerequisites: T-121.3110.

Additional information: Corresponds to T-121.500 Special Assignment in User-Centred Product Development.

T-121.5600 Usability Evaluation (5 cr) P

Autumn

Teacher: senior lecturer Mika P. Nieminen

Contents: Usability evaluation of a finished product or a product prototype using usability inspection methods and user testing.

Requirements: Lectures, a group assignment and active participation in the course sessions.

Literature: Nielsen J., 1993, Usability Engineering, Academic Press.

Prerequisites: T-121.3110, T-121.5150, T-121.5200 recommended.

Additional information: Replaces with T-121.5150 course T-121.600 Usability Evaluation. Restricted number of participants (30).

Language: Finnish.

T-121.5700 User-centred Concept Design (4 cr) P

Spring (Period III)

Teacher: senior lecturer Mika P. Nieminen

Contents: Developing new product concepts based on user research.

Requirements: Lectures, group assignment and seminar presentations.

Prerequisites: T-121.5300, T-121.5400.

Additional information: Replaces together with T-121.5150 and T-121.5400 T-121.700 User-centred Concept Design. Restricted number of participants (30).

Language: Finnish.

T-121.5800 User-Centred Design Project (6-12 cr) P

Agreed separately

Teacher: Prof (pro tem) Marko Nieminen

Contents: Product design project using user-centred design methods.

Requirements: Group work and seminar presentation.

Prerequisites: T-121.3110 and at least one of courses T-121.5300, T-121.5600, T-121.5700, or Interactive technology.

Additional information: Replaces T-121.800 User-Centred Design Project. Restricted number of participants.

T-121.5850 Individual Course on Usability (1-10 cr) P V

Agreed separately

Teacher: Prof (pro tem) Marko Nieminen, senior lecturer Mika P. Nieminen

Contents: To be defined individually in advance with teacher.

Requirements: Individual exercise.

Prerequisites: T-121.3110

Additional information: Corresponds to T-121.850 Individual Course on Usability.

T-121.5900 Seminar on User Interfaces and Usability (3-8 cr) P V

Spring (Period IV)

Teacher: Prof (pro tem) Marko Nieminen; senior lecturer Mika P. Nieminen

Contents: Current topics in usability and user-centred product development. The contents of the seminar vary.

Requirements: Participation in seminars and seminar presentation.

Preliminary courses: T-121.3110

Additional information: Replaces T-121.900 Seminar on User Interfaces and Usability.

T-121.5950 Thesis Seminar (2 cr) P V

Autumn + Spring

Teacher: Prof (pro tem) Marko Nieminen

Contents: Basics and guidance about thesis research (methodology, process). Thesis requirements. Presentation of own ongoing thesis work and evaluation of other thesis (opponent).

Additional: Replaces the course T-121.950 Thesis Seminar about User-centred Product Development.

T-124 INFORMATION NETWORKS

Prof Riitta Smeds, Innopoli 2, room B344, tel. 451 3640

For complete descriptions of all courses and actual information, please refer to <http://www.simlab.hut.fi>.

Courses credited in ECTS

T-124.5100 Networked business processes and models (4 cr)

Autumn

Lecturer: Prof Riitta Smeds

Contents: Evolution of enterprises. Organization and management of business processes. The business model concept. Process management in companies and company networks: customer relationship management processes, new product development processes, demand-supply processes. Management of business process development. ICT as enabler of innovation in business processes and business models. - Invited company presentations about core business process solutions.

Requirements: Lectures, study diary, team assignment, examination

Literature: To be announced separately. Lecture handouts

Prerequisites: TU-22.1101/TU-22.101 Tuotantotalouden peruskurssi, TU-22.1130/TU-22.130 Laskentatoimi ja kannattavuus, TU-53.1100/TU-53.100 Työpsykologian ja johtamisen perusteet, TU-53.1308/TU-53.308 Organizations and Networks, TU-91.1002/TU-91.106 Markkinointi, TU-91.1003/TU-91.131 Principles of Strategic Management

Additional information: The course replaces the course T-124.100. Course information is available on the web at www.simlab.tkk.fi

Language: Finnish and/or English

T-124.5200 Business process development methods (3 cr)

Spring (Period III)

Lecturer: Lecturing researcher Päivi Haho

Contents: The course enhances scientific and practical knowledge and mastery of business process development, focusing on consulting and scientific methods and related skills, such as development of interaction, communication and group facilitation skills.

Requirements: Active participation in lectures, problem based field study of BPD in consulting companies with seminar session and written report, planning and realizing an experimental process simulation, reading seminars of consulting and scientific methods, learning diary.

Literature: To be announced separately. Lecture handouts.

Prerequisites: T-124.5100/T-124.100

Additional information: Max 20 students. The course replaces the course T-124.200. Course information is available on the web at www.simlab.tkk.fi

Language: Finnish and/or English

T-124.5300 Development of Business Processes, project assignment (5 cr)

Autumn (Period I) & Autumn (Period II) & Spring (Period III) & Spring (Period IV)

Lecturer: Lecturing researcher Päivi Haho

Contents: The course deepens understanding of development and management of networked business processes, with the problem based project assignment, concerning a real case company's network/business process development project. The students work as a part of a professional research team, applying the SimLab process development methods.

Requirements: Project plan, final project report, follow-up report of the project, research plan/ essay on research topic of interest, self-evaluation and assessment. Acting and facilitating in the project, reporting results and participating in feed-back sessions.

Prerequisites: T-124.5200/T-124.200

Additional information: Only for the students of the Degree Programme of Information Networks, majoring in Business Process Networks. The course replaces the course T-124.300. The old course T-124.300 and credits (5 cr) are valid until the end of year

2006. Course information is available on the web at www.simlab.tkk.fi

Language: Finnish and/or English

T-124.5400 Theoretical perspectives on business processes (4 cr) P

Autumn

Lecturer: Senior researcher Miia Jaatinen

Contents: The course presents theoretical approaches from different disciplines to the study business processes and business models. The course provides a multidisciplinary approach to the problem based scientific research on business processes, and supports the development of research topics.

Requirements: Lectures and seminar sessions. Study diary.

Literature: Lecture handouts and scientific articles. To be announced at the lectures.

Prerequisites: T-124.5100/T-124.100, T-124.5200/T-124.200

Additional information: Will be organised for the first time during the academic year 2006-2007. Course information is available on the web at www.simlab.tkk.fi

Language: Finnish and/or English

T-124.5500 Business Process Networks, Master-ís Thesis seminar (1 cr)

Autumn & Spring

Lecturer: Prof Riitta Smeds

Contents: Introductory lecture and seminar sessions. Each student gives a presentation about two finished Master-ís Theses, presents the plan of his/her own Thesis, one intermediate version, and the final Master-ís Thesis (official Master-ís Thesis presentation).

Requirements: Active participation in the sessions, and the seminar presentations.

Literature: Will be announced at the introductory lecture.

Prerequisites: T-124.5200/T-124.200

Additional information: Only for the students of the Degree Programme of Information Networks. Arranged on demand. The students participate in the seminar in their Master-ís Thesis phase. The course replaces the course T-124.350. Course information is available on the web at www.simlab.tkk.fi

Language: Finnish and/or English

T-124.7100 Doctoral research seminar in business process networks (3 cr) P

Autumn & Spring

Lecturer: Prof Riitta Smeds

Contents: In the seminar, the participants analyze published Doctoral Theses related to the field of business process networks, and present and discuss their own ongoing licentiate-ís or doctoral research plans. The aim of the seminar is to support the participants in conducting post-graduate research.

Requirements: Presentation of one selected thesis, presentation of own research plan, participation in discussion.

Prerequisites: TU-22.1191/TU-22.191 Research Methods in Industrial Management I (for postgraduate students)

Additional information: Arranged on demand. Replaces the course T-124.400. Only for post-graduate students majoring in Business Process Networks (ZD 17) or Telecommunications Management (ZD 12). Course information is available on the web at www.simlab.tkk.fi.

Language: Finnish and/or English

T-124.7200 Scientific Writing Seminar in Business Process Networks (3-6 cr) P

Autumn & Spring

Lecturer: Prof Riitta Smeds

Contents: The structure of scientific articles and theses. Review practices of scientific journals. Writing own articles and peer reviews.

Requirements: Planning and presentation of own writing, review of other texts. Active participation and presentations at the seminar sessions.

Prerequisites: Agreed upon separately.

Additional information: Arranged on demand. Replaces the course T-124.410. Only for post-graduate students majoring in Business Process Networks (ZD 17) or Telecommunications Management (ZD 12). Course information is available on the web at www.simlab.tkk.fi

Language: Finnish and/or English

T-124.7300 Individual course in Business Process Networks (1-15 cr) P V

Autumn & Spring

Lecturer: Prof Riitta Smeds

Contents: Current research in Business Process Networks.

Requirements: Agreed upon separately.

Literature: Agreed upon separately.

Prerequisites: Agreed upon separately.

Additional: Replaces the course T-124.450. Only for post-graduate students majoring in Business Process Networks (ZD17) or Telecommunications Management (ZD12).

Language: Finnish and/or English

T-128 SOFTWARE BUSINESS

Prof Jyrki Kontio, TUAS House, tel. 451 3230

Researcher Päivi Pöyry, TUAS House, tel. 451 6023

Researcher Jani-Pekka Jokinen, TUAS House, tel. 040 8329 423

Office: Secretary Anna C. Kaipainen, TUAS House, tel. 451 4695

For complete descriptions of all courses and actual information, please refer to <http://www.sbl.tkk/teaching/courses.html>

Courses credited in ECTS

T-128.2101 Introduction to Software Business A (1 cr)

5 + 12 (1 + 1) Autumn, period I

Lecturer: Prof. Jyrki Kontio

Contents: Course consists of case exercises that introduce business issues in software companies.

Requirements: Exercises

Literature: To be announced later

Prerequisites: TU-22.1101 Tuotantotalouden peruskurssi

Additional information: The course is based on TU-22.1101 Tuotantotalouden peruskurssi (4 op) and it is recommended that this course is taken with the course T-128.4101 Introduction to Software Business B.

Language: Finnish

T-128.4101 Introduction to Software Business B (2 cr)

24 + 0 (2 + 0) Autumn, period I

Lecturer: Prof. Jyrki Kontio

Contents: The course presents the differences between traditional products versus software-based products, such as the role of development and manufacturing, the digital nature of software, role of system integration, complexity, role of software-based services and the impact of Internet-facilitated product distribution. The course discusses how these characteristics influence strategy, R&D management and marketing.

Requirements: Exam

Literature: E. Hyvönen (toim): Ohjelmistoliiketoiminta, 2003, WSOY

Additional information: It is recommended that students have obtained basic information about business. Such basic information is provided by courses Introduction to Industrial Management and Engineering, Principles of Strategic Management, New Venture Development ja Strategic Management of Tech-

nology and Innovation. In addition, knowledge of software engineering basics is necessary for students.

Language: Finnish

T-128.4200 Management of a Software Company (6 cr) P

36 + 12 (3 + 1) Spring, period III

Lecturer: Prof. Jyrki Kontio, Mika Ahokas

Contents: Strategy formulation in software business: vertical and horizontal positioning, balance and choice between product and service focus, complementary effects between product and service offering, platform strategies, position in value networks.

Requirements: Exam and exercises

Literature: To be announced later

Prerequisites: T-128.4101 Introduction to Software Business B.

Additional information: Replaces course T-76.640 Software Business, former name of the course: T-128.4200 Software Business I.

Language: Finnish

T-128.5300 Advanced course in software business (4 cr) P

24 + 12 (2 + 1) Autumn, period I-II

Lecturer: M.Sc.(Econ) Aki Lassila, Prof. Markku Sääksjärvi, Prof. Jyrki Kontio

Contents: Evolution of software companies, critical success factors and business models, management of product innovations, product strategies, product portfolio, product architecture, product platforms, alignment of platform strategies, network structures of software companies, assessment and improvement of product development and globalization of software companies.

Requirements: Exam and Exercises

Literature: To be announced later

Prerequisites: T-128.4200 Management of a Software Company

Language: English

T-128.5400 Software Entrepreneurship Seminar (4 cr) P

24 + 0 (3 + 0) Spring, period III

Lecturer: Olli-Pekka Mutanen

Contents: The course is targeted to undergraduate and doctoral students interested in software entrepreneurship. The aim of the course is to provide students with practical knowledge of software business, such as start-up companies, their challenges, and phases of entrepreneurship. This course also includes sparring and mentoring of business plans.

Requirements: Seminar assignment / Business plan

Literature: To be announced later

Prerequisites: T-128.4200 Management of a Software Company,

T-128.5300 Advanced Course in Software Business

Language: English

T-128.5520 Risk Management in Software Business (4 cr) P

24 + 12 (2 + 1) Autumn, period I / 2007-2008

Lecturer: Prof. Jyrki Kontio

Contents: Risk taking, assessment and management in strategic planning, R&D and business operations in a software company.

Requirements: Exam and exercises

Literature: To be announced later

Prerequisites: T-128.4200 Management of a Software Company,

T-128.5300 Advanced Course in Software Business

Language: English

T-128.5540 Pricing and Positioning of Software (4 cr) P

24 + 12 (2 + 1) Spring, period III / 2007-2008

Lecturer: M.Soc.Sc. Jani-Pekka Jokinen

Contents: Price-setting and positioning strategies and practices for software products and product-related services.

Requirements: Examination and exercises.

Literature: To be announced later

Prerequisites: T-128.4200 Management of a Software Company,

T-128.5300 Advanced Course in Software Business Additional

information:

T-128.5720 Seminar in Software Business (4-10 cr) V P

According to agreement

Lecturer: Lic.Sc.(Tech.) Päivi Pöyry

Contents: A literature study on a timely, relevant topic in software business. Topic and plan need to be approved in advance.

Requirements: Research paper and presentation

Literature: To be announced later

Prerequisites: T-128.4200 Management of a Software Company, T-128.5300 Advanced Course in Software Business

Additional information: Replaces course T-76.648 Seminar in Software Business

T-128.5740 Special Assignment in Software Business (3-10 cr) V P

Arranged according to agreement

Lecturer: Prof. Jyrki Kontio

Contents: A research report on a timely, relevant topic in software business. Topic and plan need to be approved in advance.

Requirements: Research paper and presentation

Literature: To be announced later

Prerequisites: T-128.4200 Management of a Software Company, T-128.5300 Advanced Course in Software Business

Additional information: Replaces course T-76.649 Special Assignment in Software Business

Language: English

T-128.5780 Individual Study in Software Business (3-16 cr) P V

Arranged according to agreement

Lecturer: Prof. Jyrki Kontio

Contents: Varies according to situation and agreement.

T-128.6790 Special Course in Software Business (3-10 cr) P V

Arranged according to agreement

Lecturer: Mika Ahokas

Contents: Varies according to situation and agreement.

Requirements: Varies according to situation and agreement.

T-128.7900 Thesis Seminar in Software Business (4 cr) P V

According to agreement

Lecturer: Senior researcher Nilay Oza

Contents: Course in seminar format, addressing doctoral dissertation process and dissertation plans and Master's Thesis process and plans.

Requirements: Presentations and reviewing of work.

Additional information: Replaces course T-76.655 Doctoral Seminar

Language: English

DEGREE PROGRAMME OF INFORMATION NETWORKS

Inf-0.1202 Philosophy (5 cr)

Inf-0.1220 Sociology (5 cr)

Inf-0.1300 Aesthetics (5 cr)

Inf-0.3100 Principles of Complex Networks (2 cr)

T-106.1250 Programming Course for Information Networks (10 cr)

T-106.2001 Information Networks: Studio 1 (4 cr)

AS-75.2300 Information Networks: Studio 2 (2 cr)

TU-22.2600 Information Networks: Studio 3 (4 cr)

T-111.2210 Information Networks: Studio 4 (3 cr)

The courses are given only for the students of the Degree Programme of Information Networks.

DEPARTMENT OF ELECTRICAL AND COMMUNICATIONS ENGINEERING

Head of Department: Prof Pekka Wallin, tel. 451 2280
 Anita Bisi, Planning Officer, tel. 451 5381, room SE 424
 Kati Voutilainen, Planning Officer, tel. 451 6105, room SE 417
 International Study Adviser, tel. 451 2210, e-mail: skvopinto@hut.fi
 Department office: tel. 451 6049, Otakaari 5 A, 02150 Espoo,
 Office open: 8.30 a.m.-11.30 a.m. and 12.30 p.m.- 3.30 p.m.

Chairs:

S-17 Electromechanics
 S-18 Power Systems and High Voltage Engineering
 S-26 Radio Engineering
 S-38 Networking Technology
 S-55 Circuit Theory
 S-66 Applied Electronics
 S-69 Electron Physics
 S-72 Communications Engineering
 S-81 Power Electronics
 S-87 Electronic Circuit Engineering
 S-88 Signal Processing Technology
 S-89 Acoustics and Audio Signal Processing
 S-92 Space Technology
 S-96 Electromagnetics
 S-104 Physics (Optoelectronics)
 S-108 Measurement Science and Technology
 S-113 Electronics Production Technology
 S-114 Computational Engineering
 S-118 Illumination Engineering
 S-129 Optics and Molecular Materials
 S-xxx Microelectronics Center

S-0 Departments general courses

Courses credited in ECTS

S-0.1050 Finnish Literature I (1-2 cr)
 Autumn

Teacher: Kosti Sironen B.A.
 Language: Finnish

S-0.1051 Finnish Literature II (1-2 cr)

Spring
 Teacher: Kosti Sironen B.A.
 Language: Finnish

S-0.1104 Introduction to Cell Biology (6 cr)

Autumn (period II) +Spring (period III)
 Teacher: Prof Ismo Virtanen, Prof Veli-Pekka Lehto and other lecturers from University of Helsinki
 Contents: The aim of the course is to provide a good understanding of the structure and function of cells. This includes the consideration of molecular and atomic level processes taking place inside the cell and through the cell membrane. The biology of the cell within this course is described mainly by the terms of biochemistry and molecular biology. The cell division and the development as well as the organisation of the cells into tissues and organs - and finally the apoptosis are the central contents of the course.

Requirements: Examination and exercises:

1. Basics of cell culture, Reeta Lahti M.Sc. (Tech.) 2 h
2. Biological electron microscopy, N.N.
3. Optical microscopy, Mika Hukkanen Docent

Literature: J.Heino and M.Vuento: Solubiologia, WSOY 2002; I.Rantala and K.Lounatmaa: Biologisen elektronimikroskopian menetelmät, Yliopistopaino 1995. Lecture slides and handout.
 Information: The course is for the students of Bioinformation Technology.

Language: Finnish

S-0.1501 Orientation Course for Studies in Bioinformation technology (1 cr)

Autumn
 Teacher: Departments personal
 Contents: General information on TKK and student union, and introduction to Bioinformation technology.
 Requirements: Attending lectures, library exercise, and own study plan for M.Sc. studies.

Literature: Study Programme and Department's own study programme
 Language: Finnish and English

S-17 ELECTROMECHANICS

Prof. Antero Arkkio, tel. 4512383, room SI 246
<http://www.hut.fi/Units/Electromechanics>

Courses credited in ECTS

S-17.1010 Electrical Power Technology (4 cr)

Autumn (period I)
 Teacher: Asko Niemenmaa senior lecturer
 Requirements: Examination
 Literature: handout
 Prerequisites: S-55.1210 and S-96.1111/1101

Language: Finnish

S-17.2020 Electromechanics and Electric Drives (6 cr)

Spring

Teachers: Prof Jorma Luomi and Asko Niemenmaa senior lecturer

Contents: See S-17.2030

Prerequisites: S-81.2100

Only one of the courses S-17.2020/2030 can be included in the degree programme.

Language: Finnish

S-17.2030 Electromechanics and Electric Drives (6 cr)

Spring

Teachers: Prof Luomi and Anouar Belahcen researcher

Contents: Magnetic systems, properties of ferromagnetic materials, principles of electromagnetic energy conversion, transformers. Basic principles of rotating electric machines. Commutator machines, induction machines, synchronous machines. Commutator motor drives, induction motor drives and synchronous generators, -motors and -drives. Problems and laboratory exercises.

Requirements: Examination, accepted exercises, assignments.

Literature: Sen: Principles of Electric Machines and Power Electronics.

Prerequisites: S-81.2100

Only one of the courses S-17.2020/2030 can be included in the degree programme.

Language: English

S-17.3010 Numerical Methods in Electromechanics (5 cr) P

Autumn (period I)

Teacher: Prof Antero Arkkio

Requirements: Examination and three exercises

Literature: handout

Prerequisites: S-17.2020/2030

Language: Finnish

S-17.3020 Transient Phenomena in Electrical Machines (5 cr) P

Autumn (period II)

Teacher: Prof Antero Arkkio

Contents: Space vector theory, direct and quadrature axis theory. Dynamic models of rotating electric machines. Numerical and analytical methods for linear and non-linear differential equations, and analysis of some typical transients in commutator, induction and synchronous machines. Problems, laboratory exercises and special assignment.

Requirements: Examination, accepted exercises and assignments.

Literature: handout.

Language: Finnish

S-17.3030 Design of Electrical Machines (5 cr) P

Spring (period III)

Teacher: Jarmo Perho laboratory manager

Contents: Defining the parameters and dimensions of electrical machines.

Requirements: Two design exercises.

Literature: handout.

Prerequisites: S-17.2020

Language: Finnish

S-17.3040 Seminar on Electromechanics (5 cr) PV

Spring (period IV)

Teacher: Prof Antero Arkkio

Contents: The topic of the seminar is chosen annually from the field of electromechanics, such as electromechanical interactions, material modelling, thermal modelling, rotor dynamics, higher harmonics in electrical machines, special electrical machines, etc.

Language: English

S-17.3050 Special Course on Electromechanics (5 cr) PV

Autumn

Teacher: Prof Antero Arkkio

Contents: The topic of the seminar is chosen annually from the field of electromechanics, such as electromechanical interactions, material modelling, thermal modelling, rotor dynamics, higher harmonics in electrical machines, special electrical machines, etc.

Language: English

S-17.3710 Electromechanics, special assignment (2-10 cr)

Autumn& spring

Teachers: Prof Antero Arkkio

Contents: An independently conducted, supervised individual assignment on a specific topic relating to electromechanics or product development.

Requirements: Accepted report.

Prerequisites: S-17.2020

Language: Finnish and English

S-17.3720 Individual Studies in Electromechanics (2-15 cr) P V

Autumn&spring

Teacher: Prof Antero Arkkio

Contents: The topic of the course is to be agreed with the professor.

Language: Finnish

S-17.3730 Doing Research (1 cr) P

Autumn+spring

Teacher: Prof Antero Arkkio

Requirements: Participation 20 times.

Language: Finnish

S-17.4020 Postgraduate Seminar on Electromechanics (3-10 cr) P V

Autumn

Teacher: Prof Antero Arkkio

Contents: The topic and contents vary annually.

Requirements: Examination and a modelling exercise.

Language: English

S-17.4030 Postgraduate Seminar on Electromechanics (3-10 cr) P V

Spring

Teacher: Prof Antero Arkkio

Contents: The topic and contents vary annually.

Requirements: Examination and a modelling exercise.

Language: English

S-17.9000 Electrical Engineering Project (5-8 cr)

Autumn + spring

Teacher: Prof Antero Arkkio, laboratory's researchers and assistants

Contents: Organization and follow-up of a project. Working in a project, getting familiar with engineering work. The course is intended for first year students but senior students may participate as well.

Requirements: Active participation in the project work and reporting according to the project plan. The number of accepted students and registration is announced at the beginning of the term. The evaluation of the report is pass/fail.

Language: Finnish

S-18 POWER SYSTEMS AND HIGH VOLTAGE ENGINEERING

Prof: Matti Lehtonen, tel. 4515484, room SI 334

Prof: Erkki Lakervi, tel. 4514790, room SI 333

Prof. Liisa Haarla
<http://www.powersystems.tkk.fi>

Courses credited in ECTS

S-18.2103 Power Systems (5 cr)

Autumn

Teacher: Prof Matti Lehtonen

Contents: Transmission systems, distribution networks, power system components, basics of energy markets, high voltage engineering.

Requirements: Examination, laboratory work and design, exercises.

Literature: Elovaara - Laiho: Sähkölaitostekniikan perusteet 499, Otatiето, J. A.Harrison: The essence of electric power systems, Prentice Hall, 1996.

S-18.2103 and S-18.2104 are interchangeable. Only one of the courses can be included in a degree programme.

Language: English

S-18.2104 Power Systems (4 cr)

Autumn

Teacher: Prof Matti Lehtonen

Contents: Transmission systems, distribution networks, power system components, basics of energy markets, high voltage engineering.

Literature: Elovaara - Laiho: Sähkölaitostekniikan perusteet 499, Otatiето, J. A.Harrison: The essence of electric power systems, Prentice Hall, 1996.

S-18.2103 and S-18.2104 are interchangeable. Only one of the courses can be included in a degree programme

Language: Finnish

S-18.3141 Substations and Power Lines (4 cr)

Spring (odd years)

Teacher: Kari Nurminen M.Sc. (Tech.)

Contents: Need for substations and power lines. Instructions and standards. Selection of substation equipment and their location. Parts of an open air electric line. Calculations related to utilization of power lines.

Requirements: Examination and design exercise.

Literature: handout.

Prerequisites: S-18.2103 or S-18.2104

Language: Finnish

S-18.3146 High Voltage Engineering (4 cr)

Autumn (period II)

Teacher: Esa-Pekka Suomalainen Lic.Sc. (Tech)

Contents: Insulations in electric field. Electrical discharges and insulation systems. Calculation of transient voltages. Overvoltages, overvoltage protection and insulation coordination. Testing and measuring techniques.

Requirements: Seminar, seminar exercises, calculation and laboratory exercises, personal industrial task or project task.

Literature: Aro-Elovaara-Karttunen-Nousiainen-Palva: Suurjännitetekniikka 568, Otatiето. Mörsky - Mörsky: Sähkölaitostekniikan laskuteh-täviä. Otatiето 545.

Prerequisites: S-18.2103 or S-18.2104.

S-18.3146 and S-18.3150 are interchangeable. Only one of the courses can be included in a degree programme.

Language: Finnish

S-18.3147 High Voltage Engineering, special assignment

(5-8 cr)PV

Autumn + spring

Teacher: Prof Matti Lehtonen

Contents: An independently conducted, supervised individual assignment on a specific topic relating to high voltage engineering.

Requirements: Accepted report and a presentation.

Language: Finnish

S-18.3150 High Voltage Engineering (4 cr)

Spring

Teacher: Jari Hällström D.Sc (Tech.)

Contents: Insulations in electric field. Electrical discharges and insulation systems. Calculation of transient voltages. Overvoltages, overvoltage protection and insulation coordination. Testing and measuring techniques.

Requirements: Seminar, seminar exercises, calculation and laboratory exercises, personal industrial or project task.

Prerequisites: S-18.2103 or S-18.2104

S-18.3146 and S-18.3150 are interchangeable. Only one of the courses can be included in a degree programme.

Language: English

S-18.3153 Electricity Distribution and Markets (6 cr)

Spring (period III)

Teacher: Prof Erkki Lakervi

Contents: See S-18.3154.

Requirements: Examination and laboratory exercise

Prerequisites: S-18.2103 or S-18.2104

Literature: Lakervi&Holmes: Electricity Distribution Network Design, 2nd editions. IEE 2003.

S-18.3153 and S-18.3154 are interchangeable. Only one of the courses can be included in a degree programme.

Language: Finnish

S-18.3154 Electricity Distribution and Markets (6 cr) P

Spring (period III)

Teacher: John Millar M.Sc.(Tech.)

Contents: Planning of urban and rural electricity distribution networks and procedures in open electricity market. The course consists of problem oriented lectures, laboratory exercises and a study tour.

Requirements: Examination and laboratory exercises. Individual special assignment for postgraduate students.

Prerequisites: S-18.2103 or S-18.2104

Literature: Lakervi&Holmes: Electricity Distribution Network Design, 2nd editions. IEE 2003.

S-18.3153 and S-18.3154 are interchangeable. Only one of the courses can be included in a degree programme.

Language: English

S-18.3156 Power Systems Engineering, special assignment (5-8 cr)

Autumn & spring

Teacher: Prof Erkki Lakervi, Prof Matti Lehtonen, Prof Liisa Haarla

Contents: An independently conducted, supervised individual assignment on a specific topic relating to transmission or distribution networks.

Requirements: Accepted report and presentation.

Prerequisites: S-18.2103 or S-18.2104

Language: Finnish and English

S-18.3161 Applications of Electric Energy (4 cr)

Spring (even years)

Teacher: Seppo Kärkkäinen, D.Sc. (Tech.)

Contents: The formation of total load from different user groups. Load forecasting. Demand side management (DSM) for a short and long period. DSM in an open market conditions. Design methods.

Requirements: Examination and excursions.

Literature: handout.

Prerequisites: S-18.2103 or S-18.2104

Language: Finnish

S-18.3200 Power Transmission Systems 1 (6 cr)

Autumn

Teacher: Prof. Liisa Haarla

Contents: The course introduces the basics of power transmission grids and most important components of the grid. Key topics: selection of voltage level, equations of transmission lines, load flow calculation, faults and disturbances, fault currents and symmetrical components, protection systems, stability, voltage control, high voltage direct current links and defining of transmission limits.

Requirements: Examination and 3 exercises.

Literature: To be announced later

Prerequisites: S-18.2103 or S-18.2104

Language: Finnish

Replaces S-18.3113

S-18.3201 Power Transmission Systems 2 (4 cr)

Spring

Teacher: Prof. Liisa Haarla

Contents: The course deepens knowledge of power transmission grids. The course provides information on the following topics: power system reliability, operation planning, over-voltages, electric and magnetic fields, power quality, grid planning, disturbance voltages, induced voltages, intergrating of wind power to the power system, electricity markets.

Requirements: Examination and 2 exercises.

Literature: To be announced later

Prerequisites: S-18.3200

Language: Finnish

S-18.4000 Computer Applications in Power Systems (5cr) P

Autumn (even years)

Teacher: Mikael Nordman D.Sc. (Tech)

Contents: The most significant computer applications used in the management of power systems. Presentation of the most important architectures, programs, and applications.

Requirements: Active participation, a report, a presentation and examination.

Literature: The literature based on books, publications and current standards. Guest lecturers are possible.

Language: English

S-18.4001 Communication Systems in Power Systems (5 cr) P

Autumn (odd years) beginning 2007

Teacher: Mikael Nordman D.Sc. (Tech)

Contents: The fundamental principles of communication systems for the management of power systems. Presentation of the most important systems, protocols, and interfaces.

Requirements: Active participation, a report, a presentation and examination.

Literature: The literature based on books, publications and current standards. Guest lecturers are possible.

Language: English

S-18.4002 Information System Applications in Power Systems, seminar course (6 cr) P

Spring

Teacher: Mikael Nordman D.Sc. (Tech)

Contents: The study period is a seminar with varying content that considers current topics related to information system applications in power systems.

Requirements: Active participation and examination.

Literature: The literature is based on books and new publications.

Language: English

S-18.4018 Protective Relaying in Power Systems (4 cr) P

Autumn (period I)

Teachers: Prof Matti Lehtonen

Contents: Protective relays in power distribution and transmission. Neutral earthing questions. Earth faults. Characteristics of power system faults.

Requirements: examination

Literature: handout

Language: English

S-18.4118 Protective Relaying and Distribution Automation (5 cr) P

Autumn

Teacher: Prof Matti Lehtonen

Contents: Protective relays and their applications in transmission and distribution systems. Neutral earthing problems. Computer and communication systems of power utilities. Network automation.

Language: English

S-18.4122 Postgraduate Seminar on Power Systems (3-10 cr) P V

Autumn + Spring

Teachers: Prof Erkki Lakervi, Prof Matti Lehtonen, Prof Liisa Haarla

Contents: The subject of the seminar varies yearly.

Language: Finnish or English

S-18.4148 Postgraduate Seminar on High Voltage Engineering (3-10 cr) P V

Autumn + spring

Teacher: Prof Matti Lehtonen

Contents: The subject of the seminar will varies annually.

Litterature: Material of the seminar.

Language: Finnish

S-18.4149 Condition Monitoring of Electrical Apparatus (4 cr) P

Spring (period III)

Teacher: Petri Hyvönen Lic.Tech

Contents: Methods and needs of condition monitoring of electrical apparatus. Diagnostics techniques for insulation condition estimation.

Requirements: Seminar works, personal book or industry assignment.

Literature: Aro-Elovaara-Karttunen-Nousiainen-Palva: Suurjännitetekniikka, 568, Otatieto and handout

Language: Finnish

S-26 RADIO ENGINEERING

Prof. Antti Räisänen, tel. 4512241, room SC 309

Prof: Sergei Tretyakov, tel. 4512243, room SC 316

Prof: Pertti Vainikainen, tel. 4512251, room SC 322

<http://www.tkk.fi/Units/Radio/>

Courses credited in ECTS

S-26.1100 Orientation Course for Studies in Electronics and Electrical Engineering (1 cr)

Autumn

Teacher: Prof Antti Räisänen, professors at the department

Contents: General information on TKK and student union, and introduction to Electronics and Electrical Engineering, study curriculum.

Requirements: Attending lectures, library exercise, and own study plan for M.Sc. studies.

Literature: Study Programme and Department's own study guide.

Language: Finnish

S-26.2050 Project in Electrical Engineering and Radiocommunications (5-8 cr)

Autumn & spring

Teacher: Prof N.N.

Contents: Radio spectrum allocation. Antenna design and measurement. Maximum 3 groups (3 person/group).

Requirements: Reporting according to project plan.

Grades: pass/fail.
Language: Finnish and English

S-26.2100 Foundations of Radio Engineering (5 cr)

Autumn

Teacher: Prof Antti Räisänen

Contents: Fundamentals of radio engineering: RF and microwave components and waveguides, antennas, radio wave propagation, radio transmitters and receivers, and applications of radio engineering.

Requirements: Examination, homework problems.

Literature: Räisänen&Lehto: Radio Engineering for Wireless Communication and Sensor Applications, Artech House 2003. Räisänen&Lehto: Radiotekniikan perusteet, Otatiето 2003. Louhi&Lehto: Radiotekniikan harjoituksia, Otatiето 1999.

Language: Finnish and English

S-26.2300 Radio-Frequency Measurements (2 cr)

Spring

Teacher: Juha Mallat D.Sc. (Tech.), assistants.

Contents: Lectures on radio-frequency measurements, and 3 laboratory exercises on measurements of impedance and standing wave ratio, radio-frequency spectrum, and radio-frequency apparatus.

Requirements: Examination, laboratory exercises (with reports). Literature: handout.

Prerequisites: S-26.2100 or equivalent knowledge.

Replaces S-26.199 with S-108.2010

<http://www.tkk.fi/Units/Radio/courses/S262300>

Language: Finnish

S-26.2350 Parts of Radiocommunications Systems (3 cr)

Spring (period III)

Teacher: Arto Lehto Docent, Prof Pertti Vainikainen

Contents: Radiocommunication systems, transmitter and receiver architectures, link budget, phase-locking, effects of non-linearity, analog and digital modulation, noise, effects of radio channel.

Requirements: Examination, homework problems.

Literature: handout.

Prerequisites: S-26.2100

Language: Finnish

S-26.3000 Radio Engineering, special assignment (3-8 cr) P V
Autumn & spring

Teacher: Prof Räisänen, Prof Tretyakov, Prof Vainikainen, Juha Mallat D.Sc. (Tech.) and researchers

Contents: Special assignment can be carried out either in a research or education project in the Radio Laboratory (3-8 cr) or outside (3 cr). Theoretical and experimental studies.

Requirements: Final report.

Prerequisites: S-26.2100 and autumn term part of S-26.3120.

Language: Finnish and English

S-26.3050 Research Seminar on Radio Engineering (1 cr) P V

Autumn + spring

Teacher: Prof Antti Räisänen et al.

Contents: Research reports and discussions on various topics of radio engineering.

Requirements: Attending the seminar series.

Prerequisites: S-26.2100

Language: English and Finnish

S-26.3100 RF and Microwave Engineering (5 cr)

Autumn

Teacher: Prof Pertti Vainikainen

Contents: RF and microwave engineering. Structures and models of RF and microwave circuits. Microstrip and other planar transmission lines. Passive circuits. Active circuits. Oscillators, amplifiers, frequency multipliers, mixers and modulators. Fre-

quency synthesis, phase locking. Integrated circuits and basics of circuit design software.

Requirements: Examination, homework problems.

Literature: A. Lehto-A. Räisänen: RF- ja mikroaaltotekniikka, Otatiето 2002. V. Möttönen-A. Lehto: RF- ja mikroaaltotekniikan harjoituksia, Otatiето, 2002

Prerequisites: S-26.2100

Language: Finnish

S-26.3120 Radio Engineering, laboratory course (7 cr)

Autumn lectures, autumn&spring laboratory exercises

Teacher: Arto Lehto Docent, assistants

Contents: Microwave measurement techniques: measurement equipment and methods, signal generation and detection, power, frequency, impedance, scattering parameter, spectrum, noise, time domain, antenna, and EMC measurements. Microwave amplifier design, fabrication, and measurements. GSM base station measurements.

Requirements: Examination, laboratory exercises.

Literature: A. Lehto - A. Räisänen: Mikroaaltomittaustekniikka, Otatiето 2001, handout.

Prerequisites: S-26.2100

Language: Finnish

S-26.3142 Radio Wave Propagation in Mobile Communications (3 cr) P

Autumn (even years)

Teacher: Prof Pertti Vainikainen

Contents: Basic mechanisms, properties of materials, propagation in different environments, propagation models, measurement techniques.

Requirements: Examination, homework problems and exercise

Literature: handout.

Prerequisites: S-26.2100

Language: Finnish, lecture notes in English

S-26.3161 Analytical Modelling in Radioengineering (4 cr) P

Autumn (odd years)

Teacher: Prof Sergei Tretyakov

Contents: Thin layers, good conductors, superconductors, periodic structures, temporal and spatial dispersion, electromagnetic properties of materials, higher-order impedance boundary conditions. New materials: photonic bandgap materials, artificial impedance surfaces, metamaterials, new applications.

Requirements: Examination and home exercises.

Literature: S.A. Tretyakov: Analytical modeling in applied electromagnetics, Norwood, MA, Artech House 2003.

Prerequisites: S-26.2100, S-96.1111, S-96.1121

Language: English

S-26.3301 Radio Systems in Telecommunication I (3 cr)

Spring (odd years)

Teacher: Jyri Putkonen M.Sc. (Tech.), et al.

Contents: Fixed link radio and its techniques.

Requirements: Examination, homework problems.

Literature: handout.

Prerequisites: S-26.2100

Language: Finnish

S-26.3322 Radio Systems in Telecommunication II (3 cr)

Spring (even years)

Teacher: Pekka Mikkola M.Sc. (Tech.), et al.

Contents: Mobile radio and its techniques.

Requirements: Examination, homework problems.

Literature: handout.

Prerequisites: S-26.2100

Language: Finnish

S-26.3342 Radar Engineering (4 cr) P

Spring (even years)

Teacher: Olli Klemola Lic.Sc. (Tech.)

Contents: Principles of pulsed and Doppler radars, radar equation, radar cross section, propagation, clutter, signal processing, antennas, transmitters, receivers, electronic warfare, search and tracking radars, imaging radars, applications.

Requirements: Examination, homework problems.

Literature: O. Klemola-A. Lehto: Tutkateknikka, Otatiето 1999.
Prerequisites: S-26.2100

Language: Finnish

S-26.3361 Millimetre Wave Engineering (4 cr) P

Spring (odd years)

Teacher: Arto Lehto Docent, Juha Mallat D.Sc. (Tech.)

Contents: Millimetre wave propagation, transmission lines, quasi-optics, antennas, oscillators, amplifiers, mixers, frequency multipliers, measurement techniques, applications.

Requirements: Examination, homework problems.

Literature: A. Lehto-A. Räisänen: Millimetriaaltotekniikka, Otatiето 2002.

Prerequisites: S-26.2100

Language: Finnish

S-26.3382 EMC-Design and Testing (4 cr) P

Spring (even years)

Teacher: Prof Pertti Vainikainen and Prof Sergei Tretyakov

Contents: Compatibility and interference of high-frequency equipment, consideration of immunity to interference in design, EMC test measurements.

Requirements: Examination, homework problems.

Literature: handout

Prerequisites: S-26.2100

Language: Finnish and English

S-26.3401 Antenna Techniques in Telecommunication (4 cr) P

Spring (period IV) (odd years)

Teacher: Prof Pertti Vainikainen, Arto Lehto Docent

Contents: Antenna parameters, simulation methods, antennas used in mobile and fixed telecommunication systems, small antennas, microstrip antennas, reflector antennas, arrays, adaptive antennas. Antenna design and measurement exercise.

Requirements: Examination, homework problems, antenna design and measurement exercise.

Literature: handout.

Prerequisites: S-26.2100

Language: Finnish

S-26.4100 Postgraduate Course in Radio Engineering (3-8 cr) P V

Autumn

Teacher: Prof N.N.

Contents: Course with varying content.

Requirements: Lectures, homework problems, special assignments, seminar presentations (depending on credit points).

Prerequisites: Solid background in radio engineering.

Language: English

S-26.4300 Postgraduate Course in Radio Engineering (3-8 cr) P V

Spring

Teacher: Prof N.N.

Contents: Course with varying content.

Requirements: Lectures, homework problems, special assignments, seminar presentations (depending on credit points).

Prerequisites: Solid background in radio engineering.

Language: English

S-38 NETWORKING TECHNOLOGY

Prof. Raimo Kantola, tel. 4512471, room SE 323

Prof Dr.ing. Jörg Ott, tel. 4512460, SE 324

Prof. Jorma Virtamo, tel. 4514783, room SE 311

Prof. Heikki Hämmäinen, tel. 4516144, room SE 3229

<http://www.netlab.hut.fi/>

Courses credited in ECTS

S-38.1105 Principles in Communication Engineering (2 cr)

Spring (period III)

Teacher: N.N.

Contents: An introduction to telecommunications engineering from a Finnish point of view. History, standards, legislation, elementary information theory, principles of protocols. Fixed and mobile networks, telephone and data networks.

Requirements: Examination

Literature: Annabel Dodd: The Essential Guide to Telecommunications

S-38.1105 and T-110.2110 are interchangeable. Only one of the courses can be included in a degree programme.

Language: Finnish

S-38.1145 Introduction to Teletraffic Theory (3 cr)

Spring (period III)

Teacher: Samuli Aalto Ph.D.

Contents: Traffic models. Quality of service. Principles of stochastic processes and queueing theory. Loss and waiting systems. Queueing networks. Applications to telecommunication systems. Dimensioning of systems. Traffic and congestion control.

Requirements: Examination.

Literature: handout.

Prerequisites: Mat-1.2600

Language: Finnish and English

S-38.1203 Networking Technology, project course (3 cr) V

Autum + spring

Teacher: Vesa Kosonen M.Sc. (Tech.)

Contents: Organizing a project, the role of the project personnel, following the project and reporting. Working in a project group. It is recommended to take this course at the beginning of the studies. The amount of the students may have to be limited due to the co-partners. Preliminary requirements may vary each term due to the quality of the project at hand.

Requirements: Participating actively in the project including reporting. Outside expert help may be used to evaluate the performance.

Language: Finnish

S-38.2121 Routing in Communication Networks (4 cr)

Autumn (period I)

Teacher: Nicklas Beijar M.Sc. (Tech.), Prof Raimo Kantola

Contents: Networks as graphs. Routing in circuit and packet switched networks. Routing protocols in the Internet.

Requirements: Examination and exercises.

Literature: To be announced and handout.

Prerequisites: S-72.1130

Language: Finnish and English

S-38.2132 Networking Technology, laboratory course A (2-3 cr)

Spring (period IV)

Teacher: Vesa Kosonen M.Sc. (Tech.)

Contents: Laboratory works which cover the basics of networkin technology. Work include routing (RIP, OSPF), security, WLAN etc.

Requirements: Approved laboratory works (3-5 works) and learning diary.

Literature: Educational material and laboratory's publications.

Prerequisites: S-38.2121 and S-38.2188

Language: Finnish and English

S-38.2188 Communication Networks (5 cr)

Spring (period III)

Teacher: Jouni Karvo D.Sc.(Tech.)

Contents: IP networks and routing. TCP and Internet congestion control. Some important Internet application layer services and protocols. Basics of network security.

Requirements: Examination, assignment

Literature: James F. Kurose: Computer Networking - A Top-Down Approach Featuring the Internet. (3rd Ed.), Addison-Wesley 2005.

Prerequisites: S-72.1130 and T-110.2100

Additional: S-38.2188 and T-110.4100 are interchangeable. Only one of the courses can be included in the degree programme.

Language: Finnish and English.

S-38.3001 Telecommunications Forum (1-5 cr) P V

Autumn

Teacher: Prof Heikki Hämmäinen

Contents: Telecommunications Forum is a Studia Generalia course hosted by the laboratories involved in the area of Telecommunication Engineering. The course handles hot topics in telecommunications including global and national trends, product, business and technology strategies and covers issues from recent advances in communications research to the social, economic and legal impact of the application of the latest telecommunications technology. The guest speakers are leaders in their fields, scientists, innovators, and business and technology officers in their companies.

Requirements: Attending lectures, assignment, examination. The detailed requirements will be given annually.

Literature: To be announced.

Language: English

S-38.3041 Operator Business (3-5 cr) P

Spring (period IV)

Teacher: Prof Heikki Hämmäinen

Contents: Operator business. Value nets. Network and service business. Wireline and wireless networks. Service pricing and charging. Investments and operational costs. Regulatory issues.

Requirements: Examination

Literature: To be announced later

Prerequisites: S-38.2188

Language: English.

S-38.3042 Seminar on Networking Business (3-8 cr) P V

Autumn (period I)

Teacher: Prof Heikki Hämmäinen

Contents: Licentiate seminar on current topics of networking business.

Requirements: Seminar presentation, written document, acting as opponent and participation.

Language: Finnish or English.

S-38.3045 Special Assignment on Networking Business (2-6 cr) V

Autumn&spring

Teacher: Prof Heikki Hämmäinen

Contents: Personal assignment on networking business. The course should be completed before beginning of the Master's thesis. The amount of credits is to be agreed with the supervising professor.

Language: Finnish and English.

S-38.3115 Signalling Protocols (5 cr)

Spring (period III)

Teacher: Prof Raimo Kantola

Contents: Signalling in telecommunications- and datanetworks, e.g. telephonenetwork and GSM-network, 3-G-network, VoIP.

Requirements: Examination and exercises.

Literature: To be announced later.

Prerequisites: S-72.1130 or equal knowledge.

Language: Finnish or English

S-38.3119 Seminar on Networking Technology (2-4 cr) V

Arranged when needed

Teacher: N.N.

Contents: One or two hot topics in networking technology will be discussed in seminar form.

Requirements: Seminar presentation, written document, acting as opponent and participation.

Literature: To be announced annually.

Prerequisites: S-72.1130.

Language: Finnish

S-38.3133 Networking Technology, laboratory course B (2-5 cr)

Autumn+spring

Teacher: Vesa Kosonen M.Sc. (Tech.)

Contents: Laboratory works about transmission and networking technology including signalling in telephone networks, ISDN and its services, communication networks, LANs, routing protocols (OSPF, RIP, BGP), VoIP, VPN, security etc.

Requirements: Approved laboratory works (3-9 works) and learning diary.

Literature: Educational material and laboratory's publications.

Prerequisites: S-38.2121, S-38.2188, S-38.3115 (depends on the major subject).

Language: Finnish and English

S-38.3134 Networking Technology, laboratory course C (1-3 cr)

Autumn+spring

Teacher: Vesa Kosonen M.Sc. (Tech.)

Contents: Laboratory works about transmission and networking technology including signalling in telephone networks, ISDN and its services, communication networks, LANs, routing protocols (OSPF, RIP, BGP), VoIP, VPN, security etc.

Requirements: Approved laboratory works (2-5 works) and learning diary.

Literature: Educational material and laboratory's publications.

Prerequisites: S-38.3133 (including 5 cr = 9 works).

Additional: Advanced course for S-38.3133

Language: Finnish and English

S-38.3138 Networking Technology, special assignment (2-6 cr) V

Autumn+spring

Teacher: Vesa Kosonen M.Sc. (Tech.)

Contents: Special assignment is a personal study which is done before starting the Master's thesis. The subject is selected from one of the main areas in the networking field. The amount of credits will be agreed together with the supervisor at the start of the work.

Language: Finnish and English

S-38.3141 Teletraffic Theory (5 cr) P

Spring (period IV)

Teacher: Prof Jorma Virtamo

Contents: Traffic characterisation. Dimensioning of networks. MDP theory, optimal routing. Packet level queueing models for an ATM network. HOL blocking in switches. Effective bandwidth. Call level blocking in multirate networks. Traffic control, TCP flow control. Fair resource sharing.

Requirements: Examination. Exercises (24 h) obligatory.

Literature: M. Schwartz: Broadband Integrated Networks, 1996; J.Roberts, U.Mocci, J.Virtamo (eds.): Broadband Network Teletraffic, 1996

Prerequisites: S-38.1145, S-38.3143

Language: Finnish and English

S-38.3143 Queueing Theory (5 cr) P

Autumn (period II)

Teacher: Prof Jorma Virtamo

Contents: Principles of probability theory and stochastic processes. Simple Markovian queues. The M/G/1 queue. Blocking probability and delays. Priority queues. Open and closed queueing networks. Approximations methods.

Requirements: Examination, exercises (24 h) obligatory.

Literature: P.G.Harrison - N.M.Patel: Performance Modelling of Communication Networks and Computer Architectures, 1993.

Prerequisites: S-38.1145

Language: Finnish and English

S-38.3148 Simulation of Data Networks (5 cr)

Autumn (even years)

Teacher: Pasi Lassila, D.Sc. (Tech.)

Contents: The goal, possibilities and limitations of simulation approach. Construction of a simulation model, choice of level of detail. Structure of a simulation program. Generation of stochastic variables. Description of traffic sources. Gathering and analysis of measurement data. Variance reduction methods. Building a simulation program. Applications.

Requirements: Examination, Exercises.

Literature: J.Banks-J.S.Carson-B.L.Nelson: Discrete-Event System Simulation, 2nd ed. (1996).

Prerequisites: S-38.1145, C/C++ programming skills recommended.

Language: Finnish and English

S-38.3150 Network Multimedia Protocols and Services (4 cr)

Autumn (period II)

Teacher: Prof Jörg Ott

Contents: Starting with a review of the basics of IP-based multimedia communications, we will explore the details of media announcements (SAP, SDP), Internet Media Guides (IMG), media streaming (RTSP), and as the focus of the Session Initiation Protocol (SIP) as defined in RFC 3261 and may related documents. We will discuss concepts, protocol details, the concepts for SIP extensions, present SIP building blocks, and the various approaches to SIP-based service creation. Specific application scenarios to be discussed including telephone as well as instant messaging and personal presence. We will also address security and NAT/firewalls traversal. Finally, system design aspects (for endpoints as well as for infrastructures) will be investigated.

Requirements: Examination, practical assignment

Literature: To be announced later

Prerequisites: S-38.2188

Language: English

S-38.3153 Security of Communication Protocols (4 cr)

Spring (period IV)

Teacher: Markus Peuhkuri Lic.Sc.(Tech)

Contents: Introduction to cryptographic algorithms and their modes, and to Cryptographic protocols. Security in the Internet, Java-based applications and mobile agents, Secure Electronic Commerce, X.509-certificates, firewalls.

Exercises: security software.

Requirements: Examination, practical assignment

Literature: handout

Prerequisites: S-38.2188

Additional: S-38.3153 and T-110.4200 are interchangeable. Only one of the courses can be included in the degree programme.

Language: English

S-38.3155 Challenged Networks(3 cr) P

Autumn (period I)

Teacher: Prof Jörg Ott

Contents: We will investigate (network,) transport, session, and application layer solutions to communications in challenged networks (with particular focus on delay-tolerant networking) as well as novel networking architectures dealing with such specific environments and also consider potential consequences for applications and user interaction paradigms.

Requirements: Seminar

Literature: To be announced later

Prerequisites: S-38.2188, S-38.3115 or S-38.3150 (or equal knowledge). Preferably some practical experience with protocols and systems.

Language: English

S-38.3157 Protocol Design (4 cr) P

Spring (period IV)

Teacher: Prof Jörg Ott

Contents: Communication protocols usually are designed with some underlying principles in mind, though these are not always made explicit. In this course, we will investigate protocol design principles, their pros and cons, and their areas of application. We will also review the various techniques used in today's communication protocols to achieve certain properties (e.g., scalability, reliability, robustness). Finally, we will look a design methods and tools. The focus will be on today's Internet protocols but we may address other fields where appropriate. Note that the course content differs from previous incarnations.

Requirements: Examination

Literature: To be announced later (various articles, slides).

Prerequisites: S-38.2188

Language: English

S-38.3165 Switching Technology (5 cr)

Spring (period III)

Teacher: Pertti Raatikainen Docent

Contents: Structure of switching fabrics and implementation possibilities. Multistage switching fabrics, complexity, scalability and capacity. PDH- and ATM-switches, Gbit/s-routers, optical switching elements. Basics of WDM-technology: static networks, wavelenght routing, logically routed networks.

Requirements: Examination and exercises.

Literature: To be announced later.

Prerequisites: S-72.1130 or equal knowledge.

Language: Finnish and English

S-38.3180 Quality of Service in the Internet (4 cr)

Autumn (period II)

Teacher: Mika Ilvesmäki Lic.Sc. (Tech.), Marko Luoma Lic.Sc. (Tech.) and Markus Peuhkuri Lic.Sc. (Tech.)

Contents: Architectures and mechanisms aiming to provide QoS in IP networks. Designing of services and service architectures (BE, DiffServ and IntServ). Implementation aspects of QoS architectures.

Requirements: Examination and exercises.

Literature: To be announced later

Prerequisites: S-38.2121 and S-38.2188

Language: Finnish

S-38.3183 Internet Traffic Measurements and Measurement Analysis (4 cr) P

Spring (period IV)

Teacher: Mika Ilvesmäki Lic.Sc. (Tech.), Marko Luoma Lic.Sc. (Tech), Markus Peuhkuri Lic.Sc. (Tech)

Contents: This course introduces different ways of measuring Internet traffic and analyzing the results. Course topics include packet, flow and routing related measurements and analysis.

Requirements: Examination and exercises.

Literature: To be announced later

Prerequisites: Basics in mathematics, S-38.2188 and S-38.2121

Language: Finnish

S-38.3192 Network Service Provisioning (4 cr) P

Spring (period III)

Teacher: Mika Ilvesmäki Lic.Sc. (Tech.), Marko Luoma Lic.Sc. (Tech.)

Contents: ISP network and value added services. Course provides a short introduction to methods for connecting customers to ISP network and also methods which ISPs use to communi-

cate with other ISPs. Services which are covered by the course relate to different security services (VPN, authentication), network support services (DNS, mobility management) and value added services (portal and hosting services). Last part of the course covers contracts and management aspects which relate to service level management and peering.

Requirements: Examination and course work.

Literature: Geoff Huston: ISP Survival Guide: Strategies for Running a Competitive ISP. John Wiley&Sons Inc, 1998.

Prerequisites: S-38.2188. S-38.2121 is recommended for students who are not familiar with routing.

Language: Finnish

S-38.3193 Wireless Networks (3 cr)

Autumn (period I)

Teacher: Jouni Karvo D.Sc.(Tech.)

Contents: Mobile networks, communications networks based on wireless local area networks, ad-hoc networks. Implementation of mobility and information transfer.

Requirements: Examination

Literature: To be announced later.

Prerequisites: S-38.2188

Language: Finnish and English.

S-38.3205 Individual Course on Networking Technology (1-10 cr)

Autumn+spring

Teachers: Prof Hämmäinen, Prof Kantola, Prof Virtamo, Prof Ott

Contents: Literature study based on material of networking technology agreed with a Professor.

Requirements: Examination.

Language: Finnish and English

S-38.3215 Special Course on Networking Technology (2-8 cr)

P V

Autumn or spring

Teacher: N.N.

Contents: Intended to be a special course with annually varying topic or as a course held by a visiting lecturer.

Requirements: To be defined annually.

Language: Finnish and English.

S-38.3310 Thesis Seminar on Networking Technology (1 cr) V

Autumn & spring

Teachers: Prof Hämmäinen, Prof Kantola, Prof Virtamo

Contents: Presentations and reports on current completed Master's thesis work.

Requirements: Seminar presentation based on the thesis and participation at least in 5 seminars.

Language: Finnish and English

S-38.4030 Postgraduate Course on Networking Technology (5-15 cr) P V

Autumn (period II) + spring (period IV)

Teacher: Prof Raimo Kantola

Contents: Licentiate seminar on topics of current interest in networking technology. Contents to be defined each term.

Requirements: Seminar presentation, seminar papers, exam.

Literature: Book and other material to be announced.

Prerequisites: Two of following courses: S-38.2121, S-38.3115, S-38.3165 or S-38.3180.

Language: Finnish or English.

S-38.4149 Postgraduate Course in Teletraffic Theory (5-15 cr)

P V

Autumn (period II)

Teachers: Prof Jorma Virtamo, Samuli Aalto Ph.D.

Contents: This course will focus on a specific topic of interest within the field of teletraffic theory. The course will be held in the form of a seminar.

Requirements: To be defined annually.

Language: English

S-38.4360 Research Seminar on Networking Technology (1-3 cr) P V

Autumn&spring

Teachers: Prof Hämmäinen, Prof Kantola, Prof Virtamo, Prof Ott

Contents: Reports on networking technology presented by researchers and visitors as well as discussion on research on networking technology.

Language: Finnish and English.

S-55 CIRCUIT THEORY

Prof. Martti Valtonen, tel. 4512298, room SC 123

<http://www.ct.tkk.fi>

Courses credited in ECTS

S-55.1100 Basics of Electrical and Electronics Engineering (4 cr)

Autumn & spring (Not for Est students)

Teacher: Kimmo Silvonen lecturer

Contents: Transient analysis, phasor calculus, power systems, semiconductor devices and fundamentals of electronics, transmission lines, circuit simulation.

Requirements: Final examination or two mid-term examinations. Four compulsory laboratory sessions (4 x 3 hours).

Literature: K.Silvonen: Sähkötekniikka ja elektroniikka, Yliopistokustannus 2004 or Bobrow: Fundamentals of Electrical Engineering.

<http://www.ct.tkk.fi/courses/bee/main.html>

Language: Finnish, examination also in English

S-55.1210 Circuit Analysis 1 (5 cr)

Autumn

Teacher: Prof Martti Valtonen

Contents: The basic circuit elements: independent sources, resistances, capacitances, inductances, transformers, operational amplifiers and controlled sources. Analysis methods for DC and AC circuits: circuit transformations, mesh, nodal, superposition, Thevenin's, and Norton's methods. Basic filters and resonance circuits. Power matching and reactive power compensation. Analysis of symmetrical three-phase circuits.

Requirements: Final exam or two partial examinations

Literature: handout.

<http://www.ct.tkk.fi/courses/ca1/main.html>

Language: Finnish, examination also in English

S-55.1220 Circuit Analysis 2 (5 cr)

Spring

Teacher: Prof Martti Valtonen

Contents: Time-domain analysis using Laplace transform. Harmonic analysis. Driving-point and transfer functions, natural frequencies of the circuit, and stability. Two-port z-, y- and chain parameters. Smith's diagram and matching of transmission line circuits.

Requirements: Final exam or two partial examinations.

Literature: handout.

Prerequisites: S-55.1210

<http://www.ct.tkk.fi/courses/ca2/main.html>

Language: Finnish, examination also in English

S-55.1300 Circuit Design with APLAC (3 cr)

Autumn (period II)

Teachers: Prof Valtonen (responsible) and Vesa Linja-aho assistant

Contents: Introduction to circuit simulation with APLAC. Both lectures and exercises will be held at the same time in the computer class.

Requirements: Participation in lectures (85 %), exercises and practical work during the last exercise (2 h). Participation limited.

Literature: handout.

Prerequisites: S-55.1210 and S-55.1220

<http://www.ct.tkk.fi/courses/cs/main.html>

Language: Finnish

S-55.1900 Electrical Engineering Project (5-8 cr)

Autumn & spring

Teacher: Prof Martti Valtonen, research scientists and assistants of the laboratory

Contents: Indicates the practical application of basic theories. Designing and building an electronic device (parametric equaliser) in small groups, thus giving the student knowledge of circuit simulation and project teamwork.

Requirements: Active participation, doing a personal assignment and designing, simulating, building and documenting the project in groups. Grades: pass / fail.

Language: Finnish

S-55.3110 Network Synthesis (5 cr)

Spring (period III)

Teacher: Anu Lehtovuori university teacher

Contents: The basic ideas behind circuit synthesis. The realisation of system functions using passive and active lumped element circuits. The basics of filter design.

Requirements: Examination.

Literature: Lehtovuori - Costa - Honkala - Kallio - Kivikero-Virtanen: Piirisynteesi, Yliopistopaino 2004 and handout, M.E. van Valkenburg: Introduction to Modern Network Synthesis. Wiley&Sons, 1960 (for supplementary reading).

Prerequisites: S-55.1220

<http://www.ct.tkk.fi/courses/ns/main.html>

Language: Finnish

S-55.3120 Passive Filters (5 cr) P

Autumn (period I)

Teacher: Jarmo Virtanen Lic.Sc. (Tech.)

Contents: Synthesis of two-ports. Design of passive Butterworth-Tshebyshev- and elliptic filters. Design of transmission line filters. Design of transmission line filters.

Requirements: Examination.

Literature: Valtonen-Virtanen: Passiiviset suodattimet. Yliopistopaino 2004 and A.I. Zverev: Handbook of Filter Synthesis; John Wiley & Sons, 1973 (for supplementary reading).

Prerequisites: S-55.3110

<http://www.ct.tkk.fi/courses/ans/main.html>

Language: Finnish

S-55.3130 Active Filters (5 cr) P

Spring (even years) period IV

Teacher: Jan Holmberg M.Sc. (Tech.)

Contents: Design of low-pass, high-pass, band-pass and phase-linear filters using either operational amplifiers, resistances and capacitances or operational amplifiers and switched capacitors.

Requirements: Examination.

Literature: handout and Ghauri, Laker & Schaumann: Design of Analog Filters, Passive, Active RC and Switched Capacitor. Prentice-Hall 1990 (for supplementary reading).

Prerequisites: S-55.3110

Language: Finnish

S-55.3210 Numerical Circuit Design Methods (5 cr) P

Spring (period IV)

Teacher: Jarmo Virtanen Lic.Sc. (Tech.)

Contents: Computer-aided circuit simulation methods. Circuit equations and their solutions in time and frequency domain. Statistical analysis. Optimization. Modelling of components.

Requirements: Examination and compulsory computer exercises.

Literature: handout and Jokinen-Virtanen-Aaltonen-Costa-Roos-Starck-Valtonen: Piirisuunnittelu numeeriset menetelmät. Otatieto 1998.

<http://www.ct.tkk.fi/courses/cacd/main.html>

Language: Finnish

S-55.3220 Behavioral-level Circuit Models (5 cr) P

Autumn (even years) period II

Teacher: Janne Roos D.Sc. (Tech.)

Contents: Curve/surface fitting to measurement results. (Quasi-)static table models and neural-network models of transistors. Behavioral modeling of dynamic and nonlinear RF and microwave circuit blocks using e.g., Volterra series, scattering functions, or dynamic neural networks for efficient system-level simulation.

Requirements: Examination, homework problems and practical assignment.

Literature: J.Wood and D.E.Root: Fundamentals of Nonlinear Behavioral Modeling for RF and Microwave Design and handout

<http://www.ct.tkk.fi/courses/bm/main.html>

Language: Finnish

S-55.3310 Research Seminar on Circuit Theory (1 cr) P V

Autumn&spring

Teacher: Anu Lehtovuori, university teacher

Contents: Reports presented by researchers and discussion on topics related to circuit theory.

Requirements: Active participation.

<http://www.ct.tkk.fi/courses/rscto/main.html>

Language: Finnish

S-55.3320 Special Assignment in Circuit Theory (3-5 cr) P V

Autumn & spring

Teacher: Prof Martti Valtonen

Contents: Theoretical or numerical work whose topic is defined separately for each student.

Language: Finnish

S-55.4100 Postgraduate Course in Circuit Theory (1-15 cr) P V

Autumn&spring

Teacher: Prof Martti Valtonen

Contents: Course with varying content.

Literature: Depends on the contents of the course.

Language: Finnish

S-66 APPLIED ELECTRONICS

Prof: Raimo Sepponen, tel. 4512300, room SG 309

Prof: Pekka Eskelinen, tel. 4516062, SI 320

<http://sel18.hut.fi>

Courses credited in ECTS

S-66.1100 Practical Selling Skills (3 cr)

Autumn

Teacher: Stefan Appel

Contents: Guidelines to sell an idea; influence situation and its applications in selling an idea; activation of the audience by questioning, active listening and dialog. Fields of confident and persuasive public performance; stage fright - an exploited resource. Significance of one's own attitude in the success of an influence situation. Group exercises.

Requirements: The course consists of two intensive periods: one day each on 1st period. Four presentations of the department and it's study programme in chosen high schools on second period.

Language: Finnish

S-66.2120 Basic Course in Electronics (5 cr)

Spring

Teacher: Prof Raimo Sepponen

Contents: Outlining of electronics; systems; components; functions and non-idealities. Common functional blocks; Power supply; amplifier; filter and data acquisition.

Requirements: Exercise and examination

Literature: G. Randy Slone: Tab Electronics Guide to Understanding Electricity and Electronics (2nd ed.), McGraw-Hill 2000.

Language: Finnish

S-66.3114 Audio Engineering (3 cr)

Autumn (even years)

Teacher: Ville Palomäki

Contents: Processing, recording and reproducing low-frequency signals. Closer view of device technology. Practical applications (speech, music etc.).

Literature: handout.

Prerequisites: Basics of electronics

Language: Finnish

S-66.3115 Video Engineering (3 cr)

Spring 2007 (odd years)

Teacher: Kari Risberg, engineer

Contents: Various video standards, video signal processing, recording and amplifying. Basics and standards of digital television. Data communication application.

Literature: handout. Herve Benoit: Digital Television: MPEG-1, MPEG-2 and Principles of the DVB System (2nd ed.) Wiley, John & Sons, 2002.

Prerequisites: Basics of electronics

Language: Finnish

S-66.3166 Biomedical Instrumentation (5 cr)

Spring (period IV)

Teacher: Prof Raimo Sepponen

Contents: Medical diagnostics and therapy equipment, their construction and functions. Special attention to measuring, amplification and analysis of bioelectrical signals and imaging methods.

Requirements: Exercises and examination

Literature: J.C.Webster (ed.): Medical Instrumentation - Application and Design.

Prerequisites: Basics of electronics.

<http://sel18.hut.fi/166/esite166.htm> (net-exercises)

Language: Finnish

S-66.3169 Bioelectrical Phenomena (4 cr)

Spring (period III) (odd years)

Teacher: Prof Jaakko Malmivuo

Contents: Bioelectric and biomagnetic source, measurement of bioelectric and biomagnetic signals and their use in clinical diagnosis, volume sources and volume conductors, forward and inverse problems, construction of orthonormal lead systems.

Requirements: Examination.

Literature: J. Malmivuo and R. Plonsy: Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic fields. Oxford University Press, 1995.

<http://www.tut.fi/~malmivuo/bembook>.

Language: Finnish or English

S-66.3170 Reliability in Electronics (3 cr)

Spring

Teacher: Seppo Nevalainen D.Sc. (Tech.)

Contents: Requirements of reliability in the design of electronic devices, systems, software and in product development.

Requirements: Examination. Grade is affected by home exercises on course's www-pages.

Literature: Patrick D.T. O'Connor: Practical Reliability Engineering, (3rd ed.)Wiley, 1985.

Prerequisites: Basic courses in electronics and Probability mathematics.

Language: Finnish

S-66.3171 Design of Electronic Equipment (4 cr)

Autumn

Teacher: Prof Pekka Eskelinen

Contents: Essences of electronic equipment and systems, edge conditions met in design and means to improve the level of design and implementation.

Requirements: Examination, practical exercise

Prerequisites: Basics of electronics.

Language: Finnish, Swedish or English

S-66.3201 Product Development (5 cr)

Autumn

Teacher: Prof Raimo Sepponen

Contents: Control of product development according to company strategy, financial management, marketing, quality assurance systems, patenting.

Literature: McKinsey & Company: Ideasta kasvuyritykseksi: Käsikirja liiketoimintasuunnitelman laatimiseen, WSOY 2000. Reijo Miettinen, Sampsä Hyysalo, Janne Lehenkari and Mervi Hasu: Tuotteesta työvälineeksi? Uudet teknologiat terveydenhuollossa. Gummerrus Kirjapaino Oy 2003.

Language: Finnish

S-66.3204 Product Design (5 cr)

Spring

Teacher: Prof Raimo Sepponen

Contents: Project control, breakdown questions, design, device completeness planning, standards.

Literature: Sepponen, R.: EMC-Periaatteet ja käytäntö, handout.

Prerequisites: Basics of electronics.

Language: Finnish

S-66.3300 Special Study in Applied Electronics (4-8 cr) V

Autumn & spring

Teacher: Prof Raimo Sepponen and Prof Pekka Eskelinen

Contents: A comprehensive theoretical or design exercise connected with major/minor subject. The topic is specified with the student.

Requirements: Project work, final report

Prerequisites: S-66.3201 and S-66.3204

Language: Finnish

S-66.3304 Bioelectronics, special assignment (5-8 cr) V

Autumn & spring

Teacher: Prof Raimo Sepponen and Prof Pekka Eskelinen

Contents: Special project related to bioelectronics, medicine and instrumentation of measurements. Topics related to laboratory research projects. The assignment is specified with the student.

Requirements: Project work, final report.

Prerequisites: S-66.3166

Language: Finnish

S-66.3320 NMR Basics (5 cr) P

Spring (lectured when needed)

Teacher: Prof Raimo Sepponen

Contents: Basics of nuclear magnetic phenomena.

Requirements: Examination and exercises

Literature: Zhi-Pei Liang and Paul C. Lauterbur: Principles of Magnetic Resonance Imaging, SPIE Optical Engineering Press.

Prerequisites: Basic courses in mathematics and physics.

Language: Finnish

S-66.3322 Basics of MRI (5 cr) P

Spring (lectured when needed)

Teacher: Prof Raimo Sepponen

Contents: Basics of image reconstruction.

Requirements: Examination and exercises

Literature: Zhi-Pei Liang and Paul C. Lauterbur: Principles of Magnetic Resonance Imaging, SPIE Optical Engineering Press.

Prerequisites: S-66.3320

Language: Finnish

S-66.3324 Instrumentation of MRI (5 cr) P

Autumn 2007 (period I)

Teacher: Prof Raimo Sepponen

Contents: Basic components and functioning of a MRI device.

Requirements: Examination and exercises

Literature: Material on the web page.

Prerequisites: S-66.3322

Language: Finnish

S-66.3326 Application of MRI (5 cr) P

Autumn 2007 (period II)

Teacher: Prof Raimo Sepponen

Contents: Methods and techniques of MRI in various applications.

Requirements: Examination and exercises

Literature: Material on the web page.

Prerequisites: S-66.3324

Language: Finnish

S-66.3340 Measurement Methods and Instrumentation in Ecology (5 cr)

Autumn (lectured when needed)

Teacher: Lauri Palva D.Sc. (Tech.)

Contents: Special requirements for ecological measurement instrumentation. Main issues are accuracy, reliability and environmental durability. Examples of various applications.

Requirements: Lecturers, exercises and examination.

Literature: Ian Strangeways: Measuring the Natural Environment, Cambridge University Press 2000.

Prerequisites: Basics of electronics.

Language: Finnish

S-66.4139 Postgraduate Course in Applied Electronics I (10 cr) P V

Autumn

Teacher: Prof Raimo Sepponen

Contents: The goal is to achieve a thorough knowledge of an area in applied electronics. The course is suitable for postgraduates, doctors and fifth year students.

Literature: handout, conference reports.

Prerequisites: Applied Electronics or similar advanced studies

Language: Finnish or English

S-66.4140 Postgraduate Course in Applied Electronics II (10 cr) P V

Spring

Teacher: Prof Raimo Sepponen

Contents: The goal is to achieve a thorough knowledge of an area in applied electronics. The course is suitable for postgraduates, doctors and fifth year students.

Prerequisites: Applied electronics or similar advanced studies.

Language: Finnish or English

S-66.4141 Quantitative MRI (6 cr) P

Autumn & spring

Teacher: Prof Raimo Sepponen

Contents: Measurement process; longitudinal relaxation time T1 and transverse relaxation time T2; diffusion; magnetisation transfer; MT; spectroscopy; T1-weighted dynamic contrast-enhanced MRI and T2-weighted dynamic contrast-enhanced

MRI; functional MRI; blood perfusion measurements. Biology: the significance of MR parameters in Multiple Sclerosis. Image analysis.

Literature: P. Tofts: Quantitative MRI of the Brain: Measuring Changes Caused by Disease, John Wiley & Sons 2003.

Prerequisites: Basics of MRI

Web course

S-66.4142 Design for Portability in Electronics (6 cr) P

Autumn & spring

Teacher: Prof Pekka Eskelinen

Contents: Functions and electronic circuits and subsystems needed in modern radar equipment. High power high voltage supplies, video detection and amplification, digital circuits used in modulators and coders, antenna pedestals and their control electronics, angular measurements and various display systems. As applications, stationary, maritime and airborne radars are considered.

Literature: P. Haskell: Portable Electronics Product Design and Development, McGraw-Hill 2004.

Prerequisites: electronics and measurement technology or a corresponding major or minor.

Web course

S-66.41423 Radar Electronics (6 cr) P

Spring

Teacher: Prof Pekka Eskelinen

Contents: Various electronics of portable equipment; design process, components; power supplies; integration of electronics and mechanics; software; profitability of portable equipment.

Literature: The course comprises of lecture notes based on various text books.

Prerequisites: Basics on electronics

Web-based course: <http://sel18.hut.fi/4143>

Language: English

S-66.4205 Research Seminar on Applied Electronics (3-8 cr) P V

Lectured when needed

Teacher: Prof Raimo Sepponen

Contents: Course with varying content.

Language: English

S-69 MICROELECTRONICS (SEMICONDUCTOR TECHNOLOGY)

Prof: Juha Sinkkonen, tel. 4512320, room 4122

Prof: Pekka Kuivalainen, tel. 4512321, room 4155

<http://www.hut.fi/Units/Electron/>

Micronova, Tietotie 3

Courses credited in ECTS

S-69.2101 Basic Course on Semiconductor Technology (5 cr)

Autumn (period I)

Teacher: Prof Pekka Kuivalainen

Contents: Electronic structure of materials, band theory, metals, insulators, semiconductor devices and their fabrication, optical properties of materials.

Requirements: Examination

Literature: J. Sinkkonen: Puolijohdeteknologian perusteet.

Language: Finnish

S-69.3102 Semiconductor Technology I (5 cr)

Spring (period III)

Teacher: Prof Pekka Kuivalainen

Contents: Physical and chemical properties of semiconductor devices. Basics of component physics, metal-semiconductor junction, pn-junction, diode, bipolar transistor, JFET, MOS-

structure, MOSFET, MESFET, SPICE-models and numerical simulations.

Requirements: Examination

Literature: handout "Physical Modeling of Semiconductor Devices" made by P.Kuivalainen

Prerequisites: S-69.2101

Language: English

S-69.3103 Semiconductor Technology II (5 cr)

Autumn (period I)

Teacher: Victor Ovchinnikov Ph.D.

Contents: Fabrication processes for microtechnology: integrated circuits, microsensors, nanostructures, power devices, solar cells and other microcomponents. Crystal growth, epitaxy, etching, lithography, thin films, oxidation, ion implantation, diffusion. Microscopy and measurement methods for microstructures. Visit to cleanroom.

Requirements: Examination and exercises

Literature: S. Franssila: Introduction to Microfabrication.

Prerequisites: S-69.2101

Language: English

S-69.3104 Electronic Sensors (5 cr)

Spring (period IV)

Teacher: Heikki Holmberg Lic.Sc. (Tech)

Contents: Physical properties, fabrication and use of electronic sensors implemented using technology employed by the microelectronics industry.

Requirements: Examination

Literature: S.Middelhoek and S.A.Audet: Silicon Sensors, hand-out

Language: English

S-69.3105 Special Project in Semiconductor Technology (5 cr)

Autumn & spring

Teacher: Prof Pekka Kuivalainen

Contents: The purpose of this special project is to give the student deeper knowledge about some special issue in the field of semiconductor technology; materials, devices or integrated circuits.

Requirements: written report

Language: Finnish/English

S-69.3106 Semiconductor Technology, laboratory course II (5 cr)

Autumn (period II) +spring (period III)

Teacher: Hele Savin D.Sc. (Tech.)

Contents: Processing of PMOS transistors, test structures, and integrated circuits. The students perform test measurements.

Requirements: written report

Literature: handout

Prerequisites: S-69.3107 (compulsory, valid 3 months), S-69.2101 or equal knowledge

Language: Finnish/English

S-69.3107 Semiconductor Technology, laboratory course I (1cr)

Autumn

Lecturer: N.N.

Contents: Clean room technology and safety. The students are acquainted with the HUT Microelectronic Centre's clean room and process equipment. This course is compulsory for persons wishing to do any kind of work in the clean room. This course is always lectured before S-69.3106.

Additional: Safety training is valid only 3 months after the course.

Literature: handout.

Requirements: Examination and attendance at the lectures.

Grade: Pass/fail.

Language: Finnish/English

S-69.4108 Transport Theory and its Applications (5 cr) P

Autumn (odd years)

Teacher: Prof Juha Sinkkonen

Contents: Electrical transport theory. Boltzmann's equation, scattering mechanisms, conductivity, galvanomagnetical and thermoelectrical phenomena. Hot carriers and nonlinear phenomena, the Gunn-effect. Physics of the MOSFET channel; surface scattering, subband structure, 2D-electron gas, the quantum-Hall-effect. Tunnel- and heterojunction devices.

Requirements: Examination

Literature: J.Sinkkonen: Sähkönkuljetus puolijohdeissa - komponenttifiisikaan jatkokurssi.

Prerequisites: S-69.3102

Language: Finnish

S-69.4109 Quantum Electronics (5 cr) P

Autumn (even years)

Teacher: Prof Juha Sinkkonen

Contents: Optical properties of semiconductors, light absorption, optical constants, radiative transitions, stimulated emission and the semiconductor laser.

Requirements: Examination

Literature: J.Sinkkonen: Kvanttielektronikka.

Prerequisites: S-69.4108

Language: Finnish

S-69.4112 Research Project in Semiconductor Technology (5 cr) P V

Autumn + spring

Teacher: Prof Juha Sinkkonen

Contents: The purpose of this research project is to give the student more abilities to do independent research work. Within the project the students get familiar with research methods, special methods used in semiconductor technology and reporting the results.

Requirements: Written report

Language: Finnish/English

S-69.4113 Postgraduate Course in Electron Physics I (8 cr) P V

Autumn

Teacher: Prof Juha Sinkkonen

Contents: Thin film technology.

Requirements: Seminar presentation and examination.

Literature: Handouts and scientific articles

Replaces S-69.4110

Language: Finnish/English

S-69.4114 Postgraduate Course in Electron Physics II (8 cr) P V

Spring

Teacher: Sami Franssila Ph.D.

Contents: Characterization of semiconductors.

Requirements: Seminar course, written report or examination

Literature: Dieter K. Schroder: Semiconductor material and device characterization (3rd ed.)

Replaces S-69.4111

Language: Finnish/English

S-72 COMMUNICATIONS ENGINEERING

Prof: Sven-Gustav Häggman, tel. 4512340, room SE 216

Prof: Patric Östergård, tel. 4512341, room SI 447b

<http://www.comlab.hut.fi/studies/>

Courses credited in ECTS

S-72.1010 Orientation Course for Studies in Communications Engineering (1 cr)

Autumn (period I)

Teacher: Prof Sven-Gustav Häggman.
 Contents: General information on TKK and student union, and introduction to Communications Engineering, study curriculum.

Requirements: Attending lectures, library exercise, and own study plan for M.Sc. studies.

Literature: Study Programme and Department's own study guide.

Language: Finnish

S-72.1110 Signals and Systems (5 cr)

Autumn (period II)

Teacher: N.N., laboratory exercises S. Saastamoinen

Prerequisites: Mat-1.1210 - 1230 and Mat-1.2600/2620

Language: Finnish

S-72.1120 Data Transmission and Communications Protocols (2 cr)

Spring (period IV)

Teacher: Jukka Helme M.Sc. (Tech.)

Requirements: Examination

Prerequisites: T-106.1206 and recommended S-38.1105, S-88.1110

Language: Finnish

S-72.1130 Telecommunication Systems (5 cr)

Autumn (period I)

Teacher: Timo O. Korhonen Docent

Contents: PSTN, ISDN, SDH, GSM and CDMA mobile networks, Internet.

Requirements: Examination

Literature: Understanding Telecommunications, part II, Studentliteratur, handout.

Prerequisites: S-38.1105

Language: English

S-72.1140 Transmission Methods in Communication Systems (5 cr)

Autumn (period II)

Teacher: Timo O. Korhonen Docent

Contents: Digital and analog baseband signals. Amplitude, phase and frequency modulation. Error performance of reference system in AWGN-channel. CDMA, OFDM and UWB modulation. Band limited carrier wave transmission. Basics of transmission channel properties (copper wire, radio channel and optical fibre). Examples of signals used in practice (e.g. ADSL, DVB, Ethernet, GSM).

Literature: Handout, A.B. Carlson: Communication Systems; Other recommended books: B.P. Lathi: Modern Digital and Analog Communication Systems (3rd ed.).

Prerequisites: S-72.1110.

Language: English

S-72.1510 Human Factors in Telecommunications (2 cr)

Autumn (period I)

Teacher: Johanna Leppävirta M. Edu

Requirements: Examination, exercises

Literature: handout

Language: Finnish

S-72.2210 Mobile Communications Systems and Services (3 cr)

Autumn (period II)

Teacher: Prof Olav Tirkkonen

Contents: The cellular concept, mobile radio channel models and coverage, service concepts. Physical layer specification, radio resource and mobility management, and quality of service in GSM and UMTS. What beyond UMTS?

Requirements: Examination.

Literature: handout

Prerequisites: S-72.1140

Language: English

S-72.2310 Laboratory Course in Wired Communications (2-5 cr)

Autumn&spring

Teacher: Viktor Nässi M.Sc. (Tech.)

Contents: Laboratory exercises related to communications systems, including PCM, SDH and CATV techniques etc.

Requirements: 2-5 laboratory exercises including pre and postreports.

Literature: Exercise instructions

Prerequisites: S-72.1130, S-72.1140

Language: Finnish and English

S-72.2410 Information Theory (5 cr) P

Autumn (period II)

Teacher: Prof Patric Östergård

Contents: Introduction to information theory and its applications to communications. Entropy, relative entropy and mutual information and their connections to channel capacity and source coding (data compression). The channel coding theorem. Law of large numbers. Huffman, Lempel-Ziv and other source coding methods. Discrete, continuous and multiuser channels.

Requirements: Examination and home assignments.

Literature: T.M. Cover and J.A. Thomas: Elements of Information Theory, Wiley 1991.

Prerequisites: Basic courses in mathematics.

Language: English

S-72.2420 Graph Theory (5 cr) P

Spring (period IV)

Teacher: Prof Patric Östergård and Petteri Kaski D.Sc. (Tech.)

Contents: Introduction to graph theory. Trees, planar graphs and digraphs. Graph coloring. Symmetries and automorphism groups. Algorithms for central graph problems. Applications.

Requirements: Examination and special project/home assignments.

Literature: D.B. West: Introduction to Graph Theory. 2nd ed, 2001. D. Junnickel: Graphs Networks and Algorithms, 1999.

Prerequisites: Basic courses in mathematics and computer science.

Additional information: The course also occurs with the code T-79.5203.

Language: Finnish

S-72.2510 User-Oriented Design of Telecommunications Services (5 cr)

Spring (period IV)

Teacher: N.N.

Requirements: Participation in Problem Based Groups (PBL), assignment and examination.

Prerequisites: S-72.1510, S-72.1120, Mat-2600

Language: Finnish

S-72.2530 Acceptability and Quality of Services (3 cr)

Autumn (not lectured 2005-2006)

Teacher: Kirsi Keltikangas

Contents: The aim of the course is to get the student acquainted with the quality of service, acceptability of service and Quality of Service-concepts. Also the basic concepts of perception, quality parameters and the measuring methods of the quality perceived by individual will be studied. The course consists of the theory and practical measurements. The student having studied the course comprehends all the quality parameters of the telecommunication services which have effect on user's subjective satisfaction. Having studied the course student knows how quality is measured, how the user experiences the quality and what kind of quality requirements exist.

Requirements: .

Language: Finnish

S-72.3110 Individual Studies in Communications (1-10 cr) PV
Autumn&spring

Teacher: Prof Östergård, Prof Olav Tirkkonen, Prof N.N.
Contents: Individual studies agreed with the teacher in advance.
May consist of an examination on a book and/or exercises.
Language: Finnish

S-72.3120 Special Project in Communications (3-8 cr)

Autumn + spring
Teacher: Prof Östergård, Prof Tirkkonen, Prof N.N., Korhonen Docent and Ruttik teaching researcher
Contents: An independent planning task or investigation in the final stage of the Master's studies either based on a topic given by the teacher (3-8 cr) or a topic coming from outside the communications laboratory (3-5 cr). The instructor for the outside topics must be provided by the task owner and a teacher is supervisor.
Requirements: A written report on the special project.
Replaces S-72.171
Language: Finnish and English

S-72.3210 Channel Modeling for Radio Communication Systems (3 cr)

Autumn (period I)
Teacher: Prof Häggman
Contents: Basic propagation mechanisms, radio channel modeling principles, average path loss vs. distance models, fading types, channel parameter statistics, LTV, channel representation, important channel models.
Requirements: Examination
Literature: handout
Prerequisites: S-72.1140
Language: English

S-72.3220 Radio Communication Systems (3 cr)

Spring (period III)
Teacher: N.N.
Contents: Characteristics and use of radio frequency spectrum, frequency spectrum administration, different types of radio communication systems, typical transceiver architectures, noise and interference, transceiver non-idealities, system planning principles, radio link budgeting.
Requirements: Examination
Literature: handout
Prerequisites: S-72.1140
Language: English

S-72.3230 Radio Transmission and Network Access (3 cr)

Autumn (period II)
Teacher: N.N.
Contents: Review of source and channel coding, frame multiplexing, and modulation. CDMA and OFDM. Fading countermeasures. Traffic models. Basic access methods. Packet radio access.
Requirements: Examination
Literature: handout
Prerequisites: S-72.1140
Language: English

S-72.3240 Wireless Personal, Local, Metropolitan and Wide Area Networks (3 cr)

Spring (period IV)
Teacher: Michael Hall Lic.Sc. (Tech.)
Contents: Physical layer and Medium Access Control layer specification and network architectures of Bluetooth and ZigBee WPANs, IEEE802.11 family of WLAN and IEEE802.16 family-WMANs. Other standards of WxANs. Typical services and applications.
Requirements: Examination
Literature: handout
Prerequisites: S-72.1140
Language: English

S-72.3250 Laboratory Course in Wireless Communications (2-5 cr)

Autumn&spring
Teacher: Kalle Rüttik Lic.Sc. (Tech.)
Contents: Laboratory exercises in the area of radiocommunications.
Requirements: 2-5 laboratory exercises including pre- and post-report.
Literature: Exercise instructions.
Prerequisites: S-72.1140, S-72.3210, S-72.3220 and S-72.3230
Language: English

S-72.3260 Radio Resource Management Methods (3 cr) P

Spring (period IV)
Teacher: N.N.
Contents: Capacity analysis in a mobile cellular system. Resource allocation policies, radio access control. Dynamic channel allocation. Power control. Handover and mobility. Resource management in packet access systems. Packet scheduling. Flow control.
Requirements: Examination and assignment
Literature: handout
Prerequisites: S-72.2210
Language: English

S-72.3270 Cellular Radio Network Planning Methods (3 cr) P

Spring (period III)
Teacher: N.N.
Contents: Planning objectives and approaches, capacity and coverage planning, frequency planning/code planning, optimization.
Requirements: Examination and assignment.
Literature: handout
Prerequisites: S-72.2210
Language: English

S-72.3280 Advanced Radio Transmission Methods (4 cr) P

Spring (period IV)
Teacher: N.N.
Contents: MLSE and Viterbi algorithm, equalization, techniques, space and time coding in MIMO-systems, multiuser detection, iterative processing in coding and equalization.
Requirements: Examination
Literature: handout
Prerequisites: S-72.1140, S-72.3210, S-72.3220 and S-72.3230
Language: English

S-72.3290 Cellular Radio Network Optimization (3 cr) P

Spring (period IV)
Teacher: N.N.
Contents: Focusing on UTRAN/GERAN radio network planning and the optimization of the network. The emphasis is on practical radio network planning assignment with a computer based tool.
Requirements: Examination and assignment
Literature: handout
Prerequisites: S-72.2210
Language: English

S-72.3295 Broadcasting and Distribution (3 cr)

Spring (period IV) (odd years)
Teacher: N.N.
Requirements: Examination
Prerequisites: S-72.1140
Language: Finnish

S-72.3310 Communication Transmission Lines (4 cr)

Spring (period IV)
Teacher: Lauri Halme Lic.Sc. (Tech.)
Contents: Fiber optic and copper cables in telecommunications networks. Generic cabling. Electromagnetic properties of cables,

problems and solutions in crosstalk and shielding. Grounding of cables.

Requirements: Examination and laboratory exercises.

Literature: To be announced at the first lecture.

Prerequisites: S-72.1110

Language: Finnish

S-72.3320 Advanced Digital Communication (4 cr)

Spring (period III)

Teacher: Timo O. Korhonen Docent

Contents: Advanced transmission methods in wired systems..

Requirements: Examination and/or seminar presentation, tutorial exercises, laboratory work.

Literature: A.B.Carlson: Communication Systems (3rd ed.) or B.P.Lathi: Modern Digital and Analog Communication Systems (3rd ed.).

Prerequisites: S-72.1140

Language: English

S-72.3340 Optical Networks (3 cr)

Spring (period IV)

Teacher: N.N.

Contents: Modulation and demodulation of optical signals, transmission system engineering. Client layers for the optical layer. WDM network. Deployment considerations.

Requirements: Examination and laboratory exercises

Literature: handout and R.Ramaswami&k.Sivarjan: Optical Networks: A Practical Perspective.

Language: English

S-72.3410 Coding Methods (5 cr) P

Spring (period III)

Teacher: Prof Patric Östergård

Contents: Error-detecting and error-correcting codes for digital communication and storage. The theory of the most important code classes. Coding/decoding algorithms. Applications.

Requirements: Examination and home assignments

Literature: S.B. Wicker: Error Control Systems for Digital Communications and Storage, Prentice-Hall 1995.

Prerequisites: S-72.2410, basic courses in mathematics.

Language: English

S-72.3510 Product Development of Telecommunication Systems (5 cr)

Autumn (period II)+spring (period IV)

Teacher: Timo O. Korhonen and visiting lecturer

Contents: Schematic structure of product development process and inspection of related factors: product life span, generating and filtering ideas, project financial and personnel management, marketing, product usability, design and quality. Practical case studies (workshop with industrial partners).

Requirements: Examination and workshop report.

Literature: handout. Handbooks: Mike Lanigan: Principles of Management and Product Design; Cathrine Kitcho: Tech Product Launch; Henry Petroski: Invention by Design; Eugene T. Woolf: Odyssey of the Mind.

Prerequisites: The course is intended to be taken at the end of the studies before the Master's thesis.

Language: English

S-72.3520 Learning and Learning Environments (3-6 cr)

Spring

Teacher: Ursula Holmström (T), Eija Korpelainen (TU) and Johanna Leppävirta (S)

Contents: Basics of learning and learning environments. Individual and group learning. Learning environments psychological and pedagogical content. Learning environment technology. Design and evaluation.

Requirements: The course can be taken as 3 cr or 6 cr. The 3 cr course: lectures, lecture notes and poster. The 6 cr course: in addition exercise work.

Literature: Will be announced during the course.

Alternative code T-110.6300 or TU-53.1263

Language: Finnish

S-72.4110 Postgraduate Seminar in Communications Engineering (6-12 cr) P V

Teacher: N.N.

Spring

Teacher: Prof Östergård, Prof N.N., T.O.Korhonen, Docent

Contents: Seminar course with varying content of topics of telecommunications.

Requirements: Seminar presentation and exercises

Prerequisites: For postgraduate students

Language: Finnish and English

S-72.4210 Postgraduate Seminar in Radio Communications (6-12 cr) P V

Autumn (period II)+ spring (period III)

Teacher: Prof Häggman, Prof N.N.

Contents: Seminar course with varying content of topics of telecommunications.

Requirements: Seminar presentation and exercises

Language: Finnish and English

Courses in old credit system:

S-72.158 Master's Thesis Seminar on Communications Engineering (1 ocr)

Autumn + Spring

Teacher: Prof Häggman, Prof Östergård, Korhonen Docent

Contents: Master's Thesis presentations.

Requirements: Attending 5 lectures and own presentation

Language: Finnish and English

S-72.900 Electrical Engineering Project (3-5 ocr)

Autumn & spring

Teacher: N.N.

Contents: Organization and follow-up of a project. Working in a project, getting familiar with engineering work. The course is intended for first year students but senior students may participate as well.

Requirements: Active participation in the project work and reporting according to the project plan. The number of students accepted and registration are announced at the beginning of the term. The evaluation of the report is pass/fail.

Language: Finnish

S-81 POWER ELECTRONICS

Prof: Jorma Kyryä, tel. 4512436, room SI 424

Prof: Jorma Luomi, tel. 4512430, room SI 323

Prof: Seppo Ovaska, tel. 4512468, room SI 423

<http://www.hut.fi/Units/PowerElectronics>

Courses credited in ECTS

S-81.1000 Electrical Engineering Forum (1-2 cr) P V

Spring

Contents: A joint lecture series organized by the laboratories in electric power engineering (SELA). The topics discussed are up-to-date in electrical engineering. They include national and international product, business and technology strategies, presentations on economic, social and juridical problems arising from the application of the latest research results and technology. Speakers are specialists in their areas; scientists, innovators, and business and technology managers.

Requirements: For 1 credit it is required to participate and write summaries of six presentations. An additional credit is obtained from an examination of the book.

Literature: Lindell: Sähkötekniikan historia, Otatiето, 1994.
Prerequisites: None and the course is also recommended for the first year undergraduate students.
<http://powerelectronics.tkk.fi/education/s811000>
Language: Finnish

S-81.1900 Electrical Engineering Project (5-8 cr)

Autumn & spring
Teacher: Prof Jorma Kyryä, assistants and researchers
Contents: Organization and follow-up of a project. Working in a project, getting familiar with engineering work. The course is intended for first year students but senior students may participate as well.
Requirements: Active participation in the project work and reporting according to the project plan. The number of students accepted and registration are announced at the beginning of the term. The evaluation of the report is pass/fail.
<http://powerelectronics.tkk.fi/education/s811900>
Language: Finnish

S-81.2100 Power Electronics (4 cr)

Autumn (period II)
Teacher: Prof Jorma Kyryä
Contents: The course gives an introduction to power electronics used in electric drives and power supplies. Topics discussed are: power electronic systems, power semiconductor switches, line-commutated ac-dc rectifiers, dc-dc switch-mode converters, self-commutated dc-ac inverters.
Requirements: Examination, learning diaries and laboratory exercises.
Literature: Part of Mohan, Undeland & Robbins: Power Electronics, John Wiley & Sons, 1995.
<http://powerelectronics.tkk.fi/education/s812100>
Language: Finnish
Only one of the courses S-81.2100/2110 can be included in the degree programme.

S-81.2110 Power Electronics (5 cr)

Autumn
Teacher: Prof Jorma Kyryä
Contents: The course gives an introduction to power electronics used in electric drives and power supplies. Topics discussed are: power electronic systems, power semiconductor switches, line-commutated ac-dc rectifiers, dc-dc switch-mode converters, self-commutated dc-ac inverters.
Requirements: Examination, learning diaries and laboratory exercises.
Literature: Part of Mohan, Undeland & Robbins: Power Electronics, John Wiley & Sons, 1995.
<http://powerelectronics.tkk.fi/education/s812110>
Language: English
Only one of the courses S-81.2100/2110 can be included in the degree programme.

S-81.2200 Embedded Microprocessor Systems (3 cr)

Autumn (period I)
Teacher: Prof Seppo Ovaska
Contents: Design of microprocessor systems. Microprocessor architectures. Memories and peripherals. Interfacing. Application examples.
Requirements: Examination and exercises
Literature: Frank Vahid&Tony Givargis: Embedded System Design: A Unified Hardware/Software Introduction, Wiley IEEE Press, 2002.
<http://powerelectronics.tkk.fi/education/s812200>
Language: Finnish

S-81.3100 Switch Mode Power Supplies (5 cr)

Spring (period IV)
Teacher: Prof Jorma Kyryä

Contents: Topologies of most typical power supplies based on switching technique. Dc-dc converters, resonant converters, galvanic isolation, feedback control, rectification with a diode bridge and associated power factor correction.

Requirements: Examination and simulation exercises.

Literature: handout.

Prerequisites: Basics of electrical engineering and electronics.

<http://powerelectronics.tkk.fi/education/s813100>

Language: Finnish

S-81.3110 Converter Techniques (5 cr)

Spring (period III)
Teacher: Prof Jorma Kyryä
Contents: Operation, selection and dimensioning of converters is studied more closely than in S-81.2100. Line- and self-commutated converters, voltage- and current-source converters and direct converters. In addition, harmonics and their filtering as well as protection of power semiconductor switches are discussed.
Requirements: Examination, simulation and laboratory exercises.

Literature: handout.

<http://powerelectronics.tkk.fi/education/s813110>

Language: Finnish

S-81.3120 Components of Power Electronics (5 cr)

Autumn
Teacher: Jouko Niiranen Docent
Contents: Characteristics and operation of diodes, thyristors, bipolar and FET power transistors. Dimensioning of cooling. Protection against voltage spikes and overcurrents. Resistive, capacitive and inductive components. Equipment used in the transfer of control signals. The course includes a dimensioning assignment.
Requirements: Examination and one assignment.
Literature: Niiranen: Tehoelektroniikan komponentit, Otatiето 575, 1997 and handout.
<http://powerelectronics.tkk.fi/education/s813120>
Language: Finnish

S-81.3200 Real-time Systems Design (3 cr)

Autumn (period II)
Teacher: Prof Seppo Ovaska
Contents: Development of an embedded systems for real-time environment. Software life cycle. Real-time operating systems. Performance analysis and optimization. Application examples.
Requirements: Examination and miniproject.
Literature: P.A. Laplante: Real-Time Systems Design and Analysis, 3rd edition, Wiley-IEEE Press, 2004
<http://powerelectronics.tkk.fi/education/s813200>
Language: Finnish

S-81.3210 Project Course on Embedded Systems (5 cr)

Spring
Teacher: Prof Seppo Ovaska
Contents: Development of embedded control system for an electro-mechanical application. Software specification, design and implementation. Integration testing. Documentation.
Requirements: Project to be completed by a group of students.
Prerequisites: S-81.2200 and S-81.3200
<http://powerelectronics.tkk.fi/education/s813210>
Language: Finnish

S-81.3300 Control of Electric Drives (5 cr)

Autumn (period IV)
Teacher: Prof Jorma Luomi
Contents: Characteristics and models of electric motors in electric drives. Current control and motion control. Control methods based on the vector model. Estimation of flux, torque and speed for sensorless control.
Requirements: Examination and simulation assignments

Literature: handout.

<http://powerelectronics.tkk.fi/education/s813300>

Language: Finnish

S-81.3310 Design of Electric Drives (5 cr)

Not lectured 2006-2007

Teacher: Prof Jorma Luomi

Contents: Characteristics of electric motors. Mechanics and loads in electric drives. Choice of motor and converter. Influence of performance on dimensioning. Power and flux control and economic dimensioning. Industrial and traction applications.

Requirements: Examination and assignments

Literature: handout.

<http://powerelectronics.tkk.fi/education/s813310>

Language: Finnish

S-81.3400 Special Assignment on Industrial Electronics and Electric Drives (2-10 cr)

Autumn & spring

Teacher: Prof Luomi, Prof Ovaska or Prof Kyyrä

Contents: The aim is to deepen one's knowledge in some of the areas of electric drives and power electronics and to apply it. The course is composed of a personal special assignment or participation in some of the research projects in the laboratory. The topic of the work has to be discussed and approved before starting.

Requirements: The report describing the work is evaluated.

<http://powerelectronics.tkk.fi/education/s813400>

Language: Finnish, Swedish or English

S-81.4100 EMC in Power Electronics (5 cr) P

Spring (period III)

Teacher: Prof Jorma Kyyrä

Contents: Electromagnetic compatibility in power electronics, especially conducted emissions. An overview of EMC standards, conducted EMI measurements, EMI in power electronic equipment, EMI filter elements, noise suppression, EMI filter design, testing for conducting susceptibility, reduction techniques for internal EMI.

Requirements: Examination and a seminar presentation on a selected EMC topic.

Literature: László Tihanyi: Electromagnetic compatibility in power electronics, IEEE Press, 1995

<http://powerelectronics.tkk.fi/education/s814100>

Language: English

S-81.4200 Special Course in Industrial Electronics I (5 cr) P V

Autumn

Teacher: Prof Seppo Ovaska

Contents: Lecture and seminar course for undergraduate and postgraduate students on some timely topic of industrial electronics. The course content changes annually. More detailed information is available on the www-pages of the laboratory.

Requirements: Seminars and exercises

<http://powerelectronics.tkk.fi/education/s814200>

Language: English

S-81.4210 Special Course in Industrial Electronics II (5 cr) P V

Spring

Teacher: Prof Seppo Ovaska

Contents: Lecture and seminar course for undergraduate and postgraduate students on some timely topic of industrial electronics. The course content changes annually. More detailed information is available on the www-pages of the laboratory.

Requirements: Seminars and exercises

<http://powerelectronics.tkk.fi/education/s814210>

Language: English

S-81.4400 Research Seminar on Industrial Electronics and Electric Drives (1 cr) P V

Autumn + spring

Teacher: Prof Luomi, Prof Ovaska or Prof Kyyrä

Contents: Presentations and reports by researchers in the field of electric drives, power electronics and industrial electronics. Discussion about the presentations and research work in general. The topics vary.

Requirements: Participation in 27 one-hour seminars.

<http://powerelectronics.tkk.fi/education/s814400>

Language: Finnish

S-81.4410 Postgraduate Course on Electric Drives and Power Electronics (5-10 cr) P V

Contents: Lecture or seminar course on electric drives and power electronics with varying topics. More information about the seminar is given on the www-pages of the laboratory.

<http://powerelectronics.tkk.fi/education/s814410>

Language: English

S-87 ELECTRONIC CIRCUIT ENGINEERING

Prof: Kari Halonen, tel. 4512279, room SI 310

Prof: Saska Lindfors, tel. 4512273, room SI 310a

Prof: Markku Åberg, tel. 4512926, room SI 309

<http://www.ecdl.hut.fi/> and opinnot@ecdl.hut.fi (study counselling)

Courses credited in ECTS

S-87.1111 Basic Electronics (7 cr)

Autumn & spring

Teacher: Jorma Karjalainen Lic.Sc. (Tech.)

Contents: Basic components in electronics: resistor, capacitor, diodes, transistors and operational amplifiers. Circuit design using operational amplifiers. Basics in filter techniques. Rectifier circuits. Regulators.

Requirements: Examination and laboratory works

Literature: handout.

Replaces S-87.1010, S-87.1030 and S-87.2113

Language: Finnish

S-87.2020 Electronics II (5 cr)

Spring

Teacher: Prof Saska Lindfors

Contents: Frequency response of amplifiers. Feedback and stability analysis. Internal structure opamps. Miller effect and frequency compensation. Power amplifiers and output stages. Filters and their active implementation. Oscillators, phase and delay locked loops. A/D and D/A converters. Power supplies

Requirements: One special project and two intermediate examinations or a final exam.

Literature: Sedra-Smith: Microelectronic Circuits (4th Ed.), Oxford University Press, 1998 and handout.

Prerequisites: S-87.1010

Language: Finnish

S-87.3137 Integrated Circuit Design (3 cr)

Autumn (period I)

Teacher: Prof Kari Halonen, Jouko Vankka D.Sc.(Tech)

Contents: Basics of technology-related design. Dimensioning and layout design of basic analog building blocks. Also suitable for basics of designing digital integrated circuits.

Requirements: Obligatory exercises and examination.

Literature: Allen-Holberg: CMOS Analog Circuit Design, Oxford University Press, 1987 (Johns-Martin: Analog Integrated Circuit Design, John Wiley&Sons Inc., 1997).

Prerequisites: S-87.2020

Language: Finnish or English

S-87.3141 Analog Integrated Circuits (3 cr)

Autumn (period II)

Teacher: Prof Kari Halonen

Contents: The course is a continuation of S-87.1137. Amplifiers in analog integrated circuits. Wideband, buffered and micropower amplifiers. Regulation of amplification. Comparators and multipliers. MOS and bipolar topologies.

Requirements: Obligatory exercises and examination.

Literature: Allen-Holberg: CMOS Analog Circuit Design, Oxford University Press, 1987 (Johns-Martin: Analog Integrated Circuit Design, John Wiley&Sons Inc., 1997).

Prerequisites: S-87.3137

Language: Finnish or English

S-87.3145 Analog Integrated Systems (5 cr) P

Spring (period III)

Teacher: Prof Kari Halonen

Contents: Realization of an analog system as an integrated circuit. SC-filters. Integrated A/D and D/A converters. Modulators. Phase locked loops. Determination of performance characteristics of integrated circuit blocks.

Requirements: Obligatory exercises and examination.

Literature: Johns-Martin: Analog Integrated Circuit Design, John Wiley&Sons Inc., 1997 and Gregorian-Temes: Analog MOS Integrated Circuits for Signal Processing, John Wiley&Sons Inc. 1986; Toumazou, Lidgley & Haigh: Analogue IC Design: The current-mode approach, Peter Peregrinus Ltd., 1990; Allen-Holberg: CMOS Analog Circuit Design, Holt, Rinehart and Winston Inc.; Razavi: Principles of Data Conversion System Design, IEEE Press, 1995.

Prerequisites: S-87.3137 and S-87.3141

Language: Finnish or English

S-87.3148 Computer-Aided Circuit Design (3 cr)

Autumn

Teacher: Prof Kari Halonen and Marko Kosunen Lic.Sc. (Tech.)

Contents: The course is for students of the option Electronics and Telecommunications. Common EDA-tools are used to design systems and integrated circuits.

Requirements: exercises. Grade pass/fail.

Literature: URL: <http://www.ecdl.hut.fi/~cad/>

Prerequisites: S-87.1010, S-87.2020 and S-87.3137

Language: English

S-87.3156 Integrated RF-Circuit (5 cr) P

Spring (period IV)

Teacher: Jussi Rynänen Ph.D.

Contents: Special features of linear and non-linear integrated high frequency circuits. Fast GaAs and circuit technologies. Non-linear analysis and circuit models. Integrated high frequency modules of telecommunications: amplifiers, mixers, oscillators.

Requirements: Special project: the design and measuring of an integrated RF-circuit and examination.

Literature: handout.

Prerequisites: S-87.3137

Language: Finnish

S-87.3163 Special Project in Electronic Circuit Design (5-8 cr)

Autumn&spring

Teacher: Prof Kari Halonen

Contents: Special project in electronic circuit design relating to computer-aided circuit design. Topics can be emphasized on electronics of telecommunication or custom designed integrated circuits (VLSI). The course practices the use of computer workstations and their software. The special project is specified for every student personally by Professors.

Requirements: Special project.

Literature: Will be defined separately.

Prerequisites: Advanced studies in electronic circuit design.

Language: Finnish or English.

S-87.3170 Research Seminar on Electronic Circuit Design (1 cr) P V

Autumn + spring

Teacher: Prof Kari Halonen

Contents: A mandatory course for students who's major or minor subject is Microelectronic circuit design. Presentations of Master's theses made at ECD laboratory or seminars held by top level Professionals.

Requirements: Attending 16 seminar sessions. 3 seminar sessions can be compensated by holding a presentation.

Prerequisites: Advanced studies in electronic circuit design.

Grades: pass/fail

Language: Finnish or English.

S-87.3182 Digital Microelectronics I: System Level Electric Design (5 cr) P

Autumn

Teacher: Lauri Koskinen D.Sc. (Tech)

Contents: Introduction to digital integrated circuits. Covered range from CMOS devices and manufacturing technology to CMOS inverters and gates. Other topics include propagation delay, noise margins, power dissipation, timing and synchronization.

Requirements: Examination.

Literature: To be announced later

Prerequisites: S-87.3137

Language: Finnish or English

S-87.3185 Digital Microelectronics II: Design and Implementation Basics (5 cr) P

Spring

Teacher: Marko Kosunen Lic.Sc. (Tech)

Contents: The course divides in three related sections. In the first section, Basic theory of signal processing, and basic algorithms of signal processing are studied with MATLAB-program. In the second section, matters considering realization of simple signal processing algorithms are studied, and algorithms are realized with VHDL-hardware description language. The goal is to learn the basics of writing synthesizable VHDL-code, simulation and logic synthesis. In the third section, the realization of the synthesized digital circuit with place and route tools is studied. The goal of the third section is to teach, what can be done, and should be able to do with place and route tools. The student will go through the whole design flow during the practical exercise, that includes the design and implementation of a simple signal processing block.

Requirements: Practical exercise and examination

Literature: P. Ashenden: Designers guide to VHDL

Prerequisites: S-88.3133 and S-87.3148

<http://www.ecdl.hut.fi>

Language: Finnish or English

S-87.3188 Electrical Design of Digital Circuits III: Digital Signal Processing (4 cr) P

Autumn

Teacher: N.N.

Contents: This course will give insight into how a digital signal processing algorithm specification can be implemented from a given set of criteria. The main part of the course will be focused on the design of application specific architectures that can be implemented on either reconfigurable hardware, e.g. FPGAs, or as a custom circuit, i.e. ASIC.

Requirements: Examination

Literature: Keshab K. Parni: VLSI Digital Signal Processing Systems; Design and Implementation

Prerequisites: S-88.3105

<http://www.ecdl.hut.fi>

Language: Finnish

S-87.3190 Computer Architecture (5 cr)

Spring

Teacher: Lauri Koskinen D.Sc. (Tech)

Contents: Basic knowledge on computer systems and their parts, from processor architecture to system level and SW/HW interface. The topics will be discussed from a hardware design viewpoint.

Requirements: Examination

Literature: Patterson&Hennessy: Computer Organization & Design. The Hardware and Software Interface. Morgan Kaufman, (3rd ed.). Handout

Prerequisites: S-87.3182, S-88.3106

Language: Finnish or English

S-87.3200 Special Course in Electronic Circuit Design (1-8 cr) P V

Will be lectured in a period to be specified later

Teacher: N.N.

Contents: Variable. A special course in electronic circuit design.

Requirements: To be announced later.

Prerequisites: S-87.1010.

Language: Finnish

S-87.4193 Postgraduate Course in Electronic Circuit Design I (1-8 cr) P V

Autumn

Teacher: laboratory professor and/or N.N.

Contents: Variable. A postgraduate-level seminar course.

Requirements: One seminar presentation and homework. Mandatory attendance at seminars.

Literature: To be announced later.

Prerequisites: Advanced studies in electronic circuit design.

Language: Finnish or English.

S-87.4198 Postgraduate Course in Electronic Circuit Design II (1-8 cr) P V

Spring

Teacher: laboratory professor and/or N.N.

Contents: Variable. A postgraduate-level seminar course.

Requirements: One seminar presentation and homeworks. Mandatory attendance in seminars.

Literature: To be announced later.

Prerequisites: Advanced studies in electronic circuit design.

Language: Finnish or English.

S-87.4199 Postgraduate Course in Electronic Circuit Design III (1-11 cr) P V

Will be lectured in a period to be specified later

Teacher: laboratory professor and/or N.N.

Contents: Variable. A postgraduate-level seminar course.

Requirements: To be announced later.

Literature: To be announced later.

Prerequisites: Advanced studies in electronic circuit design.

Language: Finnish or English.

S-88 SIGNAL PROCESSING TECHNOLOGY

Prof: Iiro Hartimo, tel. 4512454, room SG 406

Prof: Visa Koivunen, tel. 4512453, room SG408

Prof: Timo Laakso, tel. 4512473, room SG410

Prof: Jorma Skyttä, tel. 4512450, room SG 407

Prof: Risto Wichman, tel. 4512484, room SG413

<http://wooster.hut.fi/English/>**Courses credited in ECTS****S-88.1110 Digital Technology, basic course (3 cr)**

Autumn (period I)

Teacher: Prof Jorma Skyttä

Contents: Design and implementation methods of digital electronic devices. Coupling functions, combinatorial and sequential logic, MSI and LSI circuits, PLA circuits, memory, timing and interference issues, digital arithmetic and codes.

Requirements: Examination.

Literature: Mano&Kime: Logic and Computer Design Fundamentals, Prentice-Hall 1997. Handout.

<http://wooster.hut.fi/kurssit/s881110.html>

Language: Finnish

S-88.2111 Signal Processing in Telecommunications I (3 cr)

Spring (period IV)

Teacher: Prof Timo Laakso and visiting lecturers from industry

Contents: Communication systems and channel models. Channel capacity. Pulse shaping filters. Nyquist criterion, matched filters. Optimal linear equalizers: zero-forcing and minimum mean squared error (MMSE) design criteria. Adaptive equalizer implementations. Decision-feedback equalizers. Optimal maximum likelihood reception and Viterbi algorithm. Echo cancellation. Examples from mobile communications and digital subscriber lines.

Requirements: Examination. Solving of voluntary homework problems and MATLAB exercise.

Literature: Handout.

Prerequisites: S-72.1140

<http://wooster.hut.fi/kurssit/s882111.html>

Replaces S-88.2211

Language: English

S-88.2145 Stochastic Processes in Communications (4 cr)

Autumn (period I)

Teacher: Prof Visa Koivunen

Requirements: Examination

Literature: Yates & Goodman: Probability and Stochastic Processes - A Friendly Introduction for Electrical and Computer Engineers. Handout

Prerequisites: 1st years mathematics and Mat-1.2600

<http://wooster.hut.fi/kurssit/s882145.html>

Language: Finnish

S-88.3105 Digital Signal Processing Systems (5 cr)

Autumn (odd years) period I

Teacher: Prof Risto Wichman

Contents: Design of FIR-filters, multirate filters, filterbanks and wavelets, introduction to adaptive filtering.

Requirements: Examination and exercises

Literature: N.J.Fliege: Multirate Digital Signal Processing. John Wiley&Sons 1994.

Prerequisites: T-61.3010 or equivalent.

<http://wooster.hut.fi/kurssit/s883105.html>

Language: English

Only one of the courses S-88.3105/3106 can be included in the degree programme.

S-88.3106 Digital Signal Processing Systems (5 cr)

Autumn (even years) period I

Teacher: Prof Risto Wichman

Equivalent to S-88.3105.

Language: Finnish

Only one of the courses S-88.3105/3106 can be included in the degree programme.

S-88.3132 Design of VLSI Circuits (4 cr)

Autumn (period II)

Teacher: Prof Jorma Skyttä

Contents: Implementation of digital logic elements: combinational circuits, latches and flip-flops. Synchronous and asynchronous digital systems. Implementation of finite state machines, testing of digital circuits.

Requirements: Examination and project work.

Literature: Brown, Vranesic: Fundamentals of digital logic with VHDL design. McGraw-Hill 2000.

Prerequisites: S-88.1110 and S-87.2113 or equivalent knowledge.

<http://wooster.hut.fi/kurssit/s883132.html>

Language: Finnish

S-88.3133 Digital Design with Hardware Description Language (3 cr)

Autumn (period II)

Teacher: N.N.

Contents: Semantics and timing models of hardware description languages. Structural modelling on digital systems. Use of high level model modules. Description on behavioural level.

Requirements: Examination and exercises.

Literature: Peter J. Ashenden: The Designer's Guide to VHDL, Morgan Kaufmann 1996.

Prerequisites: S-88.1110

<http://wooster.hut.fi/kurssit/s883133.html>

Language: Finnish

S-88.3134 Design of ASIC Circuits (4 cr)

Spring (period III)

Teacher: Prof Jorma Skyttä

Contents: Hierarchical design methodology of electronic systems. Automation of integrated circuit design and operating principles of design tools.

Requirements: Examination and exercise work.

Literature: De Micheli: Synthesis and Optimization of Digital Circuits, McGraw-Hill 1994. Handout.

Prerequisites: S-88.3132, S-88.3133

<http://wooster.hut.fi/kurssit/s883134.html>

Language: Finnish

S-88.3150 Digital Technology, laboratory course (2 cr)

Autumn&spring

Teacher: Prof Jorma Skyttä, assistants

Contents: Design and laboratory exercises concerning digital circuits and devices and electrical phenomena.

Requirements: Exercises and reports.

Literature: Handout.

Prerequisites: Basic courses in digital technology and electronics.

<http://wooster.hut.fi/kurssit/s883150.html>

Language: Finnish

S-88.3155 Signal Processing, special assignment (5-10 cr) V

Autumn&spring

Teachers: Prof Jorma Skyttä, Prof Visa Koivunen, Prof Risto Wichman, assistants

Contents: An independent design project related to digital signal processing, circuit design, computer equipment or system programming.

Requirements: Design and implementation of the assignment under the guidance of a tutor. Final report.

<http://wooster.hut.fi/kurssit/s883155.html>

Language: Finnish and English

S-88.4175 Signal Processing in Wireless Communications (4 cr) P

Autumn (period I)

Teacher: Prof Risto Wichman

Contents: Baseband signal processing techniques for broadband wireless communications: radio channel models, diversity techniques, multiantenna transceivers, interference cancellation, multiuser detection, equalization, RAKE.

Requirements: Examination and project work.

Literature: To be announced.

Prerequisites: S-72.1140 recommended.

<http://wooster.hut.fi/kurssit/s8841755.html>

Language: English

S-88.4191 Individual Course in Signal Processing (2-10 cr) P V

Autumn+spring

Teacher: Prof Jorma Skyttä, Prof Visa Koivunen and Prof Risto Wichman

Contents: The topic and depth of the course is negotiated with one of the teachers.

Replaces S-88.4190

Language: Finnish or English

S-88.4200 Statistical Signal Processing (5 cr) P

Spring

Teacher: Prof Visa Koivunen

Contents: Basics in parameter estimation, optimum filtering and signal detection. Estimation of deterministic unknown parameters, estimation of random parameters, optimum filtering, Wiener, LMS, Kalman, EKF, high resolution spectral and direction of arrival (DOA) estimation, signal detection.

Requirements: Examination, Matlab project work.

Literature: Handout.

Prerequisites: T-61.3010 or equivalent knowledge

<http://wooster.hut.fi/kurssit/s884200.html>

Language: English

S-88.4205 Image and Video Compression (4 cr) P

Spring (period III)

Teacher: Prof Visa Koivunen

Contents: Representation methods of video signals, picture composition and sampling, estimation of motion, filtering, picture and video signal coding, standards.

Requirements: Examination.

Literature: To be announced.

Prerequisites: T-61.3010 or equivalent knowledge.

<http://wooster.hut.fi/kurssit/s884205.html>

Language: English

S-88.4212 Signal Processing in Telecommunications II (4 cr) P

Autumn (period II)

Teacher: Prof Timo Laakso

Contents: Digital receivers, inner receiver and outer receiver concepts. Synchronization functions and their classification. Data-aided, decision-directed, and non-data-aided algorithms. Maximum likelihood estimation principles. Carrier frequency estimation. Carrier phase estimation. Symbol timing estimation. Channel estimation principles.

Requirements: Examination. Solving of voluntary homework problems.

Literature: U.Mengali - A.N.D'Andrea: Synchronization Techniques for Digital Receivers. Plenum Press 1997, 520 p.

Prerequisites: S-88.2111

<http://wooster.hut.fi/kurssit/s884212.html>

Language: English

S-88.4221 Postgraduate Seminar on Signal Processing (4-8 cr) P V

Autumn

Teacher: Prof Timo Laakso

Contents: A postgraduate seminar on annually varying subjects within the field of signal processing in telecommunications. The subject will be announced at the beginning of the term.

Requirements: Seminar presentations and exercises.

Literature: To be announced.

<http://wooster.hut.fi/kurssit/s884221.html>

Language: English

S-88.4222 Postgraduate Seminar on Signal Processing II (4-8 cr) P V

Spring

Teacher: Prof Koivunen, Prof Skyttä and Prof Wichman

Contents: A postgraduate seminar on annually varying subjects within the field of information technology. The subject will be announced at the beginning of the term.

Requirements: Seminar presentations and exercises.

Literature: To be announced.

<http://wooster.hut.fi/kurssit/s884222.html>

Language: English

S-88.4223 Postgraduate Seminar on Signal Processing 3 (4-8 cr) P V

Spring

Teachers: Prof Koivunen, prof Skyttä and Prof Wichman

Contents: A postgraduate seminar on annually varying subjects within the field of information technology. The subject will be announced at the beginning of the term.

Requirements: Seminar presentations and exercises.

Literature: To be announced.

<http://wooster.hut.fi/kurssit/s884223.html>

Language: English

S-88.4224 Postgraduate Seminar on Signal Processing 4 (4-8 cr) P V

Autumn

Teacher: Prof Koivunen, Prof Skyttä and Prof Wichman

Contents: A postgraduate seminar on annually varying subjects within the field of information technology. The subject will be announced at the beginning of the term.

Requirements: Seminar presentations and exercises.

Literature: To be announced

<http://wooster.hut.fi/kurssit/s884224.html>

Language: English

S-89 ACOUSTICS AND AUDIO SIGNAL PROCESSING

Prof: Matti Karjalainen, tel. 4512490, room SE 211

Prof: Paavo Alku, tel. 4515680, room SE 114

Prof: Unto K. Laine, tel. 4512492, room SE 213

Prof: Vesa Välimäki, tel. 4515749, room SI 214d

<http://www.acoustics.hut.fi/>

Courses credited in ECTS

S-89.2300 Sound and Voice Technology (5 cr)

Autumn (period I)

Teacher: Prof Matti Karjalainen

Contents: Fundamental concepts in acoustics. Sound and voice as physical phenomena and communications signals. Hearing and auditory perception. Music and speech. Audio technology. Room and auditorium acoustics. Noise.

Requirements: Examination.

Literature: Rossing et al: The Science of Sound. 3rd ed. Addison-Wesley. Handout.

<http://www.acoustics.hut.fi/teaching/S-89.2300>

Language: Finnish

Examination in Finnish and English

S-89.3310 Acoustics and Physics of Sound (4 cr)

Autumn (period II)

Teacher: Seppo Uosukainen D.Sc. (Tech.)

Contents: Mathematical and physical foundations of vibration mechanics and acoustics, sound sources, radiation and propagation of sound, equivalent circuits, acoustical components.

Requirements: Seminar or examination

Literature: Lecture notes (in Finnish)

Prerequisites: S-89.2300

<http://www.acoustics.hut.fi/teaching/S-89.3310>

Language: Finnish

S-89.3320 Communication Acoustics (5 cr)

Spring

Teacher: Prof Matti Karjalainen

Contents: Communication by sound and voice. Sound sources and their properties. Physiology of hearing. Psychology of hearing. Spatial hearing. Auditory modelling. Sound quality. Technical audiology.

Requirements: Examination

Literature: handout.

<http://www.acoustics.hut.fi/teaching/S-89.3320>

Language: Finnish

S-89.3330 Exercise on Acoustical Measurements (1 cr)

Spring

Teacher: Ila Tokola M.Sc. (Tech.)

Contents: Exercise on acoustical measuring, which familiarizes with the most common acoustical measuring equipment and basic loudspeaker measurements.

Requirements: Exercise

Prerequisites: S-89.2300

<http://www.acoustics.hut.fi/teaching/S-89.3330>

Language: Finnish

S-89.3410 Electroacoustics (4 cr)

Spring (even years)

Teacher: Juha Backman M.Sc. (Tech.)

Contents: Nonlinear acoustics, applications of electroacoustical transducers in audio (loudspeakers, headphones, microphones), sound reproduction systems, ultrasound.

Requirements: Examination or final seminar.

Literature: To be announced.

Prerequisites: S-89.2300, S-89.3310

<http://www.acoustics.hut.fi/teaching/S-89.3410>

Language: Finnish

S-89.3421 Room Acoustics (5 cr)

Spring (odd years, beginning 2007)

Teacher: Henrik Möller M.Sc. (Tech.)

Contents: Basics of room acoustics, acoustic conditions of halls and small rooms, room and room acoustical design.

Requirements: Examination and assignment

Literature: To be announced.

Prerequisites: S-89.2300, S-89.3310

<http://www.acoustics.hut.fi/teaching/S-89.3421>

Language: Finnish, examination in English by agreement

Replaces: S-89.3420

S-89.3430 Acoustic Measurements (5 cr) P

Autumn (odd years)

Teacher: Timo Peltonen M.Sc. (Tech.)

Contents: Room and building acoustics, noise control in buildings.

Requirements: Examination and assignment.

Literature: handout.

Prerequisites: S-89.2300, S-89.3310 or equal knowledge.

<http://www.acoustics.hut.fi/teaching/S-89.3430>

Language: Finnish

S-89.3440 Acoustic Field Theory (7 cr) P

Spring (even years)

Teacher: Seppo Uosukainen D.Sc. (Tech.)

Contents: The foundations of acoustic field theory, based on kinetic fluid theory, the basic theory of acoustic wave motion, the radiation, propagation, and scattering of sound, foundations of the theory of vibration, analytical and numerical calculation methods.

Requirements: Home work and active participation. Weekend examination can be arranged by agreement.

Literature: handout.

Prerequisites: S-89.2300 and S-89.3310 or equal knowledge.

<http://www.acoustics.hut.fi/teaching/S-89.3440>

Language: Finnish

S-89.3460 Spatial Sound (5-8 cr) P

Autumn (even years)

Teacher: Ville Pulkki D.Sc. (Tech.)

Contents: The influence of listening space to sound. Spatial perception of sound. Recording and reproduction of spatial sound. Subjective and objective evaluation of spatial sound quality. Listening tests. Students design and conduct listening tests in groups. The number of attendees is limited, participants are chosen depending on their grades in earlier studies.

Requirements: Listening test conduction, exercises and seminar. Literature: handout.

Prerequisites: S-89.2300 and S-89.3320

<http://www.acoustics.hut.fi/teaching/S-89.3460>

Language: English

S-89.3470 Noise Control (3 cr)

Autumn

Teacher: Valtteri Hongisto Docent

Contents: Basic concept of the noise control. Airborne sound insulation. Impact sound insulation. Building acoustics. Ventilation noise. Flow noise. Environmental noise. Noise and vibration at workplaces. Vibration isolation. National regulations. The effects of noise.

Requirements: Examination

Literature: handout.

Prerequisites: S-89.2300 recommended

<http://www.acoustics.hut.fi/teaching/S-89.3470>

Language: Finnish, examination in English by agreement.

S-89.3480 Acoustics Seminar (3 cr) V

Spring

Teacher: Prof Matti Karjalainen

Contents: Varying current topics in acoustics.

Requirements: Seminar presentation.

Literature: To be announced in the beginning of the course.

Prerequisites: S-89.2300 and S-89.3310 or equal knowledge.

<http://www.acoustics.hut.fi/teaching/S-89.3480>

Language: Finnish or English (will be announced in the beginning of the course)

S-89.3490 Acoustics and Audio Signal Processing, special assignment (1-10 cr) P V

Autumn & Spring

Teacher: Prof Matti Karjalainen

Contents: Independent research or design project in the field of acoustics and/or audio signal processing.

Requirements: Instructed research or design and implementation project and documentation.

<http://www.acoustics.hut.fi/teaching/S-89.3490>

Language: Finnish or English

S-89.3510 DSP Processors and Audio Signal Processing (5 cr)

Spring

Teacher: Henri Penttinen M.Sc. (Tech.)

Contents: Architecture, development tools, and assembly programming of general purpose DSP processors. Assembly programming exercise in small groups. Real-time DSP is applied to filtering, shaping, generation, and recognition of audio signals and to generate different audio effects. DSP processors used: Texas Instruments TMS320C54, Motorola 56303 and Analog Devices ADSP-21261.

Requirements: Exercises and assembly programming assignment.

Literature: handout and processor manuals.

Prerequisites: T-61.3010, T-0.3123 recommended.

<http://www.acoustics.hut.fi/teaching/S-89.3510>

Language: Finnish

S-89.3540 Audio Signal Processing (5 cr) P

Spring

Teacher: Prof Vesa Välimäki and Jyri Huopaniemi D.Sc. (Tech.)

Contents: General overview, history and applications of audio signal processing, sampling rates and number of bits in digital audio, dither, noise shaping, digital filters used in digital audio, audio-specific design methods for digital filters, sampling rate conversion, analysis methods for audio signals, digital reverberation and effects, 3-D sound and virtual acoustics, sound synthesis, adaptive audio signal processing techniques, audio coding and multimedia standards.

Requirements: Special assignment and examination or alternatively special assignment and learning diaries with exercises.

Literature: handout and additional reading to be announced in the beginning of the course.

Prerequisites: S-89.2300 and T-61.3010.

<http://www.acoustics.hut.fi/teaching/S-89.3540>

Language: English

S-89.3580 Audio Signal Processing Seminar (3 cr) V

Autumn

Teacher: Prof Vesa Välimäki

Contents: The seminar is devoted to changing current topics in audio signal processing. In autumn 2006 the title of the seminar will be sound analysis. The seminar will focus on signal processing issues related to feature extraction, spectral analysis, content analysis and quality assessment of music and other sounds.

Requirements: Attendance, seminar presentation and seminar paper.

Literature: Parts of textbooks and papers from journals and conferences.

Prerequisites: S-89.2300 and T-61.3010

<http://www.acoustics.hut.fi/teaching/S-89.3580>

Language: English

S-89.3610 Processing of Speech Signals (5 cr)

Autumn

Teacher: Prof Unto K. Laine

Contents: Basics of audio signal processing. Basics of psychoacoustics and perceptually motivated signal processing. Acoustic theory of speech production. The functions, acoustics and modelling of the larynx and the vocal tract. Phones and phonation. Time-frequency analysis of speech signals. Principles of speech coding. Linear prediction and its application in processing of speech signals. Speech synthesis and speech recognition.

Requirements: Examination and assignment

Literature: Lecture notes and parts of the books: L.R. Rabiner & R.W. Shafer: Digital Processing of Speech Signals, Prentice-Hall 1978. D.O'Saughnessy: Speech Communication, Human and Machine, Addison-Wesley, 1987 and J.R. Deller, jr., J.G. Proakis, J.H.L. Hansen: Discrete-Time Processing of Speech Signals, Macmillan 1993.

Prerequisites: Basics of digital signal processing, for example T-61.3010

<http://www.acoustics.hut.fi/teaching/S-89.3610>

Language: Finnish

S-89.3630 Speech Transmission Technology (3 cr) P

Spring

Teacher: Prof Paavo Alku

Contents: Characteristics of speech signals, fundamentals of low bit rate speech coding: bit rate, speech quality, application areas of speech coding, Pulse Code Modulation (PCM), sampling, quantization, Linear Predictive Coding (LPC), speech coding methods in digital mobile phone: RPE-LTP, CELP, ACELP, AMR-WB.

Requirements: Examination.

Literature: handout

Prerequisites: Basics of digital signal processing and S-89.3610 recommended.

<http://www.acoustics.hut.fi/teaching/S-89.3630>

Language: Finnish

S-89.3640 Methods of Speech Processing (3 cr) P

Spring

Teacher: Prof Unto K. Laine, Prof Paavo Alku

Contents: The most important methods of speech processing (spectrum, linear prediction, cepstrum etc). Introductory lectures are first given on each topic after which assignments on the topics are done in groups using mainly the MatLab tool. It is possible to expand the assignments by taking the course S-98.490.

Requirements: Assignments.

Literature: handout

Prerequisites: S-89.3610

<http://www.acoustics.hut.fi/teaching/S-89.3640>

Language: Finnish

S-89.3680 Speech Processing Seminar (3 cr) V

Autumn

Teacher: Prof Paavo Alku, Prof Unto K. Laine

Contents: Varying current topics in speech processing.

Requirements: Seminar presentations.

Literature: handout.

<http://www.acoustics.hut.fi/teaching/S-89.3680>

Language: Finnish or English (Will be announced in the beginning of the course)

S-89.3690 Speech Processing, special assignment (1-10 cr) PV

Autumn&Spring

Teacher: Prof Paavo Alku

Contents: Independent research or design project in the field of speed processing. The topic of the project, which is given by the lecturer, can be within technical or multidisciplinary areas of speech processing.

Requirements: Instructed research or design and implementation project and documentation.

<http://www.acoustics.hut.fi/teaching/S-89.3690>

Language: Finnish or English

S-89.4810 Postgraduate Course in Acoustics (8 cr) P V

Spring

Teacher: Prof Matti Karjalainen

Contents: Varying current topics in acoustics.

Requirements: Seminar presentations, course thesis and report.

<http://www.acoustics.hut.fi/teaching/S-89.4810>

Language: Finnish or English

S-89.4820 Postgraduate Course in Audio Signal Processing (8 cr) P V

Autumn

Teacher: Prof Vesa Välimäki

Contents: The postgraduate course is devoted to changing current topics in audio signal processing. It consists of two parts: a seminar and a special assignment. The course is intended for persons who have a Master's degree. In 2006-2007, the title of the course will be sound analysis. It will focus on signal processing issues related to feature extraction, spectral analysis, content analysis and quality assessment of music and other sounds. The seminar part will be arranged in the autumn of 2006 in connection with the Audio Signal Processing Seminar (S-89.3580). In addition, the students taking this course are asked to produce a special assignment that is related to the theme of the course. Both parts of the Postgraduate Course must be finished within one academic year.

Requirements: Attendance, seminar paper, presentation, special assignment and report.

Literature: Parts of textbooks and papers from journals and conferences.

<http://www.acoustics.hut.fi/teaching/S-89.4820>

Language: English

S-89.4830 Postgraduate Course in Speech Processing (8 cr) P V

Autumn

Teacher: Prof Paavo Alku, Prof Unto K. Laine

Contents: Varying current topics in speech processing.

Requirements: Seminar presentations, course thesis and report

<http://www.acoustics.hut.fi/teaching/S-89.4830>

Language: Finnish or English

S-92 SPACE TECHNOLOGY

Prof. Martti Hallikainen, tel. 4512371, room SC 228B

<http://www.space.tkk.fi/>

Courses credited in ECTS

S-92.3100 Space Physics (5 cr)

Autumn (even years)

Teacher: Jukka Heikkinen Docent

Contents: Physical conditions in space: temperature, pressure, gravity, electric and magnetic fields, solar wind, plasma and its behaviour.

Requirements: Examination.

Literature: handout.

Language: Finnish

S-92.3113 Spaceflight Instrumentation (5 cr)

Autumn

Teacher: Simo Tauriainen Lic.Sc. (Tech.)

Contents: Design, construction and testing of spaceborne instruments and their integration in satellite. Reliability analysis. Satellite orbits and spaceflights. Examples of spaceflight instrumentation projects.

Requirements: Examination.

Literature: P.Fortescue - J.Stark: Spacecraft Systems Engineering, (3rd edition), Wiley 2003. Handout.

Language: Finnish

S-92.3121 Satellite Communications (3 cr)

Spring

Teacher: Lauri Kurvonen D.Sc. (Tech.)

Contents: Satellite communication systems, structure and operation of ground stations, influence of radiowave propagation phenomena on satellite communication.

Requirements: Examination

Literature: Pratt, J., Bostian, C.W, Allnut, J.E., Satellite Communications (2nd ed.), Wiley 2002. Handout.

Language: Finnish

S-92.3131 Remote Sensing (5 cr)

Autumn (period II)

Teacher: Prof Martti Hallikainen

Contents: Active (radar, lidar) and passive (scanner, radiometer, spectrometer) remote sensing instruments and their applications. Remote sensing satellites and their orbits. Meteorological satellites and soundings. Planetary probes.

Requirements: Examination

Literature: handout

Language: Finnish

S-92.3145 Radio Astronomy (3 cr)

Autumn (even years)

Teacher: Merja Tornikoski Docent

Contents: Fundamentals of astronomy and radio astronomy. Radio astronomy antennas and receivers, radiometers and observation methods. Radio emission by Sun, quasars and black holes. SETI. Recent results in radio astronomy.

Literature: handout

Prerequisites: S-26.2100

Language: Finnish

S-92.3186 Laboratory Course in Space Technology (4 cr)

Spring

Teacher: assistants

Contents: Laboratory exercises in spaceflight instrumentation technology and remote sensing and their applications.

Requirements: Laboratory exercises.

Literature: handout

Prerequisites: S-92.3113

Language: Finnish

S-92.3192 Special Assignment in Space Technology (5 cr)

Autumn&spring

Teacher: Prof Martti Hallikainen and assistants

Contents: An assignment on the development and use of space technology and its applications. The assignment may be a theoretical and/or experimental investigation, including a final report. The assignment may also be carried out by a group of students.

Language: Finnish or English

S-92.3205 Research Seminar on Space Technology (1 cr) P V

Autumn + spring

Teacher: Prof Martti Hallikainen

Contents: Researchers from academic institutes and industry give presentations on space technology and its applications.

Requirements: Attendance at seminars

Language: Finnish

S-92.4135 Microwave Remote Sensing (5 cr) P

Autumn (odd years)

Teacher: Prof Martti Hallikainen and researchers

Contents: Microwave radiometers and synthetic aperture radars. Basics of polarimetry and interferometry and their use in remote sensing instruments. Applications.

Requirements: Examination

Literature: handout

Language: Finnish

S-92.4138 Optical Remote Sensing (3 cr)

Spring (even years)

Teacher: Jouni Pulliainen Docent and researchers

Contents: Optical remote sensing instruments and their applications.

Requirements: Examination

Literature: handout

Language: Finnish

S-92.4305 Special Problems in Space Technology (5 cr) P V

Autumn (odd years)

Teacher: Prof Martti Hallikainen

Contents: A varying topic of current interest on space technology (remote sensing, spaceflight instrumentation).

Requirements: Homework and/or one special assignment.

Literature: To be announced.

Language: Finnish or English

S-92.4405 Data Interpretation and Modelling Methods in Remote Sensing (5 cr) P

Autumn (even years)

Teacher: Jouni Pulliainen Docent

Contents: Physical basis and terminology of remote sensing. Modelling of target scattering coefficient, reflectance and emissivity. Effect of atmosphere and sensor parameters to satellite observations. Inversion methods in data interpretation. Assimilation of remote sensing observations to other information and to dynamic modelling of (natural) targets.

Requirements: Examination.

Literature: handout.

Language: Finnish

S-92.4505 Postgraduate Course in Space Technology I (8 cr) P V

Autumn

Teacher: Prof Martti Hallikainen or N.N.

Contents: Postgraduate seminar on varying topic in space technology.

Requirements: Participants give lectures, carry out homework and write essays.

Language: Finnish or English

S-92.4605 Postgraduate Course in Space Technology II (8 cr) P V

Spring

Teacher: Prof Martti Hallikainen or N.N.

Contents: Postgraduate seminar on varying topic in space technology.

Requirements: Participants give lectures, carry out homework and write essays.

Language: Finnish or English

S-96 ELECTROMAGNETICS

Prof: Keijo Nikoskinen, tel. 4512263, room SC 223

Prof: Jukka Sarvas, tel. 4512226, room SC209

Academy Prof: Ari Sihvola, tel. 4512261, room SC 225B (leave of absence 2005-2010)

Emeritus Prof: Ismo V. Lindell, tel. 4512266, room SC 210

<http://www.tkk.fi/Units/Electromagnetics/>**Courses credited in ECTS****S-96.1011 Research Seminar (2 cr) P V**

Autumn + spring

Teacher: Prof Keijo Nikoskinen, Prof Ari Sihvola, Prof Jukka Sarvas

Contents: Research in electromagnetics. Creative work: Theory and experiences.

Requirements: Active participation.

Literature: To be announced.

Language: Finnish and English

S-96.1020 History of Electrical Engineering (3 cr) P

Autumn

Teacher: Emeritus Prof Ismo Lindell

Contents: The historical developments of the scientific basis of electrical engineering. Electricity and magnetism, galvanism, electromagnetism, induction, electromagnetic waves.

Literature: Lindell: Sähkötekniikan historia.

Language: Finnish

S-96.1101 Applied Field Theory (5 cr)

Spring (period III)

Teacher: Prof Keijo Nikoskinen

Contents: An introduction to electromagnetic field theory for students specializing in information and telecommunication technology. The course covers static and dynamic field theory and introduces the principles of radiation and antenna theory.

Requirements: Examination

Literature: Cheng: Fundamentals of Engineering Electromagnetics.

Prerequisites: Basic mathematics S1 and S2.

Language: Finnish

S-96.1111 Static Field Theory (5 cr)

Autumn (period I)

Teacher: Jari Hänninen D.Sc. (Tech.)

Contents: Maxwell equations in statics. Vector analysis. Electrostatic field and potential, capacitance. Static current and potential, resistance. Magnetostatic field and vector potential, inductance.

Requirements: Examination and home exercises.
 Literature: Lindell - Sihvola: Sähkömagneettinen kenttäteoria 1: Staattiset kentät and Sihvola: Sähkömagneettinen kenttäteorian harjoituskirja (Otatieto).
 Prerequisites: Basic mathematics S1 and S2.
 Language: Finnish

S-96.1121 Dynamic Field Theory (5 cr)

Autumn (period II)
 Teacher: Prof Keijo Nikoskinen
 Contents: Maxwell equations in dynamics. Faraday law, time-harmonic fields, eddy currents. Electromagnetic waves in free space and closed structures. Reflection and transmission. Basics of antennas.
 Requirements: Examination and home exercises.
 Literature: Sihvola - Lindell: Sähkömagneettinen kenttäteoria 2: Dynaamiset kentät and Sähkömagneettisen kenttäteorian harjoituskirja (Otatieto).
 Prerequisites: Basic mathematics S1 and S2.
 Language: Finnish

S-96.3131 Electromagnetics (5 cr)

Autumn (period II)
 Teacher: Ari Viitanen Docent
 Contents: Introduction to analytical and numerical methods for solving static and dynamic boundary value problems. The course covers Green's functions, spectral expansions, image theories and electromagnetic source representations in various coordinate systems.
 Requirements: Examination and home exercises.
 Literature: Lindell I.: Sähkömagnetiikka.
 Language: Finnish

S-96.3171 Difference Methods in Electromagnetics (5 cr) P

Spring (period III-IV)(even years)
 Teacher: Prof Keijo Nikoskinen
 Contents: The finite-difference-time-domain method (FDTD) for computational solution of Maxwell's equations. The course covers FDTD implementations for open and closed structures, dispersive media and modelling of lumped circuit elements in an FDTD grid.
 Requirements: Homework and programming project.
 Literature: A. Taflove: Computational Electrodynamics. The Finite-Difference Time-Domain Method. Handout.
 Language: Finnish

S-96.3173 Finite and Boundary Element Methods in Electromagnetics (5 cr) P

Autumn (period I-II) (odd years)
 Teacher: Seppo Järvenpää Ph.D.
 Contents: Introduction to the finite element method (FEM) in the context of electrostatics, magnetostatics and time-harmonic problems. Weak form of partial differential equations, boundary conditions, discretization and solving sparse linear systems.
 Requirements: Homework and programming project.
 Literature: handout
 Prerequisites: Matlab-program
 Language: Finnish

S-96.3174 Integral Equation Methods in Electromagnetics (5 cr) P

Autumn (period I-II) (even years)
 Teacher: Pasi Ylä-Oijala Docent
 Contents: Electromagnetic surface and volume integral equation methods for static and dynamic field problems. Numerical integration, integral equations, basis functions, scattering and radiation problems.
 Requirements: Homework and programming project.
 Literature: handout
 Prerequisites: Matlab-program
 Language: Finnish

S-96.3191 Special Project in Electromagnetics (3-5 cr)

Autumn & spring
 Teacher: Prof Nikoskinen and Academy Prof Sihvola.
 Contents: An individual project associated with electromagnetic field analysis.
 Language: Finnish, Swedish, English

S-96.3211 Waveguides and Resonators (5 cr)

Spring (period IV)
 Teacher: Prof Keijo Nikoskinen
 Contents: Analysis of waveguides and resonators: TEM and quasi-TEM waveguides, planar structures, closed and open waveguides, optic fibre, cavity and open resonators.
 Requirements: Examination which can be partly compensated by homework.
 Literature: Lindell: Aaltojohtoteoria (Otatieto 1997).
 Language: Finnish

S-96.3311 Radio Wave Propagation (5 cr)

Autumn (period I) (odd years)
 Teacher: Ari Viitanen Docent
 Contents: Radio wave propagation and scattering in different kind of media consisting of obstacles and interfaces. In application examples: wave propagation in troposphere, in ionosphere and near the surface of the ground and propagation in periodic structures are considered.
 Requirements: Examination which can be partly compensated by homework.
 Literature: Lindell: Radioaaltojen eteneminen, Otakustantamo 1994.
 Language: Finnish

S-96.3410 Antenna Theory (5 cr)

Autumn (period I) (even years)
 Teacher: Prof Keijo Nikoskinen
 Contents: The course covers the principles and theory of electromagnetic radiation. Analysis and design techniques are presented for all common antenna structures including the theory and synthesis methods for antenna arrays.
 Requirements: Examination which can be partly compensated by home work.
 Literature: Lindell-Nikoskinen: Antenniteoria; Otakustantamo 1995; Sihvola-Lindell: Antenniteorian harjoituksia.
 Language: Finnish

S-96.3510 Advanced Field Theory (5 cr) P

Teacher: Emeritus Prof Ismo Lindell
 Contents: Introduction to graduate studies in electromagnetics. Mathematical and physical basics needed for undertaking advanced electromagnetics literature and tools for theoretical research in electromagnetics.
 Requirements: Examination.
 Language: Finnish and English.

S-96.4610 Postgraduate Course in Electromagnetics (8 cr) P V

Autumn
 Teacher: Prof N.N.
 Contents: Seminar on a chosen topic in electromagnetics. The participants give seminar lectures, do homework, and/or prepare a special study.
 Language: Finnish

S-96.4620 Postgraduate Course in Electromagnetics (8 cr) P V

Spring
 Teacher: N.N
 Contents: Seminar on a chosen topic in electromagnetics. The participants give seminar lectures, do homework, and/or prepare a special study.
 Language: Finnish

S-104 PHYSICS (Optoelectronics)

Prof: Harri Lipsanen, tel. 4513123, room 4186
 Prof: Turkka Tuomi (emeritus), tel. 451 3120, room4172
<http://atomi.hut.fi>
 Micronova, Tietotie 3

Courses credited in ECTS**S-104.1010 Physics I (AS, Bio, Est, Tlt) (6 cr)**

Autumn
 Teacher: Markku Sopanen Docent
 Contents: Mechanics, wave motion and fundamentals of thermodynamics.
 Requirements: Two mid-examinations or final examination.
 Literature: Young&Freedman, University Physics, (11th ed.)
 Language: Finnish

S-104.1020 Physics II (AS, Bio, Est, Tlt) (6 cr)

Spring
 Teacher: Prof Harri Lipsanen
 Contents: Static and dynamic electromagnetic field, electromagnetic waves, interference, diffraction and quantum mechanics.
 Requirements: Two mid-examinations of final examination.
 Literature: Young&Freedman, University Physics, (11th ed.)
 Language: Finnish

S-104.1310 Additional Course in Physics I (SFT) (2 cr)

Autumn
 Teacher: Markku Sopanen Docent
 Contents: Supplementary course after the basics of physics I and II.
 Requirements: examination
 Literature: Young&Freedman, University Physics, (11th ed.) and handout
 Additional: S-104.1010 + S-104.1310 replaces S-104.301
 Language: Finnish

S-104.1320 Additional Course in Physics 2 (SFT) (2 cr)

Spring
 Teacher: Prof Harri Lipsanen
 Contents: Advanced material, supplementary course to S-104.1020.
 Requirements: Exercises and examination
 Literature: Young&Freedman, University Physics, (11th ed.) and handout
 Additional: S-104.1020 + S-104.1320 replaces S-104.302
 Language: Finnish

S-104.3310 Optoelectronics (5 cr)

Spring
 Teacher: Markku Sopanen Docent
 Contents: Physics, technology and applications of compound semiconductors and optoelectronic devices: lasers, LEDs, detectors, solar cells, amplifiers and modulators.
 Requirements: Examination.
 Literature: handout and selected parts of the books and publications of the field.
 Additional: replaces S-104.171
 Language: Finnish

S-104.3410 Photonics and Integrated Optics (5 cr)

Autumn
 Teacher: N.N.
 Contents: Optical fibers, integrated optics and optical microsystems and their materials, structures and fabrication technology. Applications and use in optical telecommunications and sensors.
 Requirements: Exercises and examination.
 Literature: Handout and selected parts of the books and publications of the field.
 Language: Finnish or English

S-104.3610 Nanotechnology (5 cr)

Autumn
 Teacher: Prof Harri Lipsanen
 Contents: Multidisciplinary nanoscience and nanotechnology including brief introductory to topics such as nanolithography, self-assembly, scanning probe microscopy, fullerenes, carbon nanotubes, quantum dots, molecular electronics, single electron devices, quantum computation, magnetoresistance, NEMS, quantum confined optoelectronics, organic optoelectronic nanostructures, photonic crystals, biomimetic nanostructure and nanofluidics.
 Requirements: Examination.
 Additional: replaces S-104.380
 Language: Finnish or English

S-104.3710 Nanoscience I: Introduction to Nanoscience (3 cr)

Autumn
 Teacher: Prof Harri Lipsanen
 Additional: Lectured jointly with TTK and University of Helsinki. The same course as Tfy-125.4001.
 Language: Finnish or English

S-104.3870 Seminar on Optoelectronics and Nanotechnology (2 cr) V

Autumn
 Teacher: Prof Harri Lipsanen
 Contents: Varying every year.
 Requirements: Participation and 2 presentations.
 Language: Finnish

S-104.3880 Optoelectronics and Nanotechnology, special assignment (8 cr)

Autumn+spring
 Teacher: Prof Harri Lipsanen
 Contents: Special assignment is an individual laboratory work, design assignment or literature survey. The content will be agreed with the teacher.
 Language: Finnish or English

S-104.3910 Laboratory Course on Micro- and Nanotechnology (4 cr)

Autumn+spring
 Teacher: Prof Harri Lipsanen
 Contents: Five laboratory assignments in the field of micro- and nanotechnology. The assignments are organized by the laboratories of Circuit Theory, Electron Physics, Electronics Production Technology, Optics and Molecular Materials (S) and Optoelectronics.
 Requirements: Laboratory work and approved report.
 Language: Finnish or English

S-104.3920 Nanotechnology Laboratory Course (5 cr)

Autumn+spring
 Teacher: Prof Harri Lipsanen and Prof Ilkka Tittonen
 Contents: Laboratory assignments in the field of nanotechnology. The assignments are organized by the laboratories of Optics and Molecular Materials (S) and Optoelectronics.
 Requirements: Laboratory work and approved report.
 Language: Finnish or English

S-104.4350 Postgraduate Course on Optoelectronics (10 cr) P V

Spring (lectured when needed)
 Teacher: Markku Sopanen Docent
 Contents: Course with variable topics. Seminar presentations and exercises on selected topics in optoelectronics, photonics and semiconductor technology.
 Language: Finnish or English

S-104.4650 Postgraduate Course on Nanotechnology (10 cr) P V

Autumn (lectured when needed)

Teacher: Prof Harri Lipsanen
 Contents: Course with variable topics. Seminar presentation and exercises on selected topics in nanotechnology.
 Language: Finnish or English

S-104.4720 Nanoscience II: Nanostructures (5 cr) P
 Autumn

Teacher: Prof Harri Lipsanen
 Additional: Lectured jointly with TKK and University of Helsinki. The same course as Tfy-125.4002.
 Language: Finnish or English

S-104.4730 Nanoscience III: Molecular Nanoscience (5 cr) P
 Spring

Teacher: Prof Harri Lipsanen
 Additional: Lectured jointly with TKK and University of Helsinki. The same course as Tfy-125.4003.
 Language: Finnish or English

S-104.4730 Nanoscience IV: Bionanoscience (5 cr) P
 Spring

Teacher: Prof Harri Lipsanen
 Additional: Lectured jointly with TKK and University of Helsinki. The same course as Tfy-125.4004.
 Language: Finnish or English

S-104.4890 Individual Course (1-10 cr) P V

Teacher: Prof Harri Lipsanen
 Contents: The contents of the course and the number of credits will be agreed with the teacher.
 Language: Finnish or English

S-108 MEASUREMENT SCIENCE AND TECHNOLOGY

Prof. Pekka Wallin, tel. 4512280, room SI 430
 Prof. Erkki Ikonen, tel. 4512283, room SI 432
<http://metrology.tkk.fi/>

Courses credited in ECTS

S-108.1010 Fundamentals of Measurements A (4 cr)

Autumn
 Teacher: Petri Kärhä D.Sc. (Tech.)
 Contents: The purpose of the course is to learn the practice of making common electrical measurements and to understand the theory and operation of fundamental measurement equipment.

Requirements: Examination and laboratory works.
 Literature: Wallin, P.: Sähkömittaustekniikan perusteet, Otatiето
 Prerequisites: S-55.1210
<http://metrology.tkk.fi/courses>
 Language: Finnish

S-108.1020 Fundamentals of Measurements Y (3 cr)

Autumn
 Teacher: Petri Kärhä D.Sc. (Tech.)
 Contents: Fundamental knowledge of measurement equipment. Principles and limitations of most common electrical measurements. The course is not intended for students of the departments of Electrical and Communications Engineering or of Engineering Physics and Mathematics.
 Requirements: Examination and laboratory works.
 Literature: Wallin P.: Sähkömittaustekniikan perusteet, Otatiето.
 Only one of the courses S-108.1010 or S-108.1020 can be included in the degree.
<http://metrology.tkk.fi/courses>
 Language: Finnish

S-108.2010 Electronic Measurements (3 cr)

Spring (period III)
 Teacher: Petri Kärhä D.Sc. (Tech.)
 Contents: Measurement methods for electrical quantities and operation of electrical measurement equipment. Noise and electrical disturbances. Signals and systems in time and frequency domains.
 Requirements: The theory part may be passed with an examination, which determines the grade. In addition 4 laboratory practicals have to be done.
 Literature: handout
 Prerequisites: S-108.1010 or S-108.1020.
<http://metrology.tkk.fi/courses>
 Language: Finnish

S-108.2110 Optics (5 cr)

Autumn (period I)
 Teacher: Prof Erkki Ikonen
 Contents: Basic knowledge of optics for instrumentation purposes. Geometrical optics, wave optics, interferometry, diffraction, fiber optics, optical communications.
 Requirements: Laboratory work and examination.
 Literature: Ikonen: Optiikan perusteet.
<http://metrology.tkk.fi/courses>
 Language: Finnish

S-108.3010 Electronic Instrumentation (5 cr)

Autumn (period II)
 Teacher: Prof Pekka Wallin
 Contents: The most common measurement schemes on non-electric units (sensor technology), including industrial measurements and environment pollution control and instrumentation.
 Requirements: Examination or weekly part exam and exercises
 Literature: Ikonen - Lehto - Wallin - Äijälä: Anturitekniikan perusteita. Mittaustekniikan laboratorio.
<http://metrology.tkk.fi/courses>
 Prerequisites: S-108.1010 or S-108.1020
 Language: Finnish

S-108.3020 Electromagnetic Compatibility (2 cr)

Spring (period IV)
 Teacher: Esa Häkkinen Lic.Sc. (Tech.)
 Contents: Electrical disturbances in measurements, EMC.
 Requirements: Examination
 Literature: Esa Häkkinen: Häiriökysymykset - Häiriöt mittauksissa. TKK/Mittaustekniikka.
<http://metrology.tkk.fi/courses>
 Prerequisites: S-108.1010 or S-108.1020.
 Language: Finnish

S-108.3110 Optical Communications (5 cr)

Spring (period III)
 Teacher: Farshid Manoocheri D.Sc. (Tech.)
 Contents: Optical fiber, optical sources and detectors, fiber optic components, wavelength division multiplexing (WDM), fiber optic measurements, system aspects. Laboratory exercises: measurements with optical fiber, WDM, fiber amplifier, simulation program, detector, spectral responsivity.
 Requirements: Laboratory work, home work, written report and examination.
 Literature: Ramaswami&Sivarajan: Optical Networks (2nd ed.)
<http://metrology.tkk.fi/courses>
 The courses S-108.3110 and S-72.3340 together replaces S-108.199.
 Language: English

S-108.3120 Project Work (2-8 cr) V

Autumn&spring
 Teacher: Prof Erkki Ikonen, Antti Lamminpää M.Sc.(Tech)
 Contents: Usually a literary survey of design project made in a group.

Requirements: An approved project report.
<http://metrology.tkk.fi/courses>
 Prerequisites: S-108.1010 or S-108.1020.
 Language: Finnish

S-108.3130 Project Work in Measurement Science and Technology (2-10 cr) V
 Autumn&spring
 Teacher: Prof Erkki Ikonen, Antti Lamminpää M.Sc.(Tech)
 Contents: Usually a literary survey of design project made in a group.
 Requirements: An approved project report.
<http://metrology.tkk.fi/courses>
 Prerequisites: S-108.1010 or S-108.1020.
 Language: Finnish

S-108.3140 Project Work in Optical Technology (2-10 cr) V
 Autumn&spring
 Teacher: Prof Erkki Ikonen, Antti Lamminpää M.Sc.(Tech)
 Contents: Usually a literary survey of design project made in a group.
 Requirements: An approved project report.
<http://metrology.tkk.fi/courses>
 Prerequisites: S-108.1010 or S-108.1020.
 Language: Finnish

S-108.4010 Postgraduate Course in Measurements (10 cr) P V
 Autumn + spring
 Teacher: Petri Kärhä D.Sc. (Tech)
 Contents: This course is intended for students carrying out licentiate or doctoral studies. The detailed programme varies annually.
 Requirements: Participation, assignments
 Literature: To be announced.
<http://metrology.tkk.fi/courses>
 Language: Finnish

S-108.4020 Research Seminar on Measurement Science and Technology (2 cr) P V
 Autumn + spring
 Teacher: Prof Erkki Ikonen
 Contents: Reports and discussion on measurement science and technology. Reports are mostly held in English. Suitable for postgraduate but also undergraduate students.
 Requirements: Participation and taking part in discussions.
<http://metrology.tkk.fi/courses>
 Language: Finnish and English.

S-108.4110 Biological Effects and Measurements of Electromagnetic Fields and Optical Radiation (4 cr) P
 Autumn (period II)
 Teacher: Kari Jokela Docent
 Contents: RF-radiation and low-frequency electromagnetic fields biophysics, biological effects, dose levels, measurements, calibration of measurement equipment and calculation methods. Health risks of UV-radiation. Laser safety. Fundamentals of radiometry. Real-life examples of radiation protection. The course can be included in undergraduate or postgraduate studies.
 Requirements: Examination.
 Literature: handout.
<http://metrology.tkk.fi/courses>
 Language: Finnish and English

S-108.4120 Special Course in Measurements (2-6 cr) P V
 Autumn + spring
 Teacher: Prof Erkki Ikonen
 Contents: The content of the course varies annually (e.g. laser technology, problems on accuracies in electronics or optical measuring techniques). The course is lectured when needed.
 Requirements: Examination.

Prerequisites: Basics in physics and measurement technology
<http://metrology.tkk.fi/courses>
 Language: Finnish

S-113 ELECTRONICS PRODUCTION TECHNOLOGY

Prof. Jorma Kivilahti, tel. 4512715, room SG 414
<http://www.ept.hut.fi/>

Courses credited in ECTS

S-113.1201 Introduction to Bionics (2 cr)
 Autumn (period II)
 Teacher: Markus Turunen D.Sc.(Tech.), Matti Linnavuo Lic.Sc.(Tech.), Prof Raimo Sepponen and Prof Jorma Kivilahti
 Contents: Introduction to bionics including materials science, bioelectronics design and manufacturing, and bioautomation related issues. Basics about reliability testing and biocompatibility of bionic devices.
 Requirements: Examination
 Literature: handout.
 Replaces S-113.1200
 Language: Finnish

S-113.2105 Materials and Microsystems Integration (3-8 cr)
 Autumn (period I)
 Teacher: Tomi Laurila docent
 Contents: Commonly used materials and components in microsystems. Principles of manufacturing, inspection and testing methods.
 Requirements: Examination and approved seminar.
 Literature: To be announced.
 Language: English

S-113.2110 Introduction to Materials Science (5-8 cr)
 Autumn
 Teacher: Tomi Laurila docent
 Contents: .
 Requirements: Examination (5 cr), optional special assignment (3 cr)
 Literature: handout
 Replaces S-113.2100
 Language: Finnish

S-113.2210 Biomaterials Science (6 cr)
 Spring
 Teacher: Prof Jorma Kivilahti
 Contents: Organic and inorganic materials used in healthcare and wellware-technology. Interfacial compatibility of living tissues and synthetic materials, the most common failure modes and mechanisms of components and devices under different operational environments. Surface properties of biomaterials and their modification treatments. Biomaterial applications and their biocompatibility.
 Requirements: Examination .
 Literature: handout. Roland Glaser: Biophysics; An Introduction to Tissue-Biomaterials Interactions by K.C. Dee, D.A.Puleo and R.Bizios; An Introduction to Materials in Medicine by B.D.Rattner, A.S. Hoffman, F.J.Shoen and J.E.Lemons
 Prerequisites: Recommends S-0.1104, S-113.2110 and S-113.1201
 Language: Finnish

S-113.3100 Principles of Electronics' Reliability (6 cr)
 Spring
 Teacher: Prof Jorma Kivilahti
 Contents: Materials scientific fundamentals of manufacturing and reliability. The most common failure modes and mechanisms of components and devices under different operational

environments. Concurrent design tools for manufacturing and reliability of electronics and photonics.

Requirements: Examination.

Literature: handout.

Prerequisites: S-113.2110 or S-113.2105

Replaces S-113.3120

Language: Finnish

S-113.3130 Laboratory of Production Technology (4 cr)

Spring

Teacher: Vesa Vuorinen lecturer

Contents: Characterization methods of materials and manufacturing in electronics and photonics. The characterization of solder joints. Fabrication of printed circuit boards and optical waveguides. Testing of physical, mechanical and chemical (corrosion) properties of interconnections. Integration methods of packaged and bare chips onto/into substrates.

Requirements: Accepted laboratory works

Literature: handout and work program.

Language: Finnish

S-113.3140 Reliability of Electronics (6 cr)

Autumn (period I+II)

Teacher: Vesa Vuorinen lecturer and Prof Jorma Kivilahti

Contents: Basics of the design for reliability. Design for manufacturability from reliability viewpoint. Product's reliability prediction. Generally used inspection and testing methods.

Requirements: Examination

Literature: handout and V.Puligandla: Failure Modes and Mechanisms in Electronic Packages.

Language: Finnish

S-113.3145 Reliability of Micro- and Nanosystems (4 cr)

Autumn (period II)

Teacher: Prof Jorma Kivilahti and Vesa Vuorinen lecturer

Contents: General principles of micro- and nanosystem reliability. The life-time prediction of electronic as well as optoelectronic devices. The most common failure modes and mechanisms of components and devices under different operational environments.

Requirements: Examination

Literature: V.Puligandla: Failure Modes and Mechanisms in Electronic Packages. Chapman&Hall 1998.

Prerequisites: S-113.2100 or S-113.2105

Language: English

S-113.3150 Production Technology Seminar (4 cr)

Spring

Teacher: Vesa Vuorinen lecturer and Prof Jorma Kivilahti

Contents: Materials, manufacturing techniques and reliability of microsystems as well as special issues related to their research and development work. The planning and execution of scientific and technological research programs.

Requirements: Examination and approved seminar.

Literature: handout.

S-113.3155 Project Work in Microsystem Reliability (3-6 cr) V

Spring

Teacher: Prof Jorma Kivilahti

Contents: The contents will be planned individually for each student.

Literature: Will be decided with the teacher.

Language: English

S-113.3220 Interfacial Phenomena between Tissue and Implant (6 cr)

Spring

Teacher: Prof Jorma Kivilahti and Markus Turunen D.Sc.(Tech.)

Contents: Interfacial compatibility of living tissues and synthetic materials. Interfacial interactions, water and protein adsorption

on surfaces, surface properties of biomaterials and surface treatments for improved biocompatibility.

Requirements: Examination and exercises

Literature: handout. G.Barnes&I.Gentle: Interfacial Science - An Introduction, Oxford University Press, 2006; M.Morra: Water in Biomaterials Surface Science, Wiley 2001; Duncan Shaw: Introduction to Colloid and Surface Chemistry, Fourth ed. (Colloid&Surface Engineering S), Butterworth-Heinemann, 1992

Prerequisites: S-113.2210

Language: Finnish

S-113.3230 Characterization Methods in Bioadaptive Technique (6 cr)

Autumn

Teacher: Prof Jorma Kivilahti and Markus Turunen D.Sc.(Tech.)

Contents: On the characterization methods utilized in the study in bioadaptive technology.

Requirements: Examination and exercises

Literature: handout. David I. Bower: An introduction to polymer physics, Cambridge 2002 (to the appropriate extent), Linda C. Sawyer & David T. Grubb: Polymer Microscopy, Chapman&Hall 1996 (to the appropriate extent), Skoog, Holler & Nieman: Principles of Instrumental Analysis, Harcourt 1998 (to the appropriate extent)

Prerequisites: S-113.2210, recommends S-113.2110

Language: Finnish

S-113.3240 Laboratory Course of Bioadaptive Technique (1-5 cr)

Spring (period III)

Teacher: Markus Turunen D.Sc.(Tech.), Reeta Lahti M.Sc. (Tech.) and Prof Jorma Kivilahti

Contents: Working with the instruments, characterization methods, and production equipments utilized in bioadaptive technology. Reliability and biocompatibility testing. Cell interactions with biomaterial. The extent of the course will be determined separately for each project.

Requirements: Approved laboratory works and report

Literature: handout. Work instructions

Prerequisites: S-113.2210

Language: Finnish

S-113.3251 Project Work in Bioadaptive Technique (3-8 cr)

Autumn+spring

Teacher: Markus Turunen D.Sc., Prof Jorma Kivilahti

Contents: Various issues on the use of biomaterials, design of bioadaptive devices, and research. Project work is related to the research of the laboratory and the extent of each project work is determined individually.

Requirements: Project work and final report

Literature: handout. Work instructions

Prerequisites: S-113.2210

Replaces S-113.3250

Language: Finnish

S-113.3260 Bioadaptive Technique (7 cr)

Autumn

Teacher: Markus Turunen D.Sc.(Tech.), Prof Jorma Kivilahti

Contents: Design, production methods, and characterization methods used with bioadaptive devices. Basics of the reliability studies of micro- and nanosystems. The most common physico-chemical failure modes and mechanisms in bioadaptive components and devices. About inspection and testing as well as research methods used in bioadaptive technique.

Requirements: Examination

Literature: Rolando Barbucci: Integrated Biomaterials Science. Kluwer Academic/Plenum Publishers 2002 (to the appropriate extent), B.Dodson and D.Nolan; Reliability Engineering Handbook, 1999 and Gabor Harsanyi: Sensors in Biomedical Applications - Fundamentals, Technology & Applications (to the appropriate extent)

Prerequisites: S-113.3240+ S-113.3220 or S-113.3230
Language: Finnish

S-113.4100 Postgraduate Course in Electronics Production Technology (3-9 cr) P V

Lectured when needed
Teacher: Prof Jorma Kivilahti
Contents: Advanced topics of electronics production technology. Varies annually.
Literature: Depends on the contents.
Language: Finnish or English

S-113.4200 Postgraduate Course on Biocompatible Electronics (3-5 cr) P V

Lectured when needed (period II, IV)
Teacher: Prof Jorma Kivilahti, Markus Turunen D.Sc.(Tech.), Kari Lounatmaa docent
Contents: Introduction to biomaterials and tissue engineering in electronics. Design and manufacturing of biosensors. Reliability of biomaterials and sensing and actuating devices. Laboratory course for postgraduate students.
Requirements: Examination (3 cr), voluntary special assignment (1-2 cr)
Literature: Will be announced according to a given content.
Prerequisites: S-113.3260
Language: English

Courses credited in old credit system:

S-113.160 Individual Course (2-8 ocr)

Autumn&spring
Teacher: Prof Jorma Kivilahti
Contents: Individual course may contain courses that provide an adequate knowledge base for a student in the manufacturing and reliability of electronics and photonics. The contents will be planned separately for each student.
Language: Finnish or English

S-114 COMPUTATIONAL ENGINEERING

Prof. Iiro Jääskeläinen, tel. 4515736, room IM417
Academy Prof: Kimmo Kaski, tel. 4514825, room E335
Prof: Jouko Lampinen, tel. 4514827, room E339
Academy Prof: Mikko Sams, tel. 4514848, room E349
Prof: Jukka Tulkki, tel. 4513125, room D321
<http://www.lce.hut.fi>
Innopoli II, Tekniikantie 14

Courses credited in ECTS

S-114.1100 Computational Science (5 cr)

Autumn
Teacher: Mika Ala-Korpela Docent
Contents: Basics of computational mathematical modelling for natural sciences and engineering; for example, quantum mechanical modelling, electron structures and force fields, spectroscopic data analysis, simulation methods, Lattice-Boltzmann modelling, analyses of genes and proteins, complex interaction networks. Important methods and algorithms; for example, interpolation and extrapolation, integration and optimisation, solution of linear algebraic equations, modelling of data, nonlinear models, statistical description of data, Fourier transform and its applications, Monte Carlo modelling, molecular dynamics. Computer exercises.
Requirements: Examination and mathematical exercises.
Literature: Lecture material and given articles/references. W.Cheney and D. Kincaid: Numerical mathematics and computing. 4th ed. Brooks/Cole (1999) and W.H.Press, S.A.Teukolsky, W.T.Vetterling & B.P.Flannery: Numerical Recipes (in

C++/Fortran), The Art of Scientific Computing, 2nd edition, Cambridge University Press (1992, 2002).

Prerequisites: Mathematics S1 - S3. The student should also be familiar with programming (preferably FORTRAN or C).

<http://www.lce.hut.fi/teaching/S-114.1100>

Language: Finnish

S-114.1310 Introduction to Modelling and Information Theory (3 cr)

Autumn
Teacher: Tommi Nykopp M.Sc. (Tech.)
Contents: The objective of this course is to give understanding about the basic principles of modeling, emphasizing on statistical modeling. Also information theory and its applications in statistical modeling are discussed. Practical solutions are given to model class selection, model complexity and parameter selection.

Requirements: Examination and project work.

Literature: T.M. Cover & J.A. Thomas: Elements of Information Theory. Y. Sakamoto, M. Ishiguro & G.Kitagawa: Akaike Information Criterion Statistics. J. Rissanen: Stochastic Complexity in Statistical Inquiry. Other literature announced later.

Prerequisites: Basics of statistics and probability calculus.

Language: Swedish

S-114.1327 Physics III (Est) (6 cr)

Spring
Teacher: Prof Jukka Tulkki and Prof Ilkka Tittonen
Contents: Introduction to the quantum physics of matter and electromagnetic radiation. De Broglie wave length, Planck's photon hypothesis, Schrödinger equation, hydrogen atom, electron spin, Pauli's exclusion principle, quantum statistics, black body radiation, electronic structure of molecules and solids, conductivity, phonons.

Requirements: Examination and participation in the exercise sessions.

Literature: P.Tipler&Llewellyn: Modern physics (Freeman)

Language: Finnish

S-114.1427 Modern Physics: Computational Virtual Laboratory (Sf) (2 cr)

Spring
Teacher: Prof Jukka Tulkki and Prof Ilkka Tittonen
Contents: Dynamics of electron wave packets, Ehrenfest theorem, introduction to the formal quantum theory, postulates of quantum mechanics, computational methods of electron states in molecules and solids, electronic states in metallic and semi-conducting quantum structures, transport in electron wave guides.

Requirements: Participation in the exercise sessions and approved project work.

Literature: P.Tipler&Llewellyn: Modern physics (Freeman)

Prerequisites: S-114.1327

Language: Finnish

S-114.1710 Cognitive Neuroscience (4-5 cr)

Autumn (period I)
Teacher: Prof Iiro Jääskeläinen
Contents: The course is an introduction to cognitive processes (attention, memory, perception, executive functions and emotions) and their neural basis. The neuron as an elementary processing unit of the brain, neurotransmitter systems, plasticity, research methods and applications of systemic neuroscience.

Requirements: Examination and practicals.

Literature: Gazzaniga, Ivry & Magnum (eds): Cognitive Neuroscience: The Biology of the Mind. (2nd ed.) and material distributed during the course.

<http://www.lce.hut.fi/teaching/S-114.1710>

Language: Finnish and English

S-114.2240 Seminar on Computational Engineering (3 cr) V
Spring

Teacher: N.N.

Contents: Practical work preparing a representation.

<http://www.lce.hut.fi/teaching/S-114.240>

Language: Finnish and English.

S-114.2500 Basics for Biosystems of the Cell (5 cr)

Autumn

Teacher: Peter Engelhardt Docent and visiting experts

Contents: The course gives basic knowledge to biosystems of the cell concentrating on genomics (genes, DNA and RNA) and proteomics (protein synthesis, structure and interactions), cell metabolism and signalling.

Requirements: Examination.

Literature: Alberts et al. Molecular Biology of The Cell, 4th Ed., Garland Science 2002, chapters 4-8.

<http://www.lce.hut.fi/teaching/S-114.2500>

Language: Finnish

S-114.2502 Seminar on Computational and Cognitive Bio-

Science (2-3 cr) V

Autumn+Spring

Teacher: Mika Ala-Korpela Docent

Contents: Seminar focuses on timely research topics on bioinformatics technology.

Requirements: Preparation of oral presentation and acting as opponent.

Language: Finnish and English

S-114.2510 Computational Systems Biology (5 cr)

Spring

Teacher: Jukka Heikkonen Docent

Contents: The course introduces the most important computational methods used in gene mapping, DNA and RNA sequence and microarray analysis (genomics) and protein structure (proteomics).

Requirements: Examination and special project.

Literature: Joao Setubal: Introduction to Biological Computing.

Prerequisites: S-114.2500

Language: Finnish

S-114.2601 Introduction to Bayesian Modelling (5 cr) P

Autumn

Teacher: Aki Vehtari D.Sc. (Tech.)

Contents: Bayesian probability theory and bayesian inference. Bayesian models and their analysis. Computational methods, Markov-Chain Monte Carlo.

Requirements: Examination and exercises.

Literature: Gelman, Carlin, Stern & Rubin: Bayesian Data Analysis, 2nd ed. and other material announced on the lectures.

Prerequisites: Basics in statistical mathematics and probability calculus.

Language: Finnish and English

S-114.2720 Perception and Action (4-6 cr)

Autumn (period II)

Teacher: Kaisa Tiippana Docent

Contents: Mechanisms and phenomena related to visual and auditory perception, multisensory perception, and motor actions. Basic principles of research methods.

Requirements: Examination, practicals.

Literature: E.B.Goldstein: Sensation and Perception, 1999 (5th or later edition). New York: Brooks Cole Publishing and material distributed during the course.

<http://www.lce.hut.fi/teaching/S-114.2720>

Language: Finnish and English

S-114.2730 Emotions and Communication (6 cr)

Spring (period III)

Teacher: Academy Prof. Mikko Sams

Contents: The course deals with human emotions, mechanisms of socio-emotional communication, and the utilisation of this information in human-computer interfaces. Practical include laboratory experiments on emotions and social communication, the results of which will be analysed and discussed.

Requirements: Examination, practicals.

Literature: K.Oatley & J.M. Jenkins: Understanding emotions. Cambridge MA: Blackwell Publishers, 1996 or later ed. and material to be announced during the course.

Language: Finnish and English

S-114.2740 Perception and Production of Speech (6 cr)

Spring (period IV)

Teacher: Riikka Möttönen Ph.D.

Contents: The course deals with neurocognitive mechanisms of speech, and speech technology. Practical include laboratory experiments on speech, the results of which will be analysed.

Requirements: Examination, practicals.

Literature: To be announced.

<http://www.lce.hut.fi/teaching/S-114.2740>

Language: Finnish and English

S-114.2750 Memory and Learning (3 cr)

Spring (period IV)

Teacher: N.N.

Contents: Human memory systems and the underlying neural mechanisms. Sensory memory, working memory, attention, and long-term memory. Episodic and semantic memory. Disorders of memory. Neural and neural network models of the memory.

Requirements: Examination

Language: Finnish and English

S-114.2791 Mental and other Representations (4-7 cr)

Autumn&spring

Teacher: Esko Marjomaa (University of Joensuu)

Contents: The course is multidisciplinary introduction to the theories of representation. It covers philosophical, and computational aspects of this area. The course is offered by Virtual University Connet. The course is organized by University of Joensuu.

Requirements: Practical work.

Language: Finnish

S-114.2792 Philosophy of Technology (3 cr)

Autumn&spring

Teacher: Henri Kynsilehto, Jussi Naukkarinen M.Sc. (Phil), University of Tampere.

Contents: Certain philosophical problems related to technology are first defined. Then, a few influential philosophical theories covering technology are discussed. Lastly, these theories are critically assessed to find solutions to the problems defined in the first step. In addition, some concrete current issues are discussed in this course.

The course is offered by Virtual University Connet. The course is organized by University of Tampere.

Requirements: Examination.

Language: Finnish

S-114.2801 Neuroinformatics (5 cr)

Autumn or spring

Teacher: N.N.

Contents: Introduction to neuroinformatics. Utilization of information technology in neurosciences. Statistical modelling in neuroinformatics. Databases and interoperability in neuroinformatics. Applications of neuroinformatics. The course will be given either as a series of lectures or as a seminar.

Literature: Material will be distributed during the course.

Language: Finnish and English

S-114.3155 Business Game (3 cr) P

Spring (period III)

Teacher: Juuso Töyli D.Sc (Tech), Ph.D

Contents: The game gives the participants a thorough picture of different functions of an organisation and the interactions between them and offers a possibility to practice strategic and operative management and management growth. The business game allows the participants to practise management skills without the risk of "learning it the hard way" and they learn teamwork under time pressure. Business game is a summarising course in industrial management and it is recommended to be taken near graduation.

Requirements: The teams of four students compete against each other in the same game. The decisions are made in the computer class during supervised game sessions. Participation of all players in every game session is obligatory. The completion of the course includes written initial and final reports of the business case.

Literature: Announced separately.

The course equals with T-124.5600

<http://www.lce.hut.fi/teaching/Tu22164>

Language: Finnish

S-114.3200 Special Course in Computational Engineering I (6 cr) P

Autumn

Teacher: Prof Jouko Lampinen

Literature: Special articles and C. Bishop: Neural networks for pattern recognition, Oxford Press 1995

<http://www.lce.hut.fi/teaching/S-114.3200>

Language: Finnish and English

S-114.3215 Special Project in Computational Engineering (3-8 cr)

Autumn & spring

Teacher: Academy Prof Kaski, Prof Lampinen, Academy Prof Sams, Prof Tulkki

<http://www.lce.hut.fi/teaching/kurssit.html>

Language: Finnish and English

S-114.3250 Special Course in Computational Science (6 cr) P

Spring (period 4)

Teacher: Riku Linna Ph.D.

Contents: The aim of this course is to provide the student with an understanding of the advantages and limitations of various computer simulation methods commonly used in physics and engineering.

Requirements: Homework proband Englishlems, project work.

Literature: D.W. Heerman: Computer Simulation Methods in Theoretical Physics. K. Binder and D.W. Heerman: Monte Carlo Simulation in Statistical Physics. D. Frenkel, B. Smit: Understanding Molecular Simulation: From Algorithms to Applications. A. Kersh, W.J. Morokoff: Transport Simulation in Microelectronics, Springer Verlag 1995.

Prerequisites: Basic statistical physics.

<http://www.lce.hut.fi/teaching/S-114.3250>

Language: Finnish and English.

S-114.3401 Semiconductor Quantum Structures (5 cr) P

Spring (odd years)

Teacher: Prof Jukka Tulkki, N.N.

Contents: The course deals with electronic and optical properties of semiconductors and their heterostructures. The goal of the course is to provide knowledge of basic physical properties needed for understanding the working principles of electronic and photonic devices.

Requirements: Examination, exercises and project work.

Language: English

S-114.3520 Special Project in Computational Systems Biology (3-7 cr)

Spring

Teacher: Jukka Heikkonen Docent, Peter Engelhardt Docent, Academy Prof Kimmo Kaski

Contents: The course contains a special project related to computational systems biology.

Literature: Manuals

Language: Finnish and English.

S-114.3530 Human-Machine Interaction (3-4 cr)

Spring

Teacher: Mika Ala-Korpela Docent

Contents: Structure, function and interaction of living organisms and machines, human anatomy, physiology and nervous system, human and machine intelligence, implants and artificial organs, basics of system biology, basics of molecular biotechnology, stem cells and new medical treatments, future user interfaces, robots, learning and intelligent systems in consumer products, new scientific achievements - e.g. mind control and artificial eye, discussion about business opportunities, movies, future visions and ethics in the area

Requirements: Examination and written exercise.

Literature: Handout and given articles/references. Marie O'Mahony: Cyborg - the man-machine, Eero Hyvönen (Ed.): Inhimillinen kone - konemainen ihminen.

Language: Finnish or English

S-114.3760 Measurement of Electroencephalography (6 cr)

Autumn

Teacher: N.N.

Contents: Electroencephalography (EEG) and its applications in brain research. Lectures deal with the origins of the EEG signal in the brain, and measurement principles, as well as some applied uses of EEG. The emphasis of this course is on practical measurement and analysis of EEG signals. The practicals consist of running EEG experiments and analysing the results in small study groups.

Requirements: Lecture reports, practicals

Literature: Will be announced in the beginning of the course

Prerequisites: S-114.1710 or corresponding knowledge

Organized jointly with University of Helsinki Cognitive Science.

Language: Finnish and English

S-114.3812 Computational Neuroscience (6 cr)

Autumn (even years) (period II)

Teacher: Harri Valpola Ph.D. and Jarmo Hurri Ph.D. (University of Helsinki)

Contents: On this course, the participants learn how to use computational methods to quantitatively model the activity of neurons, groups of neurons and neural systems.

Requirements: Examination and project work

Literature: P. Dayan & L.F. Abbot: Theoretical Neuroscience (MIT Press 2001)

<http://www.lce.hut.fi/teaching/S-114.3812>

Additional: Replaces S-114.3811

Language: English

S-114.4150 Complex Networks (3-6 cr) P V

Autumn & spring

Teacher: Prof Jouko Lampinen, Academy Prof Kimmo Kaski

<http://www.lce.hut.fi/teaching/teaching/kurssit.html>

Language: Finnish

S-114.4202 Special Course in Computational Engineering II (3-6 cr) P V

Spring

Teacher: Prof Jouko Lampinen

<http://www.lce.hut.fi/teaching/S-114.4202>

Language: Finnish and English.

S-114.4204 Modelling of Vision (5 cr) P

Spring

Teacher: Prof Jouko Lampinen, Kaisa Tiippana Docent, Aapo Hyvärinen Docent (University of Helsinki)

Contents: Mechanisms and modelling of human visual perception are the topics of the course. The emphasis is on modelling of visual feature extraction and object recognition.

Requirements: Examination and practical work.

Literature: Will be announced in the beginning of the course.

Prerequisites: Basic knowledge of the differential calculus, probability and linear algebra. Basic knowledge of the human visual system recommended (e.g. Perception and action or Structure and functioning of the human brain).

Organized jointly with the University of Helsinki, Dept. of Computer Science

<http://www.lce.hut.fi/teaching/S-114.4204>

Language: English

S-114.4220 Research Seminar on Computational Science (3-6 cr) P V

Autumn + spring

Teacher: Prof Jouko Lampinen

Contents: Course with varying content.

Requirements: Seminar presentation, report and active participation.

Language: Finnish and English

S-114.4230 Individual Studies on Computational Engineering (1-8 cr) P V

Autumn & spring

Teachers: Prof Jouko Lampinen, Prof Kimmo Kaski, Prof Jukka Tulkki, Mika Ala-Korpela Docent and Jukka Heikkonen Docent

Contents: The topic and its depth shall be negotiated with one of the teachers

<http://www.lce.hut.fi/teaching/kurssit.html>

Replaces S-114.230

Language: Finnish and English

S-114.4245 Laboratory Seminar on Computational Engineering (2-3 cr) P V

Autumn + spring

Teacher: Prof Lampinen, Academy Prof Sams, Prof Tulkki, Academy Prof Kaski

<http://www.lce.hut.fi/teaching/S-114.4245>

Language: English

S-114.4260 Molecular Modeling (5-8 cr) P

Autumn or spring

Teacher: N.N.

Contents: Basics concepts of molecular modeling, quantum mechanical models, empirical force fields, review of molecular dynamics and Monte Carlo, minimization methods in molecular modeling, conformational analysis, the use of molecular modeling to discover and design new drugs, future challenges in molecular modeling.

Requirements: Lectures, exercises and examination: 4 cr. Lectures, exercises, examination and project work: 6 cr.

Literature: A.R.Leach: Molecular Modeling.

Prerequisites: S-114.3250, computational physics or corresponding. Basic statistical physics and thermodynamics.

<http://www.lce.hut.fi/teaching/S-114.4260>

Language: Finnish and English.

S-114.4270 Computational Cell Biology (5-7 cr) P

Spring (even years)

Teacher: Riku Linna Ph.D.

Contents: The emphasis of this course is on learning how to analyze and model processes taking places at cellular level. Topics include molecular motors, ion pumps, intercellular communication, and various cell models. The relation between theory, experiments and simulations will be discussed in detail.

Requirements: Examination

Literature: C.P. Fall, E.S. Marland, J.M. Wagner & J.J.Tyson: Computational Cell Biology. Handout.

Prerequisites: Mathematics 1-3, S-114.1100 recommended.

<http://www.lce.hut.fi/teaching/S-114.4270>

Language: Finnish

S-114.4610 Special Course in Bayesian Modelling (1-8 cr) P Spring

Teacher: Aki Vehtari D.Sc. (Tech.)

Contents: Course with varying content. Objective of the course is to give licentiate level teaching on a topic related to computational engineering. The course may consist of lectures or seminars.

Requirements: Agreed separately for each year's course.

Literature: Book or collection of articles, announced at the beginning of the course.

Prerequisites: Basics in Bayesian Modelling.

Language: Finnish or English

S-114.4761 Special Course on Communication and Cognition (1-6 cr) P V

Autumn&spring

Teacher: N.N.

Contents: Varying every year and consisting of a current research problem.

Requirements: Active participation and seminar presentation.

Literature: To be announced

Language: Finnish or English

S-114.4762 Research Seminar on Communication and Cognition (1-6 cr) P V

Autumn&spring

Teacher: N.N.

Contents: Annually changing topic is related to current research questions. The course can be shared with other laboratories.

Requirements: Active participation, seminar presentations and possibly practicals.

Literature: To be announced.

Language: Finnish or English

S-114.4771 Special Project in Cognitive Science and Technology (3-7 cr) P V

Autumn & spring

Teacher: Academy Prof Sams, Prof Jääskeläinen, Kaisa Tiippana Ph.D.

Contents: Special project in the field of cognitive science and technology.

Requirements: To be agreed with the supervising teacher.

Literature: To be agreed with the supervising teacher

Language: Finnish or English

S-114.4772 Individual Studies in Communication and Cognition (1-9 cr) P V

Autumn&spring

Teacher: Academy Prof Sams, Academy Prof Kaski, Prof Lampinen, Prof Tulkki, Prof Jääskeläinen, Jukka Heikkonen Docent, Kaisa Tiippana Ph.D., Prof Kari-Jouko Räihä

Contents: The contents and extent of individual studies to be agreed with the teacher beforehand.

Language: Finnish or English

S-118 ILLUMINATION ENGINEERING

Prof. Liisa Halonen, tel. 451 2418, room SG 438

Prof. Jouko Pakanen, tel. 4516047, room SG 439

<http://www.hut.fi/Units/Lighting/>

Courses credited in ECTS

S-118.1900 Project in Illumination Engineering and Electric Installations (2-5 cr)

Autumn & spring

Instructor: Prof Liisa Halonen and researchers

Content: Student is introduced to research work by taking part in activities of the Lighting laboratory's research groups. The course is meant foremost for first year students and it is intended to be a contrast for theoretical first year studies.

Requirements: To take part in research projects. The fulfilling of requirements is discussed with the teacher.

Language: Finnish and English

S-118.1920 Practical Electronics (2 cr)

Autumn & spring

Teacher: Teachers from several laboratories

Content: The course familiarizes students with some common practical electrical tasks. The course includes the electric work permitted at home, installing PC-network card and WLAN in home, basic measurements, basic electric systems in cars, solar electricity. This course is for students who have no previous experience in practical electrical work. Number of attendees is limited.

Requirements: Participation, laboratory exercises.

Literature: handout

Replaces S-118.1910

Language: Finnish

S-118.2101 Illumination Engineering and Electrical Safety (3 cr)

Autumn (period II)

Teacher: Prof Jouko Pakanen

Contents: Fundamentals of illumination engineering, basic quantities and laws, light sources, electrical safety, basics of electric installations in buildings.

Requirements: Examination and laboratory assignment.

Literature: handout.

Only one of the courses S-118.2101/S-118.2102 can be included in the degree.

Language: Finnish

S-118.2102 Illumination Engineering and Electrical Safety (4 cr)

Autumn (period I)

Teacher: Prof Liisa Halonen, Prof Jouko Pakanen

Contents: Fundamentals of illumination engineering, basic quantities and laws, light sources, electrical safety, basics of electric installations in buildings.

Requirements: Examination and laboratory assignment.

Literature: handout.

Only one of the courses S-118.2101/S-118.2102 can be included in the degree.

Language: English

S-118.2240 Electrical and Illumination Engineering, basic course (3 cr)

Autumn (period IV) even years

Teacher: Prof Liisa Halonen

Contents: Basics of electrical and illumination engineering; electrical design course and cooperation of different designers; design of interior and exterior lighting, effect of light and colour, effect of electrical plan on structures; location and dimensioning of electrical sites; excursions.

Requirements: Examination. Small assignment and/or laboratory assignment.

Literature: handout

Language: Finnish

S-118.3216 Illumination Engineering I (4 cr)

Autumn (period I)

Teacher: Prof Liisa Halonen

Contents: Basis of vision, basic quantities and laws, chromatics, light sources, calculations and evaluation methods for lighting, photometric measurements, excursions.

Requirements: Examination and two laboratory assignments.

Literature: Halonen-Lehtovaara: Valaistustekniikka, 542 Otati-eto, handout.

Only one of the courses S-118.3216/S-118.3217 can be included in the degree.

Language: Finnish

S-118.3217 Illumination Engineering I (5 cr)

Autumn (period I)

Teacher: Prof Liisa Halonen

Contents: Basis of vision, basic quantities and laws, chromatics, light sources, calculations and evaluation methods for lighting, photometric measurements, excursions.

Requirements: Examination and two laboratory assignments.

Literature: To be announced separately.

Only one of the courses S-118.3216/S-118.3217 can be included in the degree.

Language: English

S-118.3218 Illumination Engineering II (4 cr)

Spring (period IV)

Teacher: Prof Liisa Halonen

Contents: Regulations and recommendations, measuring, calculating and evaluation methods for lighting, luminaires, lighting control, glare, lighting calculation and simulation programs, integrated use of daylight and artificial light, integration of lighting systems to automation technology in buildings, excursions.

Requirements: Examination and three laboratory assignments.

Literature: Halonen-Lehtovaara: Valaistustekniikka, 542, Otati-eto, handout.

Prerequisites: S-118.3216

Language: Finnish

S-118.3230 Seminar on Illumination Engineering and Electric Installations in Building (4 cr) V

Spring (period IV)

Teacher: Prof Liisa Halonen

Contents: Seminar work.

Requirements: Examination and seminar work, attendance.

Literature: Material of the seminar.

Prerequisites: S-183.3216 and S-118.3218

Language: Finnish and English

S-118.3232 Illumination Engineering and Electric Installations in Buildings, special assignment (2-8 cr) V

Autumn & spring

Teacher: Prof Liisa Halonen

Contents: The course will consist of an individual special assignment or participation in the laboratory's research project.

Requirements: Special assignment.

Prerequisites: S-118.3216

Language: Finnish and English

S-118.3260 Lighting Design (4 cr)

Spring (not lectured 2006-07)

Teacher: Prof Liisa Halonen and Jarmo Jumppanen M.Sc. (Tech), Erkki Pitkäranta Architect

Contents: Introduction to practical lighting design. Lectures contain basics of lighting design and examples from practice. Excursions are done to planning offices, luminaire factories and construction sites.

Requirements: Examination and planning exercise

Literature: handout

Prerequisites: S-118.3216 and S-118.3218

Language: Finnish

S-118.3280 System Design of Electrical Building Services (5 cr)
 Spring (period III-IV)
 Teacher: Prof Jouko Pakanen
 Contents: Design phases and procedures. Dimensioning of systems. Blueprints and directions for the installation. Designing electrical installations. Operation and basic design of telephone, antenna, security, fire alarm and automation systems. Applying CAD in design. Excursion.
 Requirements: Examination and planning assignment.
 Literature: handout and literature introduced in the beginning of the course.
 Language: Finnish

S-118.3282 Home Automation and Home Networks (2 cr)
 Autumn (period II)
 Teacher: Prof Jouko Pakanen
 Contents: Gateways to the Internet, bus standards, home networks, their development and standardization, home automation systems, Internet appliances, remote control of home appliances and HVAC systems, AMR systems.
 Requirements: Examination and assignment
 Literature: Lecture notes and literature introduced in the beginning of the course.
 Language: Finnish

S-118.4250 Postgraduate Seminar on Illumination Engineering (5-10 cr) P V
 Autumn + spring
 Teacher: Prof Liisa Halonen
 Contents: Course with varying content.
 Requirements: Examination attendance and seminar work.
 Literature: Material of the seminars.
 Language: Finnish and English

S-129 OPTICS AND MOLECULAR MATERIALS

Prof. Ilkka Tittonen, tel. 451 2287, room 4131
 Docent: Hanne Ludvigsen, tel. 451 2282, room 4030
<http://omm.tkk.fi/>
 Micronova, Tietotie 3

Courses credited in ECTS

S-129.3120 Special Assignment in Electrophysics (2-10 cr) V
 Autumn, spring
 Teacher: Prof Ilkka Tittonen and Hanne Ludvigsen Docent
 Contents: Independent research assignment within the subject areas of Micronova laboratory, such as micro- and nanotechnology.
 Requirements: Written report
<http://omm.tkk.fi>
 Language: English

S-129.3210 Microsystem Technology (5 cr)
 Autumn
 Teacher: Prof Ilkka Tittonen and Sami Franssila Ph.D.
 Contents: Microsystem physics, material, fabrication processes and devices. Case studies of microsystems (micromechanisms, RF-MEMS, microfluids, thermal microsystems, BioMEMS).
 Requirements: Examination and bonus for exercises
<http://omm.tkk.fi>
 Literature: handout and S. Franssila: Introduction to Microfabrication, Wiley 2004 (for supplementary reading).
 Replaces S-108.186
 Language: English

S-129.3310 Physics of Optical Communications (5 cr) P V
 Spring

Teacher: Hanne Ludvigsen Docent
 Contents: Physical principles behind optical communications systems and components. Photonic crustals, photonic crystal fibers and other novel materials. Propagation effects. Ultrafast switching and routing. Optical processing.
 Requirements: Examination, bonus points from home exercises.
 Literature: G.P. Agrawal: Lightwave Technology; Components and Devices. J.Wiley&Sons 2004
 Replaces S-114.402
 Language: English

S-129.4210 Special Course in Electric Physics (2-5 cr) P V
 Autumn & spring
 Teacher: Prof Ilkka Tittonen
 Contents: The content of the course varies annually (e.g. laser physics, nanotechnology).
 Requirements: Examination
 Prerequisites: Basics in physics
<http://omm.tkk.fi/>
 Language: Finnish and English

S-xxx MICROELECTRONICS CENTER

Docent: Sami Franssila, tel 451 2332, room 2169
<http://micronova.tkk.fi/>
 Mikronova, Tietotie 3

Courses credited in ECTS

S-xxx.3001 Microfluidics and BioMEMS (5 cr)
 Spring (period III, IV)
 Teacher: Sami Franssila Docent, Tarja Nevanen Ph.D. (VTT Biotechnology), Santeri Tuomikoski M.Sc. (Tech)
 Requirements: Examination, demos, exercises
 Prerequisites: Basic physics and chemistry courses
 Literature: handout and scientific articles
 Language: lectures in Finnish, slides and literature in English

S-xxx.3002 Laboratory Course on Microsystems (5 cr)
 Spring
 Teacher: Kestas Grigoras Ph.D. and Sami Franssila Docent
 Contents: This course will give practical experience in the fabrication of silicon microsystems. Laboratory work will be performed in the cleanroom of the Microelectronics Center of HUT. The students will fabricate a micromachined infrared light source that can be modulated.
 Requirements: Preparatory report and final report.
 Prerequisites: S-129.3210
 Replaces S-129.3220
 Language: English

S-xxx.4000 Individual Studies on Micro- and Nanotechnology (1-10 cr) P
 Autumn & spring (periods I-IV)
 Teacher: Sami Franssila Docent
 Contents: Experimental and theoretical projects and/or specialized courses to be agreed upon with the teacher.
 Language: Finnish

S-xxx.4001 Nanoscience I: Introduction to Nanoscience (3 cr)

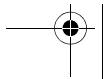
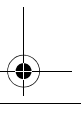
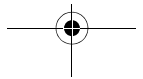
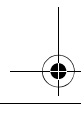
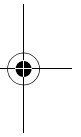
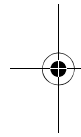
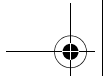
S-xxx.4002 Nanoscience II: Nanostructures (5 cr) P

S-xxx.4003 Nanoscience III: Molecular Nanoscience (5 cr) P

S-xxx.4004 Nanoscience IV: Bionanoscience (5 cr) P
 Contents: Nanoscience I-IV are TKK and University of Helsinki interdisciplinary joint lectures held by some 30 experts in the field (at Kumpula, Otaniemi and Viikki campuses)



Note: The same courses are at different TKK departments on different codes. Only one of the different code courses can be included in the degree programme.



DEPARTMENT OF ENGINEERING PHYSICS AND MATHEMATICS

Head of department: Prof Pekka Hautojärvi, tel. 451 3100
 Administrative manager: Riikka Mäki-Ontto, tel. 451 3000, fax 451 5777
 Planning officer (Study Affairs): Anna-Kaarina Hakala, tel. 451 3183
 Study secretary, International study adviser: Taru Bister-Hämäläinen, tel. 451 3005
 Department office: Otakaari 3 A, tel. 451 3005, fax 451 3014
 Office open 9 a.m.-11 a.m.

Chairs:

Mat-1 Mathematics, Mat-5 Theoretical and Applied Mechanics
 Mat-2 Applied Mathematics
 Tfy-3 Physics, Tfy-105 Physics, Computational Physics
 Tfy-56 Advanced Energy Systems
 Tfy-99 Biomedical Engineering
 Tfy-125 Optics and Molecular Materials

Please pay attention to the language of the instruction

Mat-1 MATHEMATICS

Prof Olavi Nevanlinna, tel. 451 3034, room U 302A
 Prof Timo Eirola, tel. 451 3033, room U 302B
 Prof Gustaf Gripenberg, tel. 451 3025, room U339
 Prof Juhani Pitkäranta, tel. 451 3024, room U 338
 Prof Erkki Somersalo, tel. 451 2825, room Y 334C
 Prof Esko Valkeila, tel. 451 3028, room U307
 Prof Matti Lassas, tel. 451 3069, room Y319

Mat-5 THEORETICAL AND APPLIED MECHANICS

Prof Rolf Stenberg, tel. 451 5576, room Y 319

Additional: <http://www.math.hut.fi/people/people.html.fi>

Courses credited in ECTS

Mat-1.1010 Basic course in Mathematics L1 (10 cr) Autumn

Lecturer: Pekka Alestalo, teaching research scientist
 Contents: Numbers and number sequences. Vectors and analytical geometry. Complex numbers. Functions of one and several variables, complex functions. Concepts of continuity and continuous functions. The derivative of a real and complex function. Differential calculus in one variable.

Literature: Supplementary material
 Language: Finnish

Additional: One exercise group is in Swedish. Basic courses in Mathematics L1-L4 are intended for the degree programme TFM and the students selected into the extended curriculum in basic studies.

Language: Finnish

Mat-1.1020 Basic course in Mathematics L2 (10 cr) Spring

Lecturer: Pekka Alestalo, teaching research scientist
 Contents: Integral functions and the definite integral. Differential equations. Interpolation polynomials. Linear systems of equations and matrix algebra. Matrix eigenvalues and quadratic

forms. Measures and integrals. Integral calculus in several variables. One exercise group is in Swedish.

Literature: Supplementary material

Prerequisites: Mat-1.1010/Mat-1.401

Additional: This course replaces the course Mat-1.402.

Language: Finnish

Mat-1.1030 Basic course in Mathematics L3 (10 cr)

Autumn, will be lectured for the first time during the academic year 2006-2007.

Lecturers: Prof Timo Eirola and Seppo Weikkolainen, spec. teacher

Contents: Functions of one complex variable, linear algebra and matrix computations, systems of differential equations and solving them numerically.

Literature: To be announced later + supplementary material

Prerequisites: Mat-1.1010/Mat-1.401 and Mat-1.1020/Mat-1.402

Additional: This course replaces the course Mat-1.403.

Language: Finnish

Mat-1.1040 Basic course in Mathematics L4 (10 cr)

Spring, will be lectured for the first time during the academic year 2006-2007.

Lecturer: Prof Matti Lassas and N.N.

Contents: Basic types of linear partial differential equations; their qualitative properties and numerical solution. Introduction to integral equations and their numerics.

Literature: Supplementary material

Prerequisites: Basic courses in Mathematics L1-L3.

Additional: This course replaces the course Mat-1.404.

Language: Finnish

Mat-1.1110 Basic course in Mathematics C1 (10 cr) Autumn

Lecturer: Harri Hakula, teaching research scientist

Contents: Linear algebra, linear systems of equations, calculus of one variable, elementary vector calculus, introduction to number theory, elementary graph theory.

Literature: N. L. Biggs, 2002. Discrete Mathematics. Oxford. R. A. Adams, 2002. Calculus, A Complete Course. Addison-Wesley. Supplementary material.

Additional: This course replaces the course Mat-1.411.

<http://www.math.hut.fi/teaching/c1/> Intended for the degree programmes TIK, INF, AUT, TUO, GMA, BIO.

Language: Finnish

Mat-1.1120 Basic course in Mathematics C2 (10 cr)

Spring

Lecturer: N.N.

Contents: Complex numbers, ordinary differential equations, sequences and series, power series, vector calculus, introduction to algebra.

Literature: N. L. Biggs, 2002. Discrete Mathematics. Oxford. E. Kreyzig. Advanced Engineering Mathematics, J. Wiley&Sons. Supplementary material.

Prerequisites: Mat-1.1110/Mat-1.411

Additional: This course replaces the course

Mat-1.412. <http://www.math.hut.fi/teaching/c2/>

Intended for the degree programmes TIK, INF, AUT, TUO, GMA, BIO.

Language: Finnish

Mat-1.1131 Basic course in Mathematics C3-I (5 cr)

Autumn (Period I), will be lectured for the first time during the academic year 2006-2007.

Lecturer: Kari Eloranta, Docent

Contents: Complex analysis, Laplace transforms and Fourier analysis.

Literature: E. Kreyzig. Advanced Engineering Mathematics, J. Wiley & Sons. Supplementary material.

Prerequisites: Basic courses in Mathematics L/C 1-2.

Additional: This course together with Mat-1.1132 replaces Mat-1.413.

Intended for the degree programmes TIK, INF, BIO, GMA, AUT, TUO.

Language: Finnish

Mat-1.1132 Basic course in Mathematics C3-II (5 cr)

Autumn (Period II), will be lectured for the first time during the academic year 2006-2007.

Lecturer: Kari Eloranta, Docent

Contents: Systems of differential equations, matrix analysis.

Literature: E. Kreyzig. Advanced Engineering Mathematics, J. Wiley & Sons. Supplementary material.

Prerequisites: Basic courses in Mathematics L/C 1-2.

Additional: This course together with Mat-1.1131 replaces Mat-1.413.

Additional: Intended for the degree programmes TIK, BIO, AUT.

Language: Finnish

Mat-1.1210 Basic course in Mathematics S1 (10 cr)

Autumn

Lecturer: Jarmo Malinen, senior assistant

Contents: Complex numbers, matrix algebra, linear systems of equations, eigenvalues, differential and integral calculus for functions of one variable, basic differential equations and the Laplace-transform, numerical quadrature.

Literature: R. A. Adams, 2003. Calculus, A Complete Course. Addison-Wesley Ltd. E. Kreyzig, 1999. Advanced Engineering Mathematics. John Wiley & Sons.

Additional: This course replaces the course Mat-1.421.

Intended for the degree programmes EST, TLT.

Language: Finnish

Mat-1.1220 Basic course in Mathematics S2 (10 cr)

Spring

Lecturer: Prof Erkki Somersalo

Contents: Series, power series, numerical methods, vector calculus, vector fields, Gauss's and Stokes's theorems, curvilinear coordinates, analytic geometry.

Literature: R. A. Adams. Calculus, A Complete Course. Addison-Wesley Ltd.

Prerequisites: Mat-1.1210/Mat-1.421

Additional: This course replaces the course

Mat-1.422.

Intended for the degree programmes EST, TLT.

Language: Finnish

Mat-1.1230 Basic course in Mathematics S3 (10 cr)

Autumn, will be lectured for the first time during the academic year 2006-2007.

Lecturer: Kirsi Peltonen, teaching research scientist

Contents: Functions of complex variable, residue calculus, potential theory, Laplace-, Fourier, and Z-transforms. Matrix calculus: LU-, QR- and SVD-decompositions, numerical methods. Systems of differential equations: properties of solutions, stability, numerical methods. Basics of partial differential equations.

Literature: E. Kreyzig. Advanced Engineering Mathematics, John Wiley & Sons. Supplementary material.

Prerequisites: Mat-1.1210/Mat-1.421 and Mat-1.1220/Mat-1.422

Additional: This course replaces the course

Mat-1.423.

Intended for the degree programmes EST, TLT

Language: Finnish

Mat-1.1310 Basic course in Mathematics K1 (10 cr)

Autumn

Lecturers: Teijo Arponen, researcher

Contents: Complex numbers. Matrices. Differential and integral calculus for functions of one variable (analytical and numerical methods).

Literature: R. A. Adams. Calculus, A Complete Course. Addison-Wesley Ltd.

Additional: This course replaces the course

Mat-1.431

<http://www.math.hut.fi/opetus/k1/index.html.fi>.

Intended for the degree programmes ENE, KON, MTE.

Language: Finnish

Mat-1.1320 Basic course in Mathematics K2 (10 cr)

Spring

Lecturer: Prof Gustaf Gripenberg

Contents: Differential and integral calculus for functions of several variables. Line and surface integrals. Differential equations. Series.

Literature: R. A. Adams. Calculus, A Complete Course. Addison-Wesley Ltd.

Prerequisites: Mat-1.1310/Mat-1.431

Additional: This course replaces the course

Mat-1.432.

<http://www.math.hut.fi/opetus/k2/index.html.fi>.

Intended for the degree programmes ENE, KON, MTE.

Language: Finnish

Mat-1.1331 Basic course in Mathematics KP3-I (5 cr)

Autumn, (Period I), will be lectured for the first time during the academic year 2006-2007.

Lecturer: Antti Rasila, researcher

Contents: Complex analysis, integral transforms, Fourier series.

Literature: To be announced later.

Prerequisites: Basic courses in Mathematics 1-2.

Additional: This course together with Mat-1.1332 replaces Mat-1.433/Mat-1.443.

<http://www.math.hut.fi/teaching/k3/index.html.fi>.

Intended for the degree programmes MTE, KEM.

Language: Finnish

Mat-1.1332 Basic course in Mathematics KP3-II (5 cr)

Autumn (Period II), will be lectured for the first time during the academic year 2006-2007.

Lecturer: Kenrick Bingham, researcher

Contents: Matrix algebra, systems of differential equations, partial differential equations and numerical methods related to these fields.

Literature: To be announced later.

Prerequisites: Basic courses in Mathematics 1-2.

Additional: This course together with Mat-1.1331 replaces Mat-1.433/Mat-1.443.

<http://www.math.hut.fi/teaching/k3/index.html.fi>.

Intended for the degree programmes KON; ENE, RYK, YHD.

Language: Finnish

Mat-1.1410 Basic course in Mathematics P1 (10 cr)

Autumn

Lecturer: Ville Turunen, researcher

Contents: Vectors and matrices. Sequences and series. Calculus of one variable.

Literature: To be announced later.

Additional: This course replaces the course Mat-1.441.

<http://www.math.hut.fi/teaching/p1/index.html>

Intended for the degree programmes KEM, KTA, PUU, RYK, YHD.

Language: Finnish

Mat-1.1420 Basic course in Mathematics P2 (10 cr)

Spring

Lecturers: N.N.

Contents: Complex numbers. Eigenvalues and diagonalization. Differential equations. Calculus of several variables.

Literature: To be announced later.

Prerequisites: Mat-1.1410/Mat-1.441

Additional: This course replaces Mat-1.442.

<http://www.math.hut.fi/teaching/p2/index.html>

Intended for the degree programmes KEM, KTA, PUU, RYK, YHD.

Language: Finnish

Mat-1.1510 Basic course in Mathematics I (10 cr)

Autumn

Lecturer: Georg Metsalo, lecturer

Contents: Complex numbers, vector algebra, systems of linear equations, matrices, eigenvalues and -vectors. Functions of a real variable, continuity, the derivative and its applications, Taylor's theorem. Integration of elementary functions, numerical integration, applications of definite integrals. Taylor's series.

Literature: R. A. Adams, 2003. Calculus, A Complete Course. Addison-Wesley Ltd. E. Kreyszig, 1999. Advanced Engineering Mathematics. John Wiley & Sons

Additional: This course replaces the course Mat-1.451.

Language: Swedish

Mat-1.1520 Basic course in Mathematics 2 (10 cr)

Spring (Period III)

Lecturer: Georg Metsalo, lecturer

Contents: Sequences and series. Vector valued functions. Functions of a vector variable, continuity, differentiation, extremal values. Quadratic curves and surfaces.

Literature: R. A. Adams, 2003. Calculus, A Complete Course. Addison-Wesley Ltd. E. Kreyszig, 1999. Advanced Engineering Mathematics. John Wiley & Sons

Prerequisites: Mat-1.1510/mat-1.451

Additional: This course replaces Mat-1.452.

Language: Swedish

Mat-1.1531 Basic course in Mathematics 3-I (5 cr)

Autumn (Period I), will be lectured for the first time during the academic year 2006-2007.

Lecturer: N.N.

Contents: Complex analysis. Integral transforms. Fourier series. Literature: E. Kreyszig. Advanced Engineering Mathematics. John Wiley & Sons or R. Lopez. Advanced Engineering Mathematics.

Prerequisites: Basic courses in mathematics 1-2.

Additional: This course together with Mat-1.1532 replaces Mat-1.453.

Language: Swedish

Mat-1.1532 Basic course in Mathematics 3-II (5 cr)

Autumn (Period II), will be lectured for the first time during the academic year 2006-2007.

Lecturer: N.N.

Contents: Matrix calculus. Systems of differential equations. Partial differential equations. Numerical methods.

Literature: E. Kreyszig. Advanced Engineering Mathematics. John Wiley & Sons.

Prerequisites: Basic courses in mathematics 1-2.

Additional: This course together with Mat-1.1531 replaces Mat-1.453.

Language: Swedish

Mat-1.1610 Mathematics 1 (10 cr)

Autumn

Lecturer: N.N.

Contents: Vector and matrix algebra. Complex numbers. Analytic geometry. Differential and integral calculus for functions of one variable.

Literature: E. Kreyszig. Advanced Engineering Mathematics. John Wiley & Sons. H. Anton. Calculus a new horizon. John Wiley & Sons, Inc. Or R. A. Adams. Calculus, A Complete Course. Addison-Wesley Ltd.

Additional: This course replaces the course Mat-1.461 and the implementation of the course depends on the number and needs of the students.

Language: English

Mat-1.1620 Mathematics 2 (10 cr)

Spring

Lecturer: N.N.

Contents: Differential and integral calculus for functions of several variables. Series. Differential equations.

Literature: R. A. Adams. Calculus, A Complete Course. Addison-Wesley Ltd.

Prerequisites: Mat-1.1610

Additional: This course replaces the course Mat-1.462 and the implementation of the course depends on the number and needs of the students.

Language: English

Mat-1.1631 Mathematics 3-I (5 cr)

Autumn

Lecturer: Victoria Sofieva, spec. teacher

Contents: Complex analysis, Integral transforms, Fourier series.

Literature: E. Kreyszig. Advanced Engineering Mathematics.

Prerequisites: Mat-1.1610 and Mat-1.1620

Additional: This course together with Mat-1.1632 replaces Mat-1.463 and the implementation of the course depends on the number and needs of the students.

Language: English

Mat-1.1632 Mathematics 3-II (5 cr)

Autumn

Lecturer: Victoria Sofieva, spec. teacher

Contents: Matrix calculus, Systems of differential equations, Partial differential equations, Numerical methods.

Literature: E. Kreyszig. Advanced Engineering Mathematics.

Prerequisites: Mat-1.1610 and Mat-1.1620.

Additional: This course together with Mat-1.1631 replaces Mat-1.463 and the implementation of the course depends on the number and needs of the students.

Language: English

Mat-1.2600 Applied Probability A (5 cr)

Autumn

Lecturer: Ilkka Mellin, university teacher

Contents: Fundamental notions and axioms of probability. Discrete, continuous and multi-dimensional distributions. Convergence concepts for random variables. Laws of large numbers and

the central limit theorem. Statistics: estimation theory, one and two-sample tests, tests of goodness of fit and of independence, simple regression. Applications in engineering sciences.

Literature: P. Laininen: *Todennäköisyys ja sen tilastollinen soveltaminen*, Otatiето 1998, J.S. Milton, J.C. Arnold: *Introduction to Probability and Statistics*, McGraw-Hill

Prerequisites: 1st year basic courses in mathematics.

Additional: The course replaces Mat-2.090.

<http://www.math.hut.fi/opetus/sovtoda/index.html.fi>

Language: Finnish

Mat-1.2620 Applied Probability B (5 cr)

Autumn & spring

Lecturer: Prof Gustaf Gripenberg and Ilkka Mellin, university teacher

Contents: Fundamental notions of probability and the most important distributions. Statistical analysis: estimation theory, one and two-sample tests, tests of goodness of fit and of independence, simple regression. Applications in engineering sciences.

Literature: P. Laininen: *Todennäköisyys ja sen tilastollinen soveltaminen*, Otatiето 1998, J.S. Milton, J.C. Arnold: *Introduction to Probability and Statistics*, McGraw-Hill

Prerequisites: 1st year basic courses in mathematics.

Additional: The course replaces Mat-2.091.

<http://www.math.hut.fi/opetus/sovtodb/index.html.fi>

Language: Finnish

Mat-1.2990 Foundations of Modern Analysis (5 cr)

Spring

Lecturer: N.N.

Contents: This course provides material on fundamental concepts and methods in analysis for later studies in mathematics. Principles of topology in metric spaces, continuity and derivation, basics in measure and distribution theory.

Literature: R. F. Gariety, W. P. Ziemer, 1995. *Modern real analysis*, PWS-Publishing.

Prerequisites: Basic course in Mathematics 1

Additional: This course replaces the course

Mat-1.015

Language: Finnish

Mat-1.2991 Discrete Mathematics (5 cr)

Spring

Lecturer: Harri Hakula, teaching research scientist

Contents: Combinatorics, counting problems, generating functions, groups of permutations, and the theorems of Burnside and Polya. Number theory, congruence arithmetics, pseudoprimes, and principles of cryptology. Algebra, finite fields, and elementary coding theory.

Literature: Supplementary material. Highly recommended are also R.P. Grimaldi, 1999. *Discrete and Combinatorial Mathematics*. Addison-Wesley. K.H. Rosen, 1993. *Elementary Number Theory and its Applications*. Addison-Wesley.

Prerequisites: Basic courses in Mathematics 1 (and 2).

Mat-1.128.

Language: Finnish

Mat-1.2995 Project assignment in mathematics (2-5 cr) V

Lecturer: Prof Gustaf Gripenberg

Contents: An individual project assignment that pertains to mathematical problems arising in applications and which has as its objective to develop computer skills needed in mathematics.

Language: Finnish/English

Mat-1.3011 History of Science I (2 cr) P

Autumn (Period I)

The course is lectured every other autumn alternating with Mat-1.3013, for the first time in the autumn of 2006.

Lecturer: Ilpo Halonen, Ph.D, ilpo.halonen@helsinki.fi

Contents: The course examines the history of science by way of selected topics from antiquity to the twentieth century. The

emphasis is on the methodological development of science and on the theories developed to deal with scientific method.

Additional: This course together with Mat-1.3012 replaces Mat-1.041.

Language: Finnish

Mat-1.3012 History of Science II (3 cr) P

Autumn (Period II)

The course is lectured every other autumn alternating with Mat-1.3014, for the first time in the autumn of 2006.

Lecturer: Ilpo Halonen, Ph.D, ilpo.halonen@helsinki.fi

Contents: The course enters more deeply into the themes treated in Mat-1.3011. In particular, the great scientific advances made during the 17th century, often called "the great scientific revolution", are treated. An important theme in this revolution was the development of astronomy. Behind the central mathematical-physical discoveries during the period were persons like Kopernikus, Brahe, Kepler, Bacon, Galilei, Descartes, Newton and Leibniz. In addition the course treats certain parts of more recent history of science (e.g. Einstein).

Prerequisites: Mat-1.3011

Additional: This course together with Mat-1.3011 replaces

Mat-1.041

Language: Finnish

Mat-1.3013 Philosophy of Science I (2 cr) P

Autumn (Period I)

The course is lectured every other autumn alternating with Mat-1.3011, for the first time in the autumn of 2005.

Lecturer: Ilpo Halonen, Ph.D, ilpo.halonen@helsinki.fi

Contents: The course deals mainly the foundations, objectives, and the methods in the mathematical and physical sciences from a philosophical point of view. The course proceeds historically from the philosophers of antiquity to the scientific revolution and from there to the essential modern philosophies. The characteristic features of science and of scientific thinking are systematically treated as well as concepts about the methods and the objectives of science and the nature of scientific knowledge during different periods.

Additional: This course together with Mat-1.3014 replaces

Mat-1.042.

Language: Finnish

Mat-1.3014 Philosophy of Science II (3 cr) P

Autumn (Period II)

The course is lectured every other autumn alternating with Mat-1.3012, for the first time in the autumn of 2005.

Lecturer: Ilpo Halonen, Ph.D, ilpo.halonen@helsinki.fi

Contents: The course enters systematically more deeply into the themes treated in Mat-1.3013. Central themes are the scientific establishment of theories and concepts, scientific deduction, its nature and objectives, scientific explanations and causality problems, the ethics of science and questions pertaining to the scientific world view, growth of knowledge and the development of science.

Prerequisites: Mat-1.3013

Additional: This course together with Mat-1.3013 replaces Mat-1.042.

Language: Finnish

Mat-1.3031 Mathematical Logic I (2 cr) P

Not lectured this academic year.

Lecturer: Prof Gustaf Gripenberg

Contents: About the logical basis of some theories in mathematics and its applications. Formal logic, propositional calculus, and predicate calculus. Foundations of set theory, and number theory. Decidability problem, and Turing machines, and Gödel's theorem. Classical paradoxes. Classical and non-classical systems of logic.

Literature: Supplementary material.

Additional: This course replaces the course Mat-1.080

Language: Finnish

Mat-1.3032 Fuzzy Sets (2 cr) P

Not lectured this academic year.

Lecturer: Prof Gustaf Gripenberg

Contents: Crisp and fuzzy definitions in set theory, fuzzy operations for basic arithmetic and analysis. Fuzzy graphs and relations. About possibility and probability. Fuzzy logic and approximate reasoning. Applications.

Literature: H.-J. Zimmermann. *Fuzzy Set Theory and Its Applications*. Kluwer-Nijhoff Publishing, or supplementary material.

Prerequisites: Basic courses in Mathematics 1-3.

Additional: This course replaces the course Mat-1.188.

Language: Finnish

Mat-1.3051 Discrete Mathematical Methods (3-6 cr) P V

Not lectured this academic year.

Lecturer: Harri Hakula, teaching research scientist

Contents: Variable. The course has been given with the following contents: Discrete algebra (4 cr), Finite incidence structures (3 cr), Finite automata (2 cr).

Literature: Supplementary material.

Prerequisites: Basic courses in Mathematics 1-3.

Additional: This course replaces the course Mat-1.189.

Language: Finnish

Mat-1.3081 Algebra I (5 cr) P

Not lectured this academic year.

Lecturer: Prof Gustaf Gripenberg

Contents: Groups, rings, integral domains, fields, and vector spaces. Homomorphisms and isomorphisms. Polynomial rings, and field extensions.

Literature: W. K. Nicholson, 1999. *Abstract Algebra*. Wiley or supplementary material.

Prerequisites: Basic courses in Mathematics 1-3

Additional: This course replaces the course Mat-1.146.

Language: Finnish

Mat-1.3111 Number Theory (3 cr) P

Spring (Period III)

Lecturer: N.N.

Contents: Divisibility of integers, prime numbers, and pseudoprimes. Diophantine equations, and congruence arithmetic. Squares and non-squares in congruence arithmetic. Primitive roots. Continued fractions. Some methods of cryptology.

Literature: K.H. Rose, 1993. *Elementary Number Theory and its Applications*. Addison-Wesley or supplementary material.

Prerequisites: Basic courses in Mathematics 1-3.

Additional: This course replaces the course Mat-1.191.

Language: Finnish

Mat-1.3281 Analysis I (5 cr)

Not lectured this academic year.

Lecturer: Ville Turunen, researcher

Contents: Measure and integration theory. Lp spaces. Differentiation.

Literature: R. F. Gariepy, W. P. Ziemer: *Modern real analysis*. PWS Publishing, 1995.

Prerequisites: Basic courses in Mathematics 1-2, Mat-1.2990

Language: Finnish

Mat-1.3282 Study Group in Analysis (1-3 cr) P V

Autumn & spring

Lecturer: Juha Kinnunen, Docent, Ville Turunen, researcher

Contents: We study the most recent methods and results in modern analysis. The problems are related to e.g. partial differential equations and harmonic analysis.

Language: English on demand

Mat-1.3301 Complex analysis (5 op) L

Spring (Period IV)

Teacher: Prof Stig-Olof Londen

Contents: Properties of analytic functions, harmonic functions, conformal mappings, Hp-spaces, etc.

Literature: To be announced later.

Language: Finnish, English on demand

Mat-1.3345 Inverse problems for differential equations (4-6 cr) P V

Autumn

Lecturer: Prof. Matti Lassas

Contents: The course gives an introduction to inverse problems related to analysis, in particular to the inverse problems for ordinary differential equations. Some multidimensional inverse problems and imaging problems are also introduced. The scope of the course is 5 cr this year.

Prerequisites: Mat-1.2990, Mat-1.3460

Language: English on demand

Mat-1.3352 Hyperbolic partial differential equations (5 cr) P

Not lectured this academic year.

Lecturer: Prof Gustaf Gripenberg

Contents: Hyperbolic partial differential equations, e.g. conservation laws, and methods used to solve them.

Literature: L.C. Evans, *Partial Differential Equations*, AMS

Prerequisites: Basic courses in mathematics

Language: English on demand

Mat-1.3353 Viscosity Solution to Partial Differential Equations (5 cr) P

Not lectured this academic year.

Lecturer: Prof Gustaf Gripenberg

Contents: Elliptic and parabolic equations, the maximum principle etc.

Additional: Course homepage <http://www.math.hut.fi/teaching/viscosol/index.html>

This course replaces the course Mat-1.520.

Language: Finnish/English

Mat-1.3355 Microlocal analysis (4-6 cr) P V

Not lectured this academic year.

Lecturer: Prof Matti Lassas

Contents: Topics related to microlocal analysis: propagation of singularities, pseudodifferential operators, Fourier integral operators. This year 6 credit points.

Language: Finnish, English on demand

Mat-1.3371 Dynamical Systems (5 cr) P V

Not lectured this academic year.

Lecturer: Prof Timo Eirola

Contents: Qualitative theory of ordinary differential equations and dynamical systems. Invariant sets, bifurcations, global behaviour.

Literature: To be announced.

Prerequisites: Basic courses in mathematics 1-3.

Additional: This course replaces the course Mat-1.165

Language: Finnish

Mat-1.3379 Special Course in Dynamical Systems (3-6 cr) P V

Not lectured this academic year.

Lecturer: Prof Timo Eirola

Contents: Spring 2006: Numerical analysis of invariant sets and bifurcations. The scope of the course is 5 cr in this year.

Literature: Lecture notes.

Prerequisites: Mat-1.3371 or similar

Additional: This course replaces the course Mat-1.187.

Language: Finnish

Mat-1.3421 Basics of Fourier Analysis (5 cr) P

Not lectured this academic year.

Lecturer: Prof Gustaf Gripenberg

Contents: Fourier series, Fourier transform of L1 - and L2 - functions and distributions, discrete Fourier transform, applications.

Requirements: Requirements of the course must be discussed with the teacher.

Prerequisites: Basic courses in Mathematics 1 (and 3)

Additional: The course replaces the course Mat-1.158.

<http://www.math.hut.fi/teaching/fourier/index.html.fi>

Language: Finnish / English

Mat-1.3422 Wavelet Theory (3 cr) P

Autumn (Period I)

Lecturer: Prof Gustaf Gripenberg

Contents: Basic wavelet theory, multiresolutions, orthonormal bases, frames, etc.

Literature: Lecture notes.

Additional: This course replaces the course Mat-1.510.

Course homepage <http://www.math.hut.fi/teaching/wavelet/index.html.fi>

Language: Finnish/English

Mat-1.3460 Principles of Functional Analysis (5 cr) P

Autumn

Lecturer: Prof Olavi Nevanlinna

Contents: Banach- and Hilbert spaces. Theory of linear operators.

Literature: E. Kreyszig, 1989. Introductory Functional Analysis with Applications, John Wiley & Sons.

Prerequisites: Basic courses in Mathematics 1-2 and Mat-1.2990

Additional: The course replaces the course Mat-1.140.

Language: Finnish / English

Mat-1.3461 Operator algebras (5 cr) P V

Not lectured this academic year.

Lecturer: Ville Turunen, researcher

Contents: C^* - and Lipschitz-algebras: topology, metric spaces and measure theory from functional analysis point of view.

Prerequisites: Mat-1.3460/Mat-1.140

Language: Finnish

Mat-1.3462 Applied Functional Analysis (3-5 cr) P V

Not lectured this academic year.

Lecturer: N.N.

Literature: Supplementary material.

Prerequisites: Mat-1.3460/Mat-1.140

Additional: The course replaces the course Mat-1.141.

Language: Finnish / English

Mat-1.3530 Introduction to Differential Geometry (5 cr) P

Spring, the course is lectured every other year alternating with Mat-1.3531.

Lecturer: Kirsi Peltonen, teaching research scientist

Contents: Curves and surfaces.

Prerequisites: Basic courses in Mathematics 1-3

Additional: This course replaces the course Mat-1.166.

Language: Finnish

Mat-1.3531 Differential Geometry (5 cr) P V

Spring, the course is lectured every other year alternating with Mat-1.3530, next time in the academic year 2007-2008.

Lecturer: Kirsi Peltonen, teaching research scientist

Contents: Topics related to differential geometry varying from classical Riemannian geometry to modern geometries. More specified topics will be announced later.

Prerequisites: Basic courses in Mathematics 1-3 and

Mat-1.2990/Mat-1.015.

Language: Finnish

Mat-1.3601 Introduction to stochastics (5 cr) P

Spring (Period III)

Lecturer: Prof Esko Valkeila

Contents: Probability space, expectation, independence. Convergence concepts in stochastics. Law of large numbers, central limit theorem and large deviations. Conditional expectation.

Additional: The course replaces Mat-1.503.

<http://www.math.hut.fi/teaching>

Language: Finnish

Mat-1.3602 Stochastic analysis (3-5 cr) P V

Not lectured this academic year.

Lecturer: Prof Stig-Olof Londen

Contents: Ito integrals. Stochastic differential and integral equations. Stochastic equations in infinite dimensional spaces. Krylov's theory.

Prerequisites: Basic knowledge of stochastics and analysis

Language: Finnish, English on demand

Mat-1.3603 Mathematical Finance (5 cr) P

Autumn (Period I)

Lecturer: Prof Esko Valkeila

Contents: Arbitrage and hedging in discrete time pricing models. Optimal investment. Pricing models in continuous time. Black & Scholes formula. Asymmetric information in pricing models.

Additional: The course replaces Mat-1.504.

<http://www.math.hut.fi/teaching>

Language: Finnish

Mat-1.3604 Stationary processes (5 cr) P

Not lectured this academic year.

Lecturer: Prof Esko Valkeila

Contents: Spectral theory. L^2 integration. Prediction. Filtration.

Prerequisites: Mat-1.3601

Language: Finnish

Mat-1.3605 Information and stochastic processes (5 cr) P V

Autumn (Period II)

Lecturer: Prof Esko Valkeila

Contents: The course deals with divergence measures for the distributions of stochastic processes and applications in statistics. Project work.

Prerequisites: Mat-1.3601

Language: Finnish

Mat-1.3606 Seminar on stochastics (1-3 cr) P V

Autumn & spring

Lecturer: Prof Esko Valkeila

Contents: Lectures by visitors, researchers and students.

Language: Finnish, English on demand

Mat-1.3607 Stochastic optimization (2-5 cr) P V

Autumn

Lecturer: Teemu Pennanen, Docent

Contents: Optimization under stochastic uncertainty. This year 4 cr.

Prerequisites: Basic knowledge of probability and functional analysis.

Language: Finnish, English on demand

Mat-1.3621 Statistical inference (5 cr) P

Spring

Lecturer: university teacher Ilkka Mellin

Contents: Probability models. Sampling and sample distributions. Estimation of parameters in probability distributions and properties of the estimators. Statistical testing. Bayesian methods. Multivariate inference. Theory of large samples. Regression. Literature: Supplementary material. Information about further literature is given at the beginning of the course.

Prerequisites: Mat-1.2600 or Mat-1.2620.

Language: Finnish

Mat-1.3626 Computational methods in inverse problems

(4-6 cr) P V

Spring

Lecturer: Prof Erkki Somersalo

Contents: The course contents varies from year to year, the focus being on computational and statistical methods for solving

inverse problems in practice. The course in spring 2007 has its emphasis on statistical approach and in particular on Monte Carlo methods for exploring the posterior distributions. application areas include imaging and biological models. The scope of the course is 6 cr this year.

Literature: Material available from the lecturer.
Language: English on demand

Mat-1.3650 Finite Element Method I (5 cr) P

Spring

Lecturer: N.N.

Contents: Sobolev spaces, elliptic variational problems, mathematical background of finite element method, most common element types, approximation properties of polynomials, practical aspects.

Literature: S. Larsson, V. Thomée: Partial Differential Equations with Numerical Methods, Springer, 2005

Prerequisites: Basic courses in Mathematics 1-3/4, basics in partial differential equations

Additional: This course replaces the course

Mat-1.171 Principles of Finite Element Method

Language: Finnish

Mat-1.3651 Matrix computations (5 cr) P

Spring

Lecturer: N.N.

Contents: Matrix decompositions and their numerical computation, eigenvalue iterations, sparse matrices, iterative solution of linear systems.

Literature: Lecture notes

Additional: The course replaces the course Mat-1.175.

Language: Finnish/English

Mat-1.3652 Finite Difference Methods (5 cr) P

Autumn

Lecturer: Jan von Pfaler, researcher

Contents: Difference methods for the numerical solutions of ordinary and partial differential equations; in particular stability and convergence. Preservation of important qualitative properties under discretization are also examined.

Prerequisites: Basic courses in Mathematics 1-3

Literature: S. Larsson, V. Thomée: Partial Differential Equations with Numerical Methods, Springer, 2005

Additional: This course replaces the course Mat-1.169.

Language: Finnish, English on demand

Mat-1.3653 Theory of Approximation (5 cr) P

Not lectured this academic year.

Lecturer: Harri Hakula, teaching research scientist

Contents: Approximation of functions with polynomials, splines, trigonometric functions and wavelets in different norms.

Literature: Lecture notes

Prerequisites: Mat-1.2990/Mat-1.015 (or equal)

Additional: This course replaces the course Mat-1.170.

Language: Finnish / English

Mat-1.3654 Numeric and Symbolic Computation (3-5 cr) P

Spring

Lecturer: N.N.

Contents: The course is given in the form of project and seminar work. The mathematical topics covered include numerical methods in general, differential equations, numerical linear algebra, the mathematics of signal processing, optimization, etc. Other topics are also possible depending on the interest of participants. The mathematical software systems used are mainly Matlab and Maple.

Requirements: Project/seminar work.

Prerequisites: Basic courses in Mathematics 1-3

Additional: This course replaces the course Mat-1.192.

Course homepage <http://www.math.hut.fi/teaching/numsym/>

Language: English on demand

Mat-1.3655 Study group in numerical analysis (1-3 cr) P V

Autumn & spring

Lecturer: Prof Timo Eirola

Contents: We study the most recent methods and results in numerical analysis.

Language: Finnish

Mat-1.3656 Seminar on Numerical Analysis and

Computational Science (1-5 cr) P V

Autumn + spring

Lecturer: Prof Timo Eirola

Contents: Applications of computational methods to diverse scientific and technical problems. The seminar will meet once a week during the academic year. Suitable also for undergraduate students.

Additional: The course replaces Mat-1.600.

Language: Finnish, English on demand

Mat-1.3657 Computational Methods of Partial Differential Equations (5 cr)

Spring

Lecturer: Harri Hakula, teaching research scientist

Contents: Foundations of modern scientific computing: implementation of difference and finite element methods.

Literature: To be announced later.

Prerequisites: Mat-1.404

Additional: This course replaces the course Mat-1.174.

Language: Finnish

Mat-1.3658 Special course in numeric analysis (5 op) L V

Spring

Lecturer: prof. Timo Eirola

Contents: Problems of current interest in numerical analysis. Further details about the content this year will be given later.

Language: English on demand

Mat-1.3990 Special assignment in mathematics (5-8 cr) V

Lecturer: N.N.

Contents: An individual research assignment or a literature survey.

Language: Finnish, Swedish, English

Mat-1.3992 Computational Science, special assignment

(5-8 cr)

Autumn & spring

Lecturer: Prof Timo Eirola

Contents: Individual research project, where computational methods are applied and experimented in theoretical or practical problems.

Mat-5.3701 Analytical Mechanics (5 cr) L

Not lectured academic year 2006-2007.

Lecturer: prof. Rolf Stenberg

Contents: A second course in theoretical mechanics. Newton's, Lagrange's and Hamilton's mechanics. Symmetries and conservation laws. Noether's theorem. Liouville's theorem. Dynamics of rigid bodies. Geometrical principles of mechanics.

Literature: V. I. Arnold. Mathematical Methods of Classical Mechanics. Springer Graduate Texts in Mathematics 60. J. V. José, E. J. Saletan Classical Dynamics : A Contemporary Approach. Cambridge University Press 1998.

Language: English

Mat-5.3702 Advanced Course in Theoretical Mechanics (5 cr)

Not lectured 2005-2006.

Lecturer: Prof Rolf Stenberg

Contents: To be specified later

Mat-5.3740 Continuum mechanics (5 cr)

Autumn, will be lectured for the first time during the academic year 2007-08

Lecturer: Prof. Rolf Stenberg

Contents: A basic course in continuum mechanics, providing the basis for further study in both fluid and solid mechanics.
Literature: R. Temam, A. Miranville. *Mathematical Modelling in Continuum Mechanics*. 2nd ed. Cambridge University Press.
Prerequisites: The basic courses in mathematics
Additional: This course will replace the course Mat-5.188 Continuum mechanics.
Language: English on demand

Mat-5.3741 Theory of Elasticity (5 cr) P

Spring
Lecturer: Prof Rolf Stenberg
Contents: Linear elasticity. Variational principles of elasticity. Models for thin structures: beams and plates. Composite structures. Eigenvalue problems: free vibrations, buckling.
Literature: Feng Kang & Shi Zhong-Ci. *Mathematical Theory of Elastic Structures*. Springer-Verlag 1996.
Language: English

Courses credited in ocr

Mat-1.125 Individual Research Project in Mathematics

(3-6 ocr) V
Lecturer: Jarmo Malinen, senior assistant
Contents: Individual research project related to mathematical problems in practice. As a rule, the projects are given 3 ocr, but in exceptional cases this can vary.
Language: Finnish / English / Swedish

Mat-1.142 Seminar on Mathematics (1.5-3 ocr) P V

Autumn + spring
Lecturer: Prof Matti Lassas
Contents: The purpose of the course is to practice giving mathematical talks and presentations. Specific topics of seminars are decided on the beginning of the semester.
Language: Finnish

Mat-1.218 Seminar on Inverse Problems (1.5-4 ocr) P V

Autumn + spring
Lecturer: Prof Erkki Somersalo and Prof Matti Lassas
Contents: The seminar will assemble irregularly at times to be announced separately. For seminar information, the students are asked to give their contact information to the lecturer. The topics of the seminar include actual research topics as well as topics of the diploma, licentiate and doctoral theses.
Additional: <http://www.math.hut.fi/teaching/inversioseminaari/>
Language: English on demand

Mat-1.625 Special Assignment in Computational Science and Engineering (3-5 ocr)

Autumn & spring
Lecturer: Prof Timo Eirola
Contents: Individual research project, where computational methods are applied and experimented in theoretical or practical problems.

Mat-5.002 Individual Research Projects in Mechanics

(3-6 ocr)
Autumn + spring
Lecturer: Prof Rolf Stenberg
Contents: Individual research tasks in mechanics performed under the supervision of the teachers of the laboratory. Specific advice is given by the teachers.
Requirements: Approved report
Language: Finnish

Mat-5.100 Individual Studies (2-10 ocr) V

Lecturer: Prof Rolf Stenberg

Contents: The contents and the extent of the individual studies are decided on in advance with the teacher in charge.
Language: Finnish

Mat-5.188 Continuum Mechanics (4 ocr) P

Autumn, lectured for the last time during the academic year 2006-2007.
Lecturer: Prof Rolf Stenberg
Contents: Tensor algebra and analysis. Kinematics. Mass, momentum, force and stress. Constitutive models. Non-viscous and viscous flow. Navier-Stokes equations. Nonlinear and linear elasticity.
Literature: M. E. Gurtin. *An Introduction to Continuum Mechanics*. Academic Press.
Additional: During the academic year 2007-2008 will be replaced by the course Mat-5.3740 Continuum Mechanics
Language: English on demand

Mat-5.196 Postgraduate and Research Seminar on Mechanics (3-5 ocr) P V

Autumn + spring (Periods II-IV)
Lecturer: Prof Rolf Stenberg
Contents: Lectures given by visitors, researchers of the laboratory and postgraduate students.
Language: English

Mat-5.210 Special Course in Computational Mechanics

(2-4 ocr) P V
Autumn
Lecturer: Mikko Lyly, Docent
Contents: The course deals with computational methods for partial differential equations, such as the classical finite element method, mixed finite elements and finite volume methods. The focus is on so called a-posteriori error estimates and adaptive numerical methods. Extent this academic year 3 ocr.
Literature: P. Neittaanmäki, S. Repin. *Reliable Methods for Computer Simulation. Error Control and A-Posteriori Estimates. Studies in Mathematics and its Applications Vol. 33*. Elsevier 2004.
Language: English

Mat-2 APPLIED MATHEMATICS

Prof Raimo P. Härmäläinen, tel. 451 3054, room U 211
Prof Harri Ehtamo, tel. 451 3058, room U 238
Prof Esa Saarinen, tel. 451 3061, room U 209
Prof Ahti Salo, tel. 451 3055, room U 240

Courses credited in ECTS

Mat-2.1197 Philosophy and Systems Thinking (3 cr) P V

Spring
Lecturer: Prof Esa Saarinen
Contents: The course introduces students to conceptual thinking in a highly personal and thought provoking style. Drawing from history of philosophy, case studies and from key ideas of systems thinking, the aim is to make students more acutely aware of their own philosophy of life. Spring term courses are independent units and can be completed separately.
Requirements: Essay, based on the lectures and literature.
Literature: E. Saarinen: *Filosofia!*, 2004, WSOY. P.M. Senge: *The Fifth Discipline*, Currency Doubleday.
Additional: This course replaces the course Mat-2.197 Philosophy and Systems Thinking
Language: Finnish

Mat-2.2103 Design of Experiments and Statistical Models

(4 cr)
Spring

Lecturer: Simo Heliövaara, special lecturer
 Contents: Fundamental principles of design of experiments and of analysis of experimental data. Linear statistical models: the analysis of variance, randomized blocks, factorial experiments. Response surface methods.
 Literature: D.C. Montgomery: Design and Analysis of Experiments, John Wiley & Sons
 Prerequisites: Applied probability
 Additional: This course replaces the course Mat-2.103 Design of Experiments and Statistical Models
 Language: Finnish

Mat-2.2104 Introduction to Statistical Inference (4 cr)
 Spring

Lecturer: Kai Virtanen, researcher
 Contents: Introduction to computer oriented statistical analysis and statistical inference. Parametric and nonparametric tests. Regression analysis: linear, logistic, Poisson regression. Analysis of variance: one-way ANOVA, multiple comparisons, two-way ANOVA.
 Literature: P. Laininen: Tilastollisen analyysin perusteet, Otati-eto, 2000, or J.S. Milton and J.C. Arnold: Introduction to Probability and Statistics, McGraw-Hill, 3rd edition, 1995.
 Prerequisites: Applied probability
 Additional: This course replaces the course Mat-2.104 Introduction to Statistical Inference
 Language: Finnish

Mat-2.2105 Introduction to Optimization (3 cr)
 Spring

Lecturer: Prof Harri Ehtamo
 Contents: An introductory course to linear and non-linear programming. The following topics are included: Building of optimization models, resource allocation models, least-squares problems, goal programming, integer programming and traveling salesman problem together with genetic algorithms. In exercises Excel and Matlab are used to solve the problems.
 Literature: Lecture notes.
 Prerequisites: 1st year math.
 Additional: This course replaces the course Mat-2.105 Introduction to Optimization
 Language: Finnish

Mat-2.2107 Computational Assignments in Applied Mathematics (3 cr) V

Autumn & spring
 Lecturers: Simo Heliövaara, specialist teacher and teaching assistants
 Contents: Studying of mathematical problem solving in tutorials. The course is suitable for all the departments as an introduction to modeling. Software used in the course include Matlab, Simulink, Mathematica, NCSS, Excel and Web-Hipre.
 Requirements: The course is completed either by attending tutorials or by completing personal assignments. Tutorials are held both in spring and autumn term. Personal assignments can be collected from the course assistant. The course is recommended for second year students.
 Prerequisites: 1st year math and applied probability
 Additional: This course replaces the course Mat-2.107 Computational Assignments in Applied Mathematics
 Language: Finnish

Mat-2.3111 Stochastic Processes (5 cr) P

Autumn, not lectured this academic year.
 Additional: This course will replace the course Mat-2.111 Stochastic Processes which is lectured this academic year.
 Language: Finnish

Mat-2.3112 Statistical Multivariate Methods (3-6 cr) P
 Spring, not lectured this academic year.

Additional: This course will replace the course Mat-2.112 Statistical Multivariate Methods which is lectured this academic year.
 Language: Finnish

Mat-2.3114 Investment Science (5 cr) P

Spring, not lectured this academic year.
 Additional: This course will replace the course Mat-2.114 Investment Science which is lectured this academic year.
 Language: Finnish

Mat-2.3117 Risk Analysis (5 cr) P

Autumn, not lectured this academic year.
 Additional: This course will replace the course Mat-2.117 Risk Analysis which is lectured this academic year.
 Language: Finnish

Mat-2.3118 Reliability Engineering(5 cr) P

Not lectured this academic year. Lectured alternately with Mat-2.3117.
 Additional: This course will replace the course Mat-2.118 Reliability Engineering.
 Language: Finnish

Mat-2.3128 Prediction and Time Series Analysis (4 cr)

Autumn, not lectured this academic year.
 Additional: This course will replace the course Mat-2.128 Prediction and Time Series Analysis which is lectured this academic year.
 Language: Finnish

Mat-2.3130 Mathematical Modelling (3 cr) P

Autumn, not lectured this academic year.
 Additional: This course will replace the course Mat-2.130 Mathematical Modelling which is lectured this academic year.
 Language: Finnish

Mat-2.3132 Systems Analysis Laboratory I(3 cr)

Spring, not lectured this academic year.
 Additional: This course will replace the course Mat-2.132 Systems Analysis Laboratory, assignments 2 and 3, which is lectured this academic year.
 Language: Finnish

Mat-2.3134 Decision Making and Problem Solving (4 cr) P

Autumn, not lectured this academic year.
 Additional: This course will replace the course Mat-2.134 Decision Making and Problem Solving which is lectured this academic year.
 Language: Finnish

Mat-2.3139 Nonlinear Programming (5 cr) P

Autumn, not lectured this academic year.
 Additional: This course will replace the course Mat-2.139 Nonlinear Programming which is lectured this academic year.
 Language: Finnish

Mat-2.3140 Linear Programming (5 cr) P

Autumn, not lectured this academic year.
 Additional: This course will replace the course Mat-2.140 Linear Programming which is lectured this academic year.
 Language: Finnish

Mat-2.3148 Dynamic Optimization (5 cr) P

Spring, not lectured this academic year.
 Additional: This course will replace the course Mat-2.148 Dynamic Optimization which is lectured this academic year.
 Language: Finnish

Mat-2.3152 Game Theory (4 cr) P V

Autumn, not lectured this academic year.

Additional: This course will replace the course

Mat-2.152 Game Theory.

Language: Finnish

Mat-2.3170 Simulation (3 cr) P

Spring, not lectured this academic year.

Additional: This course will replace the course

Mat-2.170 Simulation which is lectured this academic year.

Language: Finnish

Mat-2.4108 Independent Research Projects in Applied Mathematics (5-8 cr) V

Not organised this academic year.

Additional: This course will replace the course

Mat-2.108 Independent Research Projects in Applied Mathematics which is organised this academic year.

Language: Finnish

Mat-2.4129 System Identification (4 cr) P

Spring, not lectured this academic year.

Additional: This course will replace the course

Mat-2.129 System Identification which is lectured this academic year.

Language: Finnish

Mat-2.4133 Systems Analysis Laboratory II (4 cr)

Spring, not lectured this academic year.

Additional: This course will replace the course

Mat-2.132 Systems Analysis Laboratory, assignments 1 and 4, which is lectured this academic year.

Language: Finnish

Mat-2.4136 Special Topics in Decision Making (3-6 cr) P V

Not lectured this academic year.

Additional: This course will replace the course

Mat-2.136 Special Topics in Decision Making which is lectured this academic year.

Language: Finnish

Mat-2.4142 Seminar on Optimization (5 cr) P V

Spring, not organised this academic year.

Additional: This course will replace the course

Mat-2.142 Seminar on Optimization which is organised this academic year.

Language: Finnish

Mat-2.4143 Network Optimization (3-6 cr) P

Not lectured this academic year.

Additional: This course will replace the course

Mat-2.143 Network Optimization.

Language: Finnish

Mat-2.4144 Optimization Theory (3-6 cr) P V

Autumn, not organised this academic year.

Additional: This course will replace the course

Mat-2.144 Optimization Theory which is lectured this academic year.

Language: Finnish

Mat-2.4146 Integer Programming (3-6 cr) P

Not organised this academic year.

Additional: This course will replace the course

Mat-2.144 Integer Programming.

Language: Finnish

Mat-2.4153 Multiple Criteria Optimization (3-6 cr) P

Not lectured this academic year. Exam according to agreement.

Additional: This course will replace the course

Mat-2.153 Multiple Criteria Optimization.

Language: Finnish

Mat-2.4174 Programming of Mathematical Algorithms

(3-6 cr) P V

Spring, not lectured this academic year.

Additional: This course will replace the course

Mat-2.174 Programming of Mathematical Algorithms which is lectured this academic year.

Language: Finnish

Mat-2.4177 Seminar on Case Studies in Operation Research

(5 cr) P V

Spring, not organised this academic year.

Additional: This course will replace the course

Mat-2.177 Seminar on Case Studies in Operation Research which is organised this academic year.

Language: Finnish

Mat-2.4191 Postgraduate Seminar on Applied Mathematics

(5 cr) P V

Autumn, not organised this academic year.

Additional: This course will replace the course

Mat-2.191 Postgraduate Seminar on Applied Mathematics which is organised this academic year.

Language: Finnish

Mat-2.4192 Systems Research Seminar (1-6 cr) P V

The arrangement will be announced later.

Additional: This course will replace the course

Mat-2.192 Systems Research Seminar which is lectured this academic year.

Language: Finnish

Mat-2.4193 Independent Studies in Systems Analysis and Applied Mathematics (1-9 cr) P V

Autumn & spring, not organised this academic year.

Contents: Annually changing topic. Requirement for independent studies or supplement to normal courses according to agreement.

Additional: This course will replace the course

Mat-2.193 Independent Studies in Systems Analysis and Applied Mathematics which is organised this academic year.

Language: Finnish

Mat-2.4194 Research Course in Systems Science (1-6 cr) P V

Not lectured this academic year.

Additional: This course will replace the course

Mat-2.194 Summer School in Systems Science which is lectured this academic year.

Language: Finnish

Mat-2.4195 Web-based Courses in Systems Analysis

(1-6 cr) P V

Autumn & spring, not organised this academic year.

Additional: This course will replace the course

Mat-2.195 Web-based Courses in Systems Analysis which is organised this academic year.

Language: Finnish

Mat-2.4198 Seminar of Creative Problem Solving (5 cr) P V

Autumn, not organised this academic year.

Additional: This course will replace the course

Mat-2.198 Seminar of Creative Problem Solving which is organised this academic year.

Language: Finnish

Courses credited in ocr**Mat-2.108 Independent Research Projects in Applied Mathematics** (3-5 ocr) V

Lecturer: Prof Raimo P. Hämmäläinen, Prof Harri Ehtamo, Prof Esa Saarinen, Prof Ahti Salo as well as other lecturers and researchers of the laboratory

Contents: An individual research project; topics from industry or from research projects of the laboratory. Students can also propose their own topics. The topics need to be discussed and approved by one of the teachers. One of the main aims is to get experience in writing a research report.

Requirements: Written report

Prerequisites: 1st and 2nd year math, courses of the laboratory related to the chosen topic.

Language: Finnish

Mat-2.111 Stochastic Processes (3 ocr) P

Autumn

Lecturer: Jirka Poropudas, researcher

Contents: Branching processes, discrete and continuous-time Markov chains (e.g. Poisson processes, birth and death processes), basic notions of queuing theory, renewal processes, Brownian motion.

Literature: R. Durrett: Essentials of Stochastic Processes, Springer, 1999

Prerequisites: Applied probability

Language: Finnish

Mat-2.112 Statistical Multivariate Methods (2-4 ocr) P

Spring

Lecturer: Ilkka Mellin, university teacher

Contents: Multiple regression, principal component analysis, factor analysis, cluster analysis, discriminant analysis, MANOVA, canonical correlation. Computer oriented approach.

Literature: S. Sharma: Applied Multivariate Techniques, John Wiley, 1996.

Prerequisites: Applied probability

Additional: Course can be taken in the independent studies, see Mat-2.193.

Language: Finnish

Mat-2.113 Queuing Theory (2 ocr) P

Not lectured this academic year.

Lecturer: N.N.

Contents: Queuing problems as stochastic processes, the problems including finite or infinite set of users and servers, queuing disciplines, queues as Markov processes. Applications include various serving systems, telecommunication systems etc.

Prerequisites: 1st and 2nd year math, Mat-2.111

Additional: For a similar course see S-38.3143

Language: Finnish

Mat-2.114 Investment Science (2-4 ocr) P

Spring

Lecturer: Prof Ahti Salo and Pekka Mild, researcher

Contents: Instruments of investment science and finance, risk analysis, term structure of interest rates, pricing of derivatives, optimization of investment portfolio return.

Requirements: Assignments and exam.

Literature: D.G. Luenberger: Investment Science, Oxford University Press, 1998.

Prerequisites: 1st and 2nd year math; applied probability

Language: Finnish

Mat-2.115 Seminar on Stochastic Methods (0.5-6 ocr) P V

Will be given during this academic year in connection with the Seminar on Optimization.

Lecturer: Prof Raimo P. Hämmäläinen

Contents: Varies annually.

Language: Finnish

Mat-2.117 Risk Analysis (3 ocr) P

Autumn

Lecturer: Prof Ahti Salo and Urho Pulkkinen, Docent

Contents: The aim of the course is to introduce methods and models applied in the risk analysis of various systems, including the models and approaches of economic risk management. Fur-

ther, the course provides a deeper view over concepts for handling risk and uncertainty, Finally, practical examples on risk analyses are presented.

Literature: Will be announced later.

Language: Finnish

Mat-2.118 Reliability Engineering (2.5 ocr) P

Not lectured this academic year. Lectured alternately with Mat-2.117.

Lecturer: Urho Pulkkinen, Docent

Contents: The basic principles and concepts of systems reliability analysis, and methods applied to analyzing the reliability and availability of complex systems.

Prerequisites: Applied probability and Mat-2.2104

Language: Finnish

Mat-2.125 Special Topics in Stochastics (2-4 ocr) P V

Not lectured this academic year.

Lecturer: N.N.

Contents: Annually varying topics on stochastics. Lectures and their topic will be announced later.

Requirements: Varies annually.

Language: Finnish

Mat-2.126 Statistical Quality Control (2 ocr) P

Not lectured this academic year.

Lecturer: N.N.

Contents: The course covers the mathematical foundations of methods of quality control and improvement, acceptance sampling and Taguchi methods.

Requirements: Exam.

Literature: A. Mitra: Fundamentals of Quality Control and Improvement, Macmillan, 1998.

Prerequisites: Applied probability

Language: Finnish

Mat-2.128 Prediction and Time Series Analysis (2 ocr)

Autumn

Lecturer: Ilkka Mellin, university teacher

Contents: Regression and other models and their use in the prediction of time series, especially linear time series analysis, ARIMA models and dynamic regression models; model selection, parameter estimation, diagnostic checks.

Requirements: Exam and assignments

Literature: R.S. Pindyck, D.L. Rubinfeld: Econometric models and economic forecasts, 4th edition, 1998; lecture notes; other literature will be announced later

Prerequisites: 1st and 2nd year math and applied probability.

Language: Finnish

Mat-2.129 System Identification (2 ocr) P

Spring

Lecturer: Tuomas Raivio, Docent

Contents: Transfer function and state space models of dynamic systems, modeling; systems theory. Identification of dynamic systems: nonparametric methods, inputs and design of experiments, model structures, prediction error methods, estimation of parameters, model structure selection, model validation.

Requirements: Exam and assignments

Literature: L. Ljung, T. Glad: Modeling of Dynamic Systems, Prentice Hall, 1994. Available in Swedish, publisher Studentlitteratur.

Prerequisites: 1st and 2nd year math and applied probability.

Language: Finnish

Mat-2.130 Mathematical Modelling (2 ocr) P

Autumn

Lecturer: Kai Virtanen, researcher

Contents: An introduction to systems thinking and utilization of mathematical models in different application areas. Construc-

tion of models, differential and difference equation models, modeling based on optimization, simulation of dynamic systems. Literature: F.R. Giordano, M.D. Weir, W.P. Fox: A First Course in Mathematical Modeling, Brooks/Cole, 1997

Prerequisites: 1st and 2nd year math and applied probability. Additional: Course will be held as an Internet course. Basic course of modeling is held in autumn and various advanced courses both in autumn and spring. The advanced courses are arranged within course Mat-2.195.
Language: Finnish

Mat-2.132 Systems Analysis Laboratory (2-5 ocr)

Autumn + spring

Lecturer: Kai Virtanen, researcher

Contents: Four fairly large assignments on the implementation and analysis of mathematical models. The assignments deal with optimization, system dynamics, time-series analysis and stabilization and control of a large scale system.

Requirements: Four written reports and a small exam
Prerequisites: 1st and 2nd year math, Mat-2.139, Mat-2.148. Taking the course simultaneously with Mat-2.128 and Mat-2.129 is recommended.

Language: Finnish

Mat-2.134 Decision Making and Problem Solving (2 ocr) P

Autumn

Lecturer: Jussi Liesiö, researcher

Contents: Models for decision making and problem solving: decision criteria, subjective values, uncertainty, dynamics of decision making, group decision making, optimization with multiple objectives.

Requirements: Assignments and exam.
Prerequisites: Mat-2.2105 and applied probability.

Language: Finnish

Mat-2.136 Special Topics in Decision Making (0.5-6 ocr) P V

Lectures this academic year through intensive periods.

Lecturer: Prof Ahti Salo and visiting lecturers

Contents: Annually varying topics on decision making. This year technology foresight is one of the topics.

Requirements: Assignments and exam.
Prerequisites: 1st and 2nd year math and applied probability.

Language: Finnish

Mat-2.139 Nonlinear Programming (3 ocr) P

Autumn

Lecturer: Kimmo Berg, researcher

Contents: Theory and numerical methods to solve problems in nonlinear programming. Applications from natural sciences, engineering and economics.

Requirements: Exam or mid-term exams.
Literature: M.S. Bazaraa, H.D. Sherali, C.M. Shetty: Nonlinear Programming, Theory and Algorithms, Wiley and Sons 1993.

Prerequisites: 1st and 2nd year math.
Additional: Course can be taken as an Internet course, see Mat-2.195.

Language: Finnish

Mat-2.140 Linear Programming (3 ocr) P

Autumn

Lecturer: Erkka Näsäkkälä, special lecturer

Contents: The simplex method, dual of the linear program, interior point algorithms, integer programming. Applications to transportation problems, network problems and production planning.

Requirements: Homework, assignments and take home exam/exam.

Literature: D. Bertsimas, J.N. Tsitsiklis: Introduction to Linear Optimization, Athena Scientific 1997

Prerequisites: Mat-2.2105

Language: Finnish

Mat-2.142 Seminar on Optimization (0.5-6 ocr) P V

Spring

Lecturer: Prof Raimo P. Hämmäläinen

Contents: Varies yearly with a possibility to take part multiple times. Subject is announced in the beginning of the term.

Requirements: Grade is based on presentation, homework exercises and active participation.

Prerequisites: 1st and 2nd year math, Mat-2.2105 and applied probability

Language: Finnish

Mat-2.143 Network Optimization (2-4 ocr) P

Not lectured this academic year.

Lecturer: Prof Harri Ehtamo

Contents: Graphs and network flow formulations. Maximal flow, transportation, assignment, and shortest path problems. Linear programming simplex algorithm, the dual-, and primal-dual algorithm for network problem.

Literature: D. Bertsekas: Network Optimization, Athena Scientific, 1998.

Prerequisites: Mat-2.2105 or Mat-2.140

Language: Finnish

Mat-2.144 Optimization Theory (2-4 ocr) P V

Autumn

Lecturer: Jyrki Lignell, researcher

Contents: Annually changing topic of some of the mainstream themes in optimization. This year topic is convex optimization.

Requirements: Exam and active participation in lectures

Literature: J.-B. Hiriart-Urruty, C. Lemarechal: Fundamentals of Convex Analysis, Springer, 2001.

Prerequisites: Mat-2.139 or Mat-2.140

Language: Finnish

Mat-2.146 Integer Programming (2-4 ocr) P

Not lectured this academic year.

Lecturer: Prof Harri Ehtamo

Contents: Optimization problems including integer variables together with most common algorithms: branch and bound, cutting plane, dynamic programming, approximation, simulated annealing and genetic algorithm. Complexity analysis. Dual problem and its relation to the network problem.

Literature: D. Bertsimas, J.N. Tsitsiklis: Introduction to Linear Optimization, Athena Scientific, 1997.

Prerequisites: Mat-2.2105 or Mat-2.140

Language: Finnish

Mat-2.148 Dynamic Optimization (3 ocr) P

Spring

Lecturer: Janne Karelahti, researcher

Contents: Optimization methods for dynamic systems: dynamic programming, calculus of variations, maximum principle, differential games. Application examples on engineering, economics and biology.

Literature: D.E. Kirk: Optimal Control Theory; M.I. Kamien, N.L. Schwarz: Dynamic Optimization - the Calculus of Variations and Optimal Control in Economics and Management

Prerequisites: 1st and 2nd years math.

Language: Finnish

Mat-2.152 Game Theory (2-4 ocr) P V

Not lectured this academic year.

Lecturer: Prof Harri Ehtamo

Contents: Annually varying topics on game theory. On autumn 2005 the topic was noncooperative game theory.

Requirements: Exam and assignments.

Literature: R. Gibbons: A Primer in Game Theory, Prentice Hall, 1992.

Prerequisites: Mat-2.2105 and applied probability

Language: Finnish

Mat-2.153 Multiple Criteria Optimization (2-4 ocr) P

Not lectured this academic year. Exam according to agreement.
 Lecturer: Antti Punkka, researcher
 Contents: Single and multiobjective decision making. Utility function, Pareto optimality, the theory of vector maximization, goal programming, interactive methods. Applications.
 Literature: K.M. Miettinen: *Nonlinear Multiobjective Optimization*, Kluwer 1999
 Prerequisites: Mat-2.2105 or Mat-2.139
 Additional: Course is held as an Internet course, see Mat-2.195.
 Language: Finnish

Mat-2.170 Simulation (2 ocr) P

Spring
 Lecturer: Ville Mattila, researcher
 Contents: Simulation of systems including discrete events and queues: stochastic queuing models, constructing a model, simulation techniques, graphical simulation software.
 Requirements: Assignments and a case study.
 Prerequisites: 1st and 2nd year math and applied probability
 Language: Finnish or English

Mat-2.174 Programming of Mathematical Algorithms

(2-4 ocr) P V
 Spring
 Lecturer: Janne Sorsa, special lecturer
 Contents: The course deals with numerical methods together with the main computer programs of optimization. The emphasis is on their reliability and performance. In addition the most common optimization packages are introduced.
 Requirements: Assignment and active lecture participation.
 Literature: I. Maros: *Computational Techniques of the Simplex Method*, Kluwer Academic Publishers, Boston, 2003.
 Prerequisites: Mat-2.2105 or Mat-2.140
 Language: Finnish

Mat-2.177 Seminar on Case Studies in Operation Research

(3-4 ocr) P V
 Spring
 Lecturer: Prof Ahti Salo
 Contents: Teamwork will be practised in the context of technoeconomic projects. Construction and application of models, planning and execution of projects. Excursions to firms and research organizations.
 Requirements: Assignments.
 Prerequisites: 1st and 2nd year mathematics, Mat-2.2105 and applied probability
 Language: Finnish

Mat-2.191 Postgraduate Seminar on Applied Mathematics

(1-6 ocr) P V
 Autumn
 Lecturer: Prof Harri Ehtamo and JAnne Karelahti, researcher
 Contents: Seminar on topics of current interest in systems and operations research, mainly for postgraduate but also for undergraduate students. The course can be taken repeatedly. The annually variable topic is announced separately at the beginning of the term.
 Requirements: Seminar presentation, homework exercises and attendance.
 Additional: This autumn the subject of the seminar is stochastic dynamic optimization
 Language: Finnish

Mat-2.192 Systems Research Seminar (0.5-6 ocr) P V

The arrangement will be announced later.
 Lecturer: Prof Raimo P. Hämmäläinen
 Contents: Presentations on new topics and problems in systems analysis, decision making and risk management given by participants and visitors.
 Requirements: Varies annually

Language: Finnish

Mat-2.193 Independent Studies in Systems Analysis and Applied Mathematics (0.5-6 ocr) P V

Autumn & spring
 Lecturer: Prof Harri Ehtamo, Prof Raimo P. Hämmäläinen, Prof Esa Saarinen, Prof Ahti Salo and Kai Virtanen, researcher
 Contents: For those who cannot take part in lectures there are suitable entities for independent studies on technology forecasting, environment valuation, multivariate methods, multiple criteria optimization. Courses and exams can only be taken during the terms by contacting the lecturer responsible.
 Language: Finnish

Mat-2.194 Summer School in Systems Science (0.5-6 ocr) P V

Lecturer: Sebastian Slotte, researcher
 Contents: Postgraduate and advanced course deals with topics of current interest in systems research given by visiting professionals. The topic for this year is dialogical methods in learning organizations, natural resources management, problem structuring and in leadership of different human systems.
 Additional: Credits for the course can also be earned by passing courses of the graduate school in Systems analysis, decision making and risk management, see www.sal.tkk.fi/tutkijakoulu/dialogi/.
 Language: Finnish

Mat-2.195 Web-based Courses in Systems Analysis (0.5-6 ocr) P V

Autumn & spring
 Lecturer: Kai Virtanen, researcher
 Contents: Independent studies with Web-based teaching material produced by the Systems Analysis Laboratory and selected foreign universities. Currently courses (compensation in parentheses) on the following topics are available: nonlinear programming (Mat-2.139), theory of linear systems, mathematical modelling (Mat-2.130) and multiple criteria optimization (Mat-2.153).
 Requirements: Exam or homework.
 Language: Finnish or English

Mat-2.198 Seminar of Creative Problem Solving (0.5-6 ocr) P V

Autumn
 Lecturer: Prof Esa Saarinen and Prof Raimo P. Hämmäläinen
 Contents: Suitable for both undergraduate and graduate students. Themes change annually. Students are introduced to the essentials and key methods of creative problem solving.
 Requirements: Seminar presentation, active participation and essay.
 Language: Finnish

Tfy-0 ORIENTATION COURSE FOR STUDIES AND THE DEGREE PROGRAMME'S BASIC PHYSICS COURSES**Courses credited in ECTS****Tfy-0.1011 Physics IA** (4 cr)

Autumn (Period I, second part)
 Lecturer: Prof Juhani von Boehm
 Contents: Basic physics for physics students: dynamics of many particle systems, momentum and energy quantities, conservation laws.
 Requirements: Exam.
 Literature: Mansfield, O'Sullivan, *Understanding Physics*.

Intended for the degree programme TFM and the students selected into the extended curriculum in basic studies.

Additional: Replaces the first part of the course Tfy-0.101 Physics I. The same textbook is used in Tfy-0. courses Physics I-III.

Language: Finnish

Tfy-0.1012 Physics IB (4 cr)

Autumn (Period II)

Lecturer: Prof Juhani von Boehm

Contents: Basic physics for physics students: rigid body dynamics, special relativity, dynamics of continuous systems, thermodynamics and statistical physics.

Requirements: Exam.

Literature: Mansfield, O'Sullivan, Understanding Physics.

Intended for the degree programme TFM and the students selected into the extended curriculum in basic studies.

Additional: Replaces the second part of the course

Tfy-0.101 Physics I.

Language: Finnish

Tfy-0.1023 Physics IIA (5 cr)

Spring (Period III)

Lecturer: Jouko Lahtinen, Docent

Contents: Basic physics for physics students: Wave motion, quantum mechanics and static electric fields.

Requirements: Exam.

Literature: Mansfield, O'Sullivan, Understanding Physics.

Intended for the degree programme TFM and the students selected into the extended curriculum in basic studies.

Additional: Replaces the first part of the course

Tfy-0.102 Physics II.

Language: Finnish

Tfy-0.1024 Physics IIB (5 cr)

Spring (Period IV)

Lecturer: Jouko Lahtinen, Docent

Contents: Basic physics for physics students: magnetic fields and electromagnetism.

Requirements: Exam.

Literature: Mansfield, O'Sullivan, Understanding Physics.

Intended for the degree programme TFM and the students selected into the extended curriculum in basic studies.

Additional: Replaces the second part of the course

Tfy-0.102 Physics II.

Language: Finnish

Tfy-0.2011 Physics IIIA (5 cr)

Autumn (Period I)

Lecturer: N.N.

Contents: Basic physics for physics students: Introduction to quantum physics.

Requirements: Exam.

Literature: Mansfield, O'Sullivan, Understanding Physics.

Additional: Replaces the first part of the course

Tfy-0.201 Physics III. Intended for the degree programme TFM and the students selected into the extended curriculum in basic studies.

Language: Finnish

Tfy-0.2012 Physics IIIB (5 cr)

Autumn (Period II)

Lecturer: N.N.

Contents: Basic physics for physics students: Introduction to structure of matter.

Requirements: Exam.

Literature: Mansfield, O'Sullivan, Understanding Physics.

Intended for the degree programme TFM and the students selected into the extended curriculum in basic studies.

Additional: Replaces the latter part of the course

Tfy-0.201 Physics III.

Language: Finnish

Tfy-0.2113 Theoretical Mechanics (5 cr)

Spring (Period III)

Lecturer: Prof Juhani von Boehm

Contents: Basic theoretical mechanics for physics students: Hamilton's principle, Lagrange's and Hamilton's equations of motion, dynamics of continuous systems, applications.

Requirements: Exam.

Literature: Fetter-Walecka: Theoretical Mechanics of Particles and Continua (Dover).

Intended for the degree programme TFM and the students selected into the extended curriculum in basic studies.

Additional: This course replaces part A of the course Tfy-0.202 Physics IV as well as the course Tfy-3.246 Theoretical mechanics. The same textbook is used in the course

Mat-5.3702 Advanced Course in Theoretical Mechanics.

Language: Finnish

Tfy-0.2124 Quantum Mechanics (5 cr)

Spring (Period IV)

Lecturer: Prof Juhani von Boehm

Contents: Basic course in the formalism of quantum mechanics and its applications: structure of quantum mechanics, Schrödinger's equation, harmonic oscillator, 1-D and central potentials as well as coupling to the electromagnetic field.

Requirements: Exam.

Literature: Will be given later

Intended for the degree programme TFM and the students selected into the extended curriculum in basic studies.

Additional: This course replaces part B of the course

Tfy-0.202 Physics IV. The same textbook will also be used in the course Tfy-0.3211 Advanced course in quantum mechanics.

Language: Finnish

Tfy-0.3131 Thermodynamics (5 cr)

Autumn (Period I), will be lectured for the first time during the academic year 2007-2008.

Lecturer: N.N.

Tfy-0.3141 Electricity and Magnetism (5 cr)

Autumn, will be lectured for the first time during the academic year 2007-2008.

Lecturer: N.N.

Tfy-0.3201 Applied Physics, laboratory course (5 cr)

Autumn + spring, will be lectured for the first time during the academic year 2007-2008.

Lecturer: N.N.

Tfy-0.3211 Follow-up Course in Quantum Mechanics (5 cr)

Autumn, will be lectured for the first time during the academic year 2007-2008.

Lecturer: N.N.

Tfy-0.3223 Statistical Physics (5 cr)

Spring, will be lectured for the first time during the academic year 2007-2008.

Lecturer: N.N.

Tfy-0.3233 Materials Physics I (5 cr)

Spring, will be lectured for the first time during the academic year 2007-2008.

Lecturer: N.N.

Tfy-0.3243 Nuclear and Elementary Particle Physics (5 cr)

Spring, will be lectured for the first time during the academic year 2007-2008.

Lecturer: N.N.

Tfy-0.3252 Soft Matter Physics (5 cr)

Autumn (Period II), will be lectured for the first time during the academic year 2007-2008.

Lecturer: N.N.

Courses credited in ocr

Tfy-0.002 Orientation Course for Studies in Engineering Physics (0.5 ocr)
Autumn + spring

Lecturer: Researchers and teachers of the degree programme in engineering physics, study advisors and Anna-Kaarina Hakala, planning officer

Contents: Degree programmes's tutor guidance. Tutoring aims to motivate students and help them study correctly.

Requirements: Four meetings with the tutor during the first four terms.

Additional: Intended for those studying under the old degree regulations for 1995.

Language: Finnish

Tfy-3 PHYSICS

Prof Pekka Hautojärvi, tel. 451 3100, room Y 229C
Acad Prof Risto Nieminen, tel. 451 3105, room Y 229A
Prof Tapio Ala-Nissilä, tel. 451 5807, room U 107
Prof Martti Puska, tel. 451 3106, room U 202
Prof Juhani von Boehm, tel. 451 3073, room U 216A
Prof Esko Kauppinen, tel. 020 722

Courses credited in ECTS

Tfy-3.1181 Physics IA (3 cr)

Spring (Period III)

Lecturer: Heikki Isomäki, Docent

Contents: Basic engineering physics. Mathematical preliminaries for calculus based physics, vectors, derivatives, integrals and basic differential equations. Work, energy, interactions, conservation laws and fields. Basic mechanical dynamics and electrostatics.

Requirements: Exam.

Literature: D. C. Giancoli, Physics for Scientists and Engineers with Modern Physics, 3rd edition, Prentice Hall.

Intended for the degree programmes KON, ENE, GMA, RYT, RRT, YYT.

Additional: Replaces the first part of the course

Tfy-3.118 Physics I.

Language: Finnish

Tfy-3.1182 Physics IB (3 cr)

Spring (Period IV)

Lecturer: Heikki Isomäki, Docent

Contents: Basic engineering physics. Vibrations and waves. Fluid dynamics. Basic statistical mechanics and thermodynamics.

Requirements: Exam.

Literature: D. C. Giancoli, Physics for Scientists and Engineers with Modern Physics, 3rd edition, Prentice Hall.

Intended for the degree programmes KON, ENE, GMA, RYT, RRT, YYT.

Additional: Replaces the second part of the course

Tfy-3.118 Physics I.

Language: Finnish

Tfy-3.1193 Physics IIA (3 cr)

Autumn (Period I)

Lecturer: Heikki Isomäki, Docent

Contents: Basic engineering physics. Electromagnetic interactions. Dc and ac circuits and components.

Requirements: Exam.

Literature: D. C. Giancoli, Physics for Scientists and Engineers with Modern Physics, 3rd edition, Prentice Hall.

Intended for the degree programmes KON, ENE, GMA, RYT, RRT, YYT.

Additional: Replaces the first part of the course

Tfy-3.119 Physics II.

Language: Finnish

Tfy-3.1194 Physics IIB (3 cr)

Autumn (Period II)

Lecturer: Heikki Isomäki, Docent

Contents: Basic engineering physics. Electromagnetic waves and photon, basic optics. Special theory of relativity. Quantum physics and structure of matter. Nuclear physics.

Requirements: Exam.

Literature: D. C. Giancoli, Physics for Scientists and Engineers with Modern Physics, 3rd edition, Prentice Hall.

Intended for the degree programmes KON, ENE, GMA, RYT, RRT, YYT.

Additional: Replaces the second part of the course

Tfy-3.119 Physics II.

Language: Finnish

Tfy-3.1241 Physics IA (3 cr)

Autumn (Period I)

Lecturer: Petri Salo, Docent

Contents: Basic physics for engineering studies. Kinematics. Dynamics of particles and rigid bodies. Work and energy. Interactions. Conservation laws. Physics' mathematic facilities; vectors, derivation and integration.

Requirements: Exam.

Literature: Young & Freedman: University Physics with Modern Physics (Addison-Wesley) 11th Edition.

Prerequisites: The comprehensive physics course at the Finnish high school level.

Intended for the degree programmes KEM, MTE, PUU, TIK.

Additional: Replaces the first part of the course

Tfy-3.124 Physics I.

Language: Finnish

Tfy-3.1242 Physics IB (3 cr)

Autumn (Period II)

Lecturer: Petri Salo, Docent

Contents: Basic physics for engineering studies. Vibrations and waves. Fluid mechanics. Basic statistical mechanics and thermodynamics.

Requirements: Exam.

Literature: Young & Freedman: University Physics with Modern Physics (Addison-Wesley) 11th Edition.

Prerequisites: The comprehensive physics course at the Finnish high school level.

Intended for the degree programmes KEM, MTE, PUU, TIK.

Additional: Replaces the second part of the course

Tfy-3.124 Physics I.

Language: Finnish

Tfy-3.1253 Physics IIA (3 cr)

Spring (Period III)

Lecturer: Petri Salo, Docent

Contents: Basic physics for engineering studies. Static electric and magnetic fields. Electric current and dc circuits. Electromagnetic induction and ac circuits. Electromagnetic fields in matter.

Requirements: Exam.

Literature: Young & Freedman: University Physics with Modern Physics (Addison-Wesley) 11th Edition.

Prerequisites: The comprehensive physics course at the Finnish high school level.

Intended for the degree programmes KEM, MTE, PUU, TIK.

Additional: Replaces the first part of the course

Tfy-3.125 Physics II.

Language: Finnish

Tfy-3.1254 Physics IIB (3 cr)

Spring (Period IV)

Lecturer: Petri Salo, Docent

Contents: Basic physics for engineering studies. Electromagnetic waves. Basic optics. Special theory of relativity. Quantum physics. Nuclear physics. Structure of matter.

Requirements: Exam.

Literature: Young & Freedman: University Physics with Modern Physics (Addison-Wesley) 11th Edition.

Prerequisites: The comprehensive physics course at the Finnish high school level.

Intended for the degree programmes KEM, MTE, PUU, TIK.

Additional: Replaces the second part of the course

Tfy-3.125 Physics II.

Language: Finnish

Tfy-3.1361 Physics IA (3 cr)

Autumn (Period I)

Lecturer: Jonatan Slotte, Docent

Contents: Basic physics for engineering studies. Kinematics. Dynamics of particles and rigid bodies. Work and energy. Interactions. Conservation laws. Physics' mathematic facilities; vectors, derivation and integration.

Requirements: Exam.

Literature: Young & Freedman: University Physics with Modern Physics (Addison-Wesley) 11th Edition.

Prerequisites: The comprehensive physics and mathematics at the Finnish high school level.

Intended for the degree programmes KEM, GMA, KON, ENE,

Additional: Replaces the first part of the course

Tfy-3.136 Physics I.

Language: Swedish

Tfy-3.1362 Physics IB (3 cr)

Autumn (Period II)

Lecturer: Jonatan Slotte, Docent

Contents: Basic physics for engineering studies. Vibrations and waves. Fluid mechanics. Basic statistical mechanics and thermodynamics.

Requirements: Exam.

Literature: Young & Freedman: University Physics with Modern Physics (Addison-Wesley) 11th Edition.

Prerequisites: The comprehensive physics and mathematics at the Finnish high school level.

Intended for the degree programmes KEM, GMA, KON, ENE, MTE, PUU, RYT, RRT, YTT, TIK, TUO.

Additional: Replaces the second part of the course

Tfy-3.136 Physics I.

Language: Swedish

Tfy-3.1373 Physics IIA (3 cr)

Spring (Period III)

Lecturer: Jonatan Slotte, Docent

Contents: Basic physics for engineering studies. Static electric and magnetic fields. Electric current and dc circuits. Electromagnetic induction and ac circuits. Electromagnetic fields in matter.

Requirements: Exam.

Literature: Young & Freedman: University Physics with Modern Physics (Addison-Wesley) 11th Edition.

Prerequisites: The comprehensive physics and mathematics at the Finnish high school level.

Intended for the degree programmes KEM, KON, ENE, GMA, MTE, PUU, RYT, RRT, YTT, TIK, TUO.

Additional: Replaces the first part of the course

Tfy-3.137 Physics II.

Language: Swedish

Tfy-3.1374 Physics IIB (3 cr)

Spring (Period IV)

Lecturer: Jonatan Slotte, Docent

Contents: Basic physics for engineering studies. Electromagnetic waves. Basic optics. Special theory of relativity. Quantum physics. Nuclear physics. Structure of matter.

Requirements: Exam.

Literature: Young & Freedman: University Physics with Modern Physics (Addison-Wesley) 11th Edition.

Prerequisites: The comprehensive physics at the Finnish high school level.

Intended for the degree programmes KEM, KON, ENE, GMA, MTE, PUU, RYT, RRT, YTT, TIK, TUO.

Additional: Replaces the second part of the course

Tfy-3.137 Physics II.

Language: Swedish

Tfy-3.1381 Physics IA (3 cr)

Autumn (Period I), only exercise sessions

Lecturer: Sigridur Gylfadottir, M.Sc.

Contents: Basic physics for engineering studies. Kinematics. Dynamics of particles and rigid bodies. Work and energy. Interactions. Conservation laws. Physics' mathematic facilities; vectors, derivation and integration.

Requirements: Exam.

Literature: Young & Freedman: University Physics with Modern Physics (Addison-Wesley) 11th Edition.

Intended for the degree programmes KEM, GMA, KON, ENE, MTE, PUU, RYT, RRT, YTT, TIK.

Additional: Replaces the first part of the course

Tfy-3.138 Physics I.

Language: English

Tfy-3.1382 Physics IB (3 cr)

Autumn (Period II), only exercise sessions

Lecturer: Sigridur Gylfadottir, M.Sc.

Contents: Basic physics for engineering studies. Vibrations and waves. Fluid mechanics. Basic statistical mechanics and thermodynamics.

Requirements: Exam.

Literature: Young & Freedman: University Physics with Modern Physics (Addison-Wesley) 11th Edition.

Intended for the degree programmes KEM, GMA, KON, ENE, MTE, PUU, RYT, RRT, YTT, TIK.

Additional: Replaces the second part of the course

Tfy-3.138 Physics I.

Language: English

Tfy-3.1393 Physics IIA (3 cr)

Spring (Period III), only exercise sessions

Lecturer: Sigridur Gylfadottir, M.Sc.

Contents: Basic physics for engineering studies. Static electric and magnetic fields. Electric current and dc circuits. Electromagnetic induction and ac circuits. Electromagnetic fields in matter.

Requirements: Exam.

Literature: Young & Freedman: University Physics with Modern Physics (Addison-Wesley) 11th Edition

Intended for the degree programmes KEM, KON, ENE, GMA, MTE, PUU, RYT, RRT, YTT, TIK.

Additional: Replaces the first part of the course

Tfy-3.139 Physics II.

Language: English

Tfy-3.1394 Physics IIB (3 cr)

Spring (Period IV), only exercise sessions

Lecturer: Sigridur Gylfadottir, M.Sc.

Contents: Basic physics for engineering studies. Electromagnetic waves. Basic optics. Special theory of relativity. Quantum physics. Nuclear physics. Structure of matter.

Requirements: Exam.

Literature: Young & Freedman: University Physics with Modern Physics (Addison-Wesley) 11th Edition.

Intended for the degree programmes KEM, KON, ENE, GMA, MTE, PUU, RYT, RRT, YYT, TIK.

Additional: Replaces the second part of the course

Tfy-3.139 Physics II

Language: English

Tfy-3.1500 Extended physics laboratory experiments (5 cr)

1st part in period III or IV, 2nd part in period I or II

Lecturer: Jouko Lahtinen, Docent

Objectives: Learning to perform guided experiments, process the measured data, estimate the accuracy and precision, and report the results.

Contents: Twelve experiments on mechanics, thermodynamics, optics, electricity and magnetism, atomic and nuclear physics.

Requirements: Exam and accepted reports.

Prerequisites: Physics I.

Intended for the degree programme TFM.

Additional: Replaces the course Tfy-3.150 Physics, laboratory course.

Language: Finnish

Tfy-3.1530 Concise physics laboratory experiments (2 cr)

Period I, II, III or IV

Lecturer: Jouko Lahtinen, Docent

Objectives: Learning to perform guided experiments, process the measured data, estimate the accuracy and precision, and report the results.

Contents: Four experiments on mechanics, thermodynamics, optics, electricity and magnetism.

Requirements: Exam and accepted reports.

Prerequisites: Physics I.

Intended for the degree programmes KON, ENE, TIK.

Additional: Replaces the course Tfy-3.153 Physics, laboratory course.

Language: Finnish

Tfy-3.1540 Physics, laboratory course I (3 cr)

Period I, II, III or IV

Lecturer: Docent Jouko Lahtinen

Objectives: Learning to perform guided experiments, process the measured data, estimate the accuracy and precision, and report the results.

Contents: Six experiments on mechanics, thermodynamics, optics, electricity, magnetism and radioactivity.

Requirements: Exam and accepted reports.

Prerequisites: Physics I.

Intended for the degree programmes TUO, MTE, AUT, KON, ENE, TIK, GMA.

Additional: Replaces the course Tfy-3.154 Physics, laboratory course.

Language: Finnish

Tfy-3.1550 Physics, laboratory course II (2 cr)

Autumn (Period I or II)

Lecturer: Jouko Lahtinen, Docent

Contents: Six experiments on optics, electricity, atomic and nuclear physics. The courses Tfy-3.1540 and Tfy-3.1550 can replace the Tfy-3.1500.

Requirements: Accepted reports.

Prerequisites: Tfy-3.1540 Physics, laboratory course I.

Additional: Replaces the course Tfy-3.155 Physics, additional laboratory course.

Language: Finnish

Tfy-3.1560 Physics laboratory experiments in English (2-5 cr)

Period I, II, III or IV

Teacher: Jouko Lahtinen, Docent

Goal: Learning to perform guided experiments, process the measured data, estimate the accuracy and precision, and to report the results.

Contents: Mechanics, thermodynamics, optics, electricity and magnetism, atomic and nuclear physics.

Additional: This course can be used to replace any of the courses Tfy-3.15XX. This course replaces Tfy-3.156

Tfy-3.3400 Measurements in Physics (1-4 cr) P V

Autumn & spring

Lecturer: Jouko Lahtinen, Docent

Contents: Personal student exercises in experimental physics, measurement technology and data analysis.

Additional: Replaces course Tfy-3.340 Measurements in Physics.

Language: Finnish

Tfy-3.4311 Materials Physics II (5 cr) P

Autumn, will be lectured for the first time during the academic year 2008-2009

Additional: This course will replace the course

Tfy-3.461 Materials Physics II

Language: Finnish

Tfy-3.4323 Quantum Physics (5 cr) P

Spring, will be lectured for the first time during the academic year 2008-2009

Additional: This course will replace the course

Tfy-44.130 Quantum Mechanics II

Language: Finnish

Tfy-3.4331 Surface Physics (6 cr) P

Autumn (alternate years, will be lectured for the first time autumn 2007)

Lecturer: Jouko Lahtinen, Docent

Contents: Techniques used in surface science, geometric and electronic structure of surfaces, adsorption, desorption and reactions on the surface. Applications to semiconductor and catalysis research.

Requirements: Exam.

Literature: Lüth: Surfaces and Interfaces of Solids.

Additional: This course will replace course

Tfy-3.468 Surface Physics.

Language: Finnish or English

Tfy-3.4343 Nanophysics (5 cr) P

Spring, will be lectured for the first time during the academic year 2008-2009

Language: Finnish

Tfy-3.4351 Biological Physics (5 cr) P

Autumn, will be lectured for the first time during the academic year 2008-2009

Language: Finnish

Tfy-3.4411 Experimental Methods in Physics (5 cr) P

Autumn, will be lectured for the first time during the academic year 2008-2009

Additional: This course will replace the course

Tfy-3.441 Experimental Methods in Physics.

Language: Finnish

Tfy-3.4423 Computational Physics (5 cr) P

Spring, will be lectured for the first time during the academic year 2008-2009

Additional: This course will replace the course

Tfy-3.475 Computer simulation methods in physics

Language: Finnish

Tfy-3.4510 Special Course in Physics (3-10 cr) P V

Lecturer: Prof Martti Puska

Contents: The course is held by the staff or by visiting scientists.

The topics in experimental or computational physics change every year and will be announced separately.
Language: Finnish/English

Tfy-3.4520 Special Course in Theoretical Physics (3-10 cr) P V
Lecturer: Acad Prof Risto Nieminen
Contents: The course is held by the staff or by visiting scientists. The topics of the course change every year (e.g., quantum computing, quantum gases, nanoelectronics, superconductivity) and will be announced separately.
Additional: Replaces the courses Tfy-44.188 Special Course in Materials Physics and Tfy-44.195 Special Course in Engineering Physics.
Language: Finnish/English

Tfy-3.5111 Physics, special assignment (10 cr) V
Autumn & spring,
Additional: Intended for those studying under the new ECTS degree regulations for 2005. (The course Tfy-3.394 is intended for those who study under the old degree regulations for 1995.)
Language: Finnish

Tfy-105.5111 Computational Physics, special assignment (10 cr) V
Autumn & spring,
Additional: Intended for those studying under the new ECTS degree regulations for 2005. (The course Tfy-3.393 is intended for those who study under the old degree regulations for 1995.)
Language: Finnish

Courses credited in ocr

Tfy-3.361 Materials Physics I (4 ocr)
Spring, lectured for the last time during the academic year 2006-2007.
Lecturers: Prof Pekka Hautojärvi and Prof Martti Puska
Contents: Study of atomic structures and properties of solids using quantum mechanics. Bonds in solids. Crystal structures. Diffraction. Lattice vibrations. Thermal properties. Free electrons. Electronic band structures. Motion of electrons. Semiconductors.
Literature: Elliott: The Physics and Chemistry of Solids.
Additional: During academic year 2007-2008 will be replaced by course Tfy-0.3233 Materials Physics I.
Language: Finnish

Tfy-3.363 Introduction to Soft Matter Physics (3 ocr)
Autumn, lectured for the last time during the academic year 2006-2007.
Lecturer: Emppu Salonen, PhD
Contents: The course provides the essentials of soft matter systems (including polymers, colloids, liquid crystals, surface active agents, lipids and biological systems). The basics of statistical physics and thermodynamics, the structure and physicochemical properties, interactions, research methods for studies of soft matter, applications. The course provides a foundation for follow-up courses dealing with soft matter systems and statistical physics.
Literature: As is suited Ian W. Hamley, Introduction to Soft Matter (John Wiley, 2000) and Richard A. L. Jones, Soft Condensed Matter (Oxford, 2002) together with lecture notes.
Language: Finnish

Tfy-3.365 Statistical Physics and Thermodynamics (5 ocr)
Spring, lectured for the last time during the academic year 2006-2007.
Lecturer: Prof Tapio Ala-Nissilä
Contents: A systematic treatment of equilibrium thermodynamics and statistical physics of many-particle systems. Review and deepening of basic concepts in equilibrium thermodynamics. Thermodynamics of phase transitions. Review of probability theory. Fundamental concepts in statistical physics and ensemble

theory. Statistical properties of classical and quantum harmonic oscillators. Ideal bosonic and fermionic quantum gases. Microscopic theory of phase transitions. Introduction to hydrodynamics and transport theory.

Requirements: Two mid-term exams or a final exam.
Literature: L. E. Reichl, A Modern Course in Statistical Physics, Second Edition (Wiley 1998). Jouko Arponen, Statistinen fysikka (Limes 1994).
Additional: Replaces courses Tfy-44.127 Statistical Physics and Thermodynamics and Tfy-3.364 Statistical Physics and Thermodynamics.
Language: English

Tfy-3.393 Computational Physics, special assignment (5 ocr) V
Autumn (Period I & Period II) & spring (period III & Period IV)
Lecturer: Acad Prof Risto Nieminen, Prof Martti Puska, Prof Tapio Ala-Nissilä, Prof Juhani von Boehm
Contents: Special assignments are independent research or programming projects, literature reviews etc within the field of the chair of Physics, Tfy-3. There are special guidelines for performing the assignments. The role of the special assignments is explained more closely in the description of the Master's degree.
Language: Finnish

Tfy-3.394 Physics, special assignment (5 ocr) V
Autumn (Period I & Period II) & spring (period III & Period IV)
Lecturer: Prof Pekka Hautojärvi, Jouko Lahtinen, Docent
Contents: Special assignments are independent experiments, programming tasks, literature surveys on the topics of applied physics. There are special guidelines for performing the assignments.
Additional: Replaces course Tfy-3.392 Applied Physics, special assignment.
Language: Finnish

Tfy-3.401 Advanced Mathematical Methods in Physics I (4 ocr) P
Autumn, lectured for the last time during the academic year 2007-2008.
Lecturer: Prof Tapio Ala-Nissilä
Objectives: Deepening of the mathematical concepts and techniques needed in theoretical physics. Recommended for advanced undergraduate and graduate students.
Contents: Vectors, tensors and matrices in physics. Calculus of variations. Vector spaces in physics. Complete orthonormal sets of functions in Hilbert space. Mathematical foundations of quantum mechanics.
Literature: F. W. Byron and R. W. Fuller: Mathematics of Classical and Quantum Physics vol. I.
Additional: Seminar course (no exam).
Language: English

Tfy-3.402 Advanced Mathematical Methods in Physics II (4 ocr) P
Spring, study group, lectured for the last time during the academic year 2007-2008.
Lecturer: Prof Tapio Ala-Nissilä
Objectives: Deepening of the mathematical concepts and techniques needed in theoretical physics. Recommended for advanced undergraduate and graduate students.
Contents: Theory of analytic functions. Green's functions. Integral equations. Integral equations in Hilbert space. Group theory.
Literature: F. W. Byron and R. W. Fuller: Mathematics of Classical and Quantum Physics vol. II.
Language: English

Tfy-3.441 Experimental Methods in Physics (4 ocr) P V
Autumn, lectured for the last time during the academic year 2007-2008.

Lecturer: Filip Tuomisto, D.Sc. (Tech.)
 Contents: Common sensors, amplifiers, filters and measurement systems for experimental physics. Vacuum technology and thermometry. Computer-aided experiments and data analysis.
 Additional: Replaces courses Tfy-3.245 Experimental Methods in Physics and Tfy-3.341 Experimental Methods in Physics
 Language: Finnish

Tfy-3.461 Materials Physics II (5 ocr) P
 Autumn, lectured for the last time during the academic year 2007-2008.

Lecturer: Prof Martti Puska
 Contents: Selected topics in advanced materials physics: Collective phenomena in electron gas, magnetism, superconductivity, dielectric properties, lattice defects, low-dimensional systems.
 Literature: Elliott: The Physics and Chemistry of Solids; Ibach, Lüth: Solid State Physics; Ashcroft-Mermin: Solid State Physics.
 Prerequisites: Tfy-3.361.
 Language: Finnish or English

Tfy-3.462 Advanced Topics in Biological and Soft-Matter Systems (4 ocr) P
 Autumn (alternate years, not lectured in autumn 2006), lectured for the last time during the academic year 2007-2008.

Lecturer: N.N.
 Contents: Basics of thermodynamics and statistical physics of equilibrium and non-equilibrium systems, with emphasis and applications to biological and soft condensed matter systems. Modeling of random processes and dynamical phenomena in biological matter.
 Language: English

Tfy-3.469 Physics of Soft Condensed Matter (4 ocr) P V
 Spring, not lectured in spring 2007, lectured for the last time during the academic year 2007-2008.

Lecturer: Mikko Alava, Docent
 Contents: Structure of soft matter. Liquid crystals and their thermodynamics. Landau theory and its failure through fluctuations. Scaling and criticality. Rudimentary field theory. Elasticity of non-crystalline matter. Physics of interfaces/surfaces.
 Literature: Lectures follow roughly the book Chaikin & Lubensky: Principles of Condensed Matter Physics.
 Additional: Replaces course Tfy-3.269 Physics of Soft Condensed Matter.
 Language: English

Tfy-3.475 Computer simulation methods in physics (4 ocr) P
 Spring and a special assignment, lectured for the last time during the academic year 2007-2008.

Lecturer: Ari Harju, Docent
 Contents: The course involves various ways to use computers to solve physical problems. The aim is to provide an overview of the field and discuss various simulation techniques of both classical and quantum systems, ranging from Monte Carlo calculation of integrals to electronic structure calculations of quantum systems. Actual implementations are presented using Fortran 90/95 programming language (no need of previous knowledge of it).
 Requirements: A guided programming assignment is needed to pass the course.
 Literature: J.M. Thijssen: Computational Physics.
 Additional: Replaces course Tfy-3.275 Computer simulation methods in physics.
 Language: English

Tfy-3.478 Modern Methods in Statistical Physics (4 ocr) P
 Autumn (alternate years, not lectured in 2006), lectured for the last time during the academic year 2007-2008.

Lecturer: Prof Tapio Ala-Nissilä
 Objectives: Systematic treatment of advanced techniques in statistical physics. Recommended for advanced undergraduate and graduate students.

Contents: Review of thermodynamics and statistical physics. Percolation theory and thermodynamics of interfaces. Fundamentals of phase transitions. Critical phenomena in fluids. Landau theory. Fluctuations and the breakdown of Landau theory. Anomalous dimensions. Scaling theory. The renormalization group. Special topics.

Literature: N. Goldenfeld: Lectures on Phase Transitions and the Renormalization Group.
 Additional: Replaces course Tfy-3.278 Modern Methods in Statistical Physics
 Language: English

Tfy-3.480 Microsensing (3 ocr) P

Spring, lectured for the last time during academic year 2007-2008.

Lecturer: Prof Aarne Oja, and Pekka Pursula, M.Sc.
 Contents: Design, optimization and readout techniques of modern microsensors based on silicon micromachining and other high-volume production technologies. Examples include capacitive MEMS sensors, wireless and optical sensors, biosensors.
 Additional: During academic year 2008-2009 will be replaced by course Tfy-125.4480 Microsensing (5 cr)
 Language: English

Tfy-3.484 Undergraduate Seminar in Physics (2 ocr) V

Spring, lectured for the last time during the academic year 2007-2008.

Teachers: Prof Esko Kauppinen and Prof Matti Kaivola
 Contents: Students practice to prepare and give a seminar talk and to participate in the discussion. The subject of the talk is a student's own research project or a topical subject in physics.

Tfy-3.485 Physics Research Seminar (3 ocr) P V

Autumn + spring, arranged for the last time during the academic year 2007-2008.

Lecturer: Mikko Alava, Docent
 Contents: Seminar series on current topics in physics and its applications, with contributions by both invited speakers, post-doctoral and postgraduate researchers.
 Additional: Replaces course Tfy-3.285 Physics Research Seminar.
 Language: Finnish/English

Tfy-3.491 Individual Studies in Physics (1-6 ocr) P V

Lecturer: Prof Pekka Hautiojärvi, Acad Prof Risto Nieminen, Prof Martti Puska, Prof Tapio Ala-Nissilä, Prof Juhani von Boehm and Prof Esko Kauppinen

Contents: The study period can include topics not covered by the regular curriculum. The contents and requirements for the individual study period have to be agreed upon by the teachers responsible.
 Language: Finnish/English

Tfy-3.495 Summer School in Physics (1-6 ocr) P V

Spring (Period IV), arranged for the last time during the academic year 2007-2008.

Lecturer: Acad Prof Risto Nieminen
 Contents: Postgraduate course on current research topics, usually in the form of a week-long workshop. Teachers include both Finnish and foreign experts.
 Language: Finnish/English

Tfy-44.126 Quantum Mechanics I (4 ocr)

Autumn, lectured for the last time during the academic year 2006-2007.

Lecturer: Sami Virtanen, D.Sc. (Tech.)
 Contents: An in-depth course on the foundations and calculational methods in quantum mechanics. Schrödinger's equation with applications, angular momentum, perturbation theory.
 Requirements: Two mid-term exams or a final exam.

Literature: F. Schwabl: Quantum Mechanics
Prerequisites: Tfy-0.202
Language: Finnish (English on demand)

Tfy-44.130 Quantum Mechanics II (4 ocr)

Spring, lectured for the last time during the academic year 2007-2008.
Lecturer: Sami Virtanen, D.Sc. (Tech.)
Contents: Applications of quantum mechanics: particles in an electromagnetic field, perturbation theory and scattering theory, many-particle systems and relativistic quantum mechanics.
Literature: F. Schwabl: Quantum Mechanics ;
F. Schwabl: Advanced Quantum Mechanics
Prerequisites: Tfy-44.126
Additional: During academic year 2008-2009 will be replaced by course Tfy-3.4323 Quantum Physics.
Language: Finnish (English on demand)

Tfy-44.135 Quantum Mechanics III (4 ocr) P

Lectures will be announced later.
Lecturer: Sami Virtanen, D.Sc. (Tech.)
Contents: Basic group theory, representations of groups, the symmetric group, continuous groups. Point groups. Applications in solid state physics and particle physics, symmetries of space and time, SU(2), SU(3).
Requirements: can be studied using self-access material
Prerequisites: Tfy-44.126
Language: Finnish (English on demand), course material only provided in Finnish.

Tfy-44.180 Research Seminar on Low Temperature Physics (2 ocr) P V

Autumn & spring
Lecturer: Prof Matti Krusius
Contents: The study of problems in connection with research in low temperature physics (graduate students).
Requirements: High attendance and two presentations.
Language: Finnish (English on demand)

Tfy-44.198 Materials Physics, special assignment (5 ocr) V

Autumn & spring
Lecturer: Sami Virtanen, D.Sc. (Tech.) (in charge)
Contents: The special assignments are independent laboratory assignments, planning jobs, literature reviews, etc. from the subject areas of Tfy-44. There are written instructions on how to fulfil these assignments. The role of the special assignments is explained more closely in the description of the Master's degree.
Language: Finnish (English on demand)

Tfy-56 ADVANCED ENERGY SYSTEMS

Prof Rainer Salomaa, tel. 451 3199, room K405
Prof Peter Lund, tel. 451 3197, room K406
<http://www.tkk.fi/Units/AES/>

Courses credited in ECTS

Tfy-56.4113 Advanced Energy Technologies, laboratory course (5 cr)

Spring, will be organized for the first time during the academic year 2008-2009
Lecturers: Prof Rainer Salomaa, Prof Peter Lund
Contents: Supervised laboratory projects on nuclear physics, on the operation of nuclear reactors, and on new energy sources.
Language: Finnish

Tfy-56.4211 Introduction to Nuclear Engineering (5 cr)

Autumn, will be lectured for the first time during the academic year 2008-2009
Lecturer: Prof Rainer Salomaa

Contents: Introduction to nuclear-reactor physics and engineering, fuel cycle, safety and some special issues on nuclear power.
Literature: Lamarsh: Introduction to Nuclear Engineering
Additional: This course will replace the course Tfy-56.126 Introduction to Nuclear Engineering
Language: Finnish

Tfy-56.4221 Introduction to Nuclear Reactors (5 cr)

Autumn, will be lectured for the first time during the academic year 2008-2009
Lecturer: Prof Rainer Salomaa
Contents: Introduction to nuclear-reactor physics and engineering for students from other departments than Dept. of Eng. Phys. and Math.
Literature: Lamarsh: Introduction to Nuclear Engineering.
Additional: This course will replace the course Tfy-56.128 Introduction to Nuclear Reactors
Language: Finnish

Tfy-56.4232 Radiation Physics and Radiation Safety (5 cr)

Autumn (Period II), will be lectured for the first time during the academic year 2008-2009
Lecturer: Prof Rainer Salomaa.
Contents: Risks due to ionizing radiation and protection methods. The course provides a formal competence for radiation use. A separate certification for passing the course is given.
Additional: This course will replace the course Tfy-56.112 Radiation and Safety
Language: Finnish

Tfy-56.4243 Nuclear Engineering, advanced course (5 cr) P

Spring, will be lectured for the first time during the academic year 2008-2009
Lecturer: Prof Rainer Salomaa
Contents: Advanced course on nuclear-reactor physics and engineering, fuel cycle, safety and special issues on nuclear power.
Literature: Duderstadt, Hamilton: Nuclear Reactor Analysis.
Additional: This course will replace the course Tfy-56.130 Nuclear Engineering, advanced course
Language: Finnish

Tfy-56.4311 New Energy Sources (5 cr) P

Autumn, will be lectured for the first time during the academic year 2008-2009
Lecturer: Prof Peter Lund
Contents: Renewable energy sources: trends, technical realizations, dynamics of technology change, physical limitations, and penetration models. Biomass, wind, solar, hydrogen, energy efficiency technologies.
Literature: T.B. Johansson et al.: Renewable Energy
Additional: This course will replace the course Tfy-56.160 Technology for New Energy Sources
Language: Finnish

Tfy-56.4323 Solar Energy Engineering (5 cr) P

Spring, will be lectured for the first time during the academic year 2008-2009
Lecturer: Prof Peter Lund
Contents: Physical foundations and practical applications of solar energy. Solar radiation, new materials, solar collectors, storage of energy, photovoltaic systems, solar heating, space applications, remote systems. Cases and projects.
Literature: Duffie, Beckman: Solar Thermal Engineering Processes.
Additional: This course will replace the course Tfy-56.138 Solar Energy Engineering
Language: Finnish

Tfy-56.4332 Fuel Cells and Hydrogen Technology (5 cr) P

Autumn (Period II), will be lectured for the first time during the academic year 2008-2009

Lecturer: Prof Peter Lund, Tero Hottinen, D. Sc. (Tech.)
 Contents: This course gives an introduction to the physical foundations of fuel cells, their operational principle, and practical applications as well as to the key areas of hydrogen technology.
 Language: Finnish

Tfy-56.4344 Advanced Wind Power Technology (5 cr) P
 Spring (Period IV), will be lectured for the first time during the academic year 2008-2009
 Lecturer: Prof Peter Lund
 Contents: This course gives an introduction to the large-scale exploitation of wind power.
 Language: Finnish

Tfy-56.4414 Fusion Energy Technology (5 cr)
 Spring (Period IV), will be lectured for the first time during the academic year 2008-2009
 Lecturer: Prof Rainer Salomaa
 Contents: Introduction to fusion reactors and fusion technology.
 Language: Finnish

Tfy-56.4423 Plasma Physics (5 cr) P
 Spring, will be lectured for the first time during the academic year 2008-2009
 Lecturer: Prof Rainer Salomaa
 Contents: Theoretical foundations of plasma physics and its application to issues related to fusion reactors.
 Additional: This course will replace the course Tfy-56.139 Plasma Physics and Fusion Reactors
 Language: Finnish

Tfy-56.5111 Advanced Energy Technologies, special assignment (10 cr) V
 Autumn & spring
 Lecturer: Prof Rainer Salomaa, Prof Peter Lund
 Contents: Special assignments are unique, independent laboratory measurements, design tasks, literature reviews etc. within the range of the chair Tfy-56. There are specific instructions on the procedure for doing special assignments. The role of the special assignments is explained more closely in the description of the Master's degree.
 Additional: Intended for those studying under the new ECTS degree regulations for 2005. (The course Tfy-56.198 is intended for those who study under the old degree regulations for 1995.)
 Language: Finnish, Swedish or English

Tfy-56.5121 Special Course in Advanced Energy Technologies (5 cr) P V
 Autumn & spring
 Lecturer: Prof Rainer Salomaa, Prof Peter Lund
 Contents: Special course whose topic changes yearly; given possibly by a guest lecturer.
 Language: Finnish or English

Tfy-56.5131 Individual Studies (1-10 cr) V
 Lecturer: Prof Rainer Salomaa, Prof Peter Lund
 Contents: The contents and the scope of Individual Studies are to be settled in advance with the teacher in charge.
 Language: Finnish or English

Courses credited in ocr

Tfy-56.104 Nuclear and Elementary Particle Physics (5 ocr)
 Spring, lectured for the last time during the academic year 2006-2007.

Lecturers: Janne Salo, D.Sc. (Tech.) and Taina Kurki-Suonio, Docent

Contents: The quantum-mechanical structure of matter from microcosmos to macrocosmos: elementary particles, nuclear structure, nuclear reactions, fundamental interactions, and cosmology.

Literature: Krane: Introductory Nuclear Physics, Martin and Shaw: Particle Physics

Prerequisites: Tfy-0.201

Additional: During the academic year 2007-2008 will be replaced by course Tfy-0.3233 Nuclear and Elementary Particle Physics.

Language: Finnish

Tfy-56.112 Radiation and Safety (2 ocr)

Autumn (Period I), lectured for the last time during the academic year 2007-2008.

Lecturer: Prof Rainer Salomaa.

Contents: Risks due to ionizing radiation and protection methods. The course provides a formal competence for radiation use. A separate certification for passing the course is given.

Additional: During the academic year 2008-2009 will be replaced by course Tfy-56.4232 Radiation Physics and Radiation Safety.

Language: Finnish

Tfy-56.126 Introduction to Nuclear Engineering (4 ocr)

Autumn, lectured for the last time during the academic year 2007-2008.

Lecturer: Prof Rainer Salomaa

Contents: Introduction to nuclear-reactor physics and engineering, fuel cycle, safety and some special issues on nuclear power.

Literature: Lamarsh: Introduction to Nuclear Engineering.

Additional: During the academic year 2008-2009 will be replaced by course Tfy-56.4211 Introduction to Nuclear Engineering

Language: Finnish

Tfy-56.127 Nuclear Engineering, laboratory course (3 ocr)

Spring, organized for the last time during the academic year 2006-2007.

Lecturer: Jarmo Ala-Heikkilä, Lic.Sc. (Tech.)

Contents: Supervised laboratory projects on nuclear physics and on the operation of a nuclear reactor.

Prerequisites: Tfy-56.103/Tfy-56.104 and Tfy-56.126 are recommended. At the beginning a radiation safety lecture is given.

Language: Finnish

Tfy-56.128 Introduction to Nuclear Reactors (4 ocr)

Autumn, lectured for the last time during the academic year 2007-2008.

Lecturer: Prof Rainer Salomaa

Contents: Introduction to nuclear-reactor physics and engineering for students from other departments than Dept. of Eng. Phys. and Math.

Literature: Lamarsh: Introduction to Nuclear Engineering.

Additional: During the academic year 2008-2009 will be replaced by course Tfy-56.4221 Introduction to Nuclear Reactors.

Language: Finnish

Tfy-56.130 Nuclear Engineering, advanced course (5 ocr) P
Autumn, on demand, organized for the last time during the academic year 2007-2008.
Lecturer: Prof Rainer Salomaa, Lasse Mattila D.Sc. (Tech.), Seppo Vuori D.Sc. (Tech.)
Contents: Advanced course on nuclear-reactor physics and engineering, fuel cycle, safety and special issues on nuclear power.
Literature: Duderstadt, Hamilton: Nuclear Reactor Analysis.
Prerequisites: Tfy-56.126
Additional: During the academic year 2008-2009 will be replaced by course Tfy-56.4243 Nuclear Engineering, advanced course.
Language: Finnish

Tfy-56.138 Solar Energy Engineering (3 ocr) P
Spring, alternate years, not lectured spring 2007, lectured for the last time spring 2008
Lecturer: Prof Peter Lund
Contents: Physical foundations and practical applications of solar energy. Solar radiation, new materials, solar collectors, storage of energy, photovoltaic systems, solar heating, space applications, remote systems. Cases and projects.
Literature: Duffie, Beckman: Solar Thermal Engineering Processes.
Additional: During the academic year 2008-2009 will be replaced by course Tfy-56.4323 Solar Energy Engineering.
Language: Finnish

Tfy-56.139 Plasma Physics and Fusion Reactors (4 ocr) P
Spring, lectured for the last time spring 2007
Lecturer: Seppo Karttunen, Docent
Contents: Theoretical foundations of plasma physics and its application to issues related to fusion reactors.
Additional: During the academic year 2008-2009 will be replaced by course Tfy-56.4423 Plasma Physics
Language: Finnish

Tfy-56.142 Nuclear and Reactor Physics, advanced laboratory course (2 ocr)
Autumn, organized for the last time during the academic year 2007-2008.
Lecturer: Jarmo Ala-Heikkilä, Lic.Sc. (Tech.)
Contents: Challenging supervised laboratory projects on nuclear and reactor physics.
Prerequisites: Tfy-56.127
Language: Finnish

Tfy-56.160 Technology for New Energy Sources (4 ocr) P
Autumn, alternate years, not lectured autumn 2006, lectured for the last time autumn 2007
Lecturer: Prof Peter Lund
Contents: Renewable energy sources: trends, technical realizations, dynamics of technology change, physical limitations, and penetration models. Biomass, wind, solar, hydrogen, energy efficiency technologies.
Literature: T.B. Johansson et al: Renewable Energy
Additional: During the academic year 2008-2009 will be replaced by course Tfy-56.4311 New Energy Sources.
Language: Finnish

Tfy-56.170 Seminar on Nuclear and Energy Engineering (2 ocr) V
Spring, organized for the last time during the academic year 2007-2008.
Lecturer: Prof Peter Lund
Contents: Special issues and application in nuclear and energy engineering.
Language: Finnish

Tfy-56.173 Special Course in Nuclear and Energy Engineering I (3 ocr) P V
Autumn, organized for the last time during the academic year 2007-2008.
Lecturer: Prof Rainer Salomaa, Prof Peter Lund
Contents: Special course whose topic changes yearly; given possibly by a guest lecturer.
Language: Finnish/English

Tfy-56.174 Special Course in Nuclear and Energy Engineering II (3 ocr) P V
Spring, organized for the last time during the academic year 2007-2008.
Lecturer: Prof Rainer Salomaa, Prof Peter Lund
Contents: Special course whose topic changes yearly; given possibly by a guest lecturer.
Language: Finnish

Tfy-56.176 Seminar on Engineering Physics (1-3 ocr) P V
Autumn & spring
Lecturer: Prof Rainer Salomaa
Contents: Seminar presentations by guest lecturers on current issues and applications in engineering physics. The seminar is common to all the majors and minors of the Option of Engineering Physics.
Language: Finnish

Tfy-56.181 Postgraduate seminar on Nuclear and Energy Engineering (3 ocr) P V
Autumn
Lecturer: Prof Rainer Salomaa, Prof Peter Lund
Contents: Special issues in nuclear and energy engineering. The seminar is suitable for both postgraduate and supplementary studies.
Language: Finnish

Tfy-56.185 Postgraduate Course in Nuclear Engineering (3-6 ocr) P V
Spring
Lecturer: Prof Rainer Salomaa, Prof Peter Lund
Contents: Current issues in nuclear and energy engineering. The course is suitable for both postgraduate and supplementary studies.
Language: Finnish

Tfy-56.191 Individual Studies (1-6 ocr) P V
Lecturer: Prof Rainer Salomaa
Contents: The contents and the scope of Individual Studies are to be settled in advance with the teacher in charge.
Language: Finnish or English

Tfy-56.195 Special Course in Engineering Physics (3-6 ocr) P V
(Period) autumn or spring (minimum student enrolment)
Lecturer: Prof Rainer Salomaa, Prof Peter Lund
Contents: Period course for postgraduate students on a current issue within engineering physics.
Language: Finnish or English

Tfy-56.198 Nuclear and Energy Engineering, special assignment (5 ocr) V
Autumn & spring
Lecturer: Prof Rainer Salomaa, Prof Peter Lund
Contents: Special assignments are unique, independent laboratory measurements, design tasks, literature reviews etc. within the range of the chair Tfy-56. There are specific instructions on the procedure for doing special assignments. The role of the special assignments is explained more closely in the description of the Master's degree.
Language: Finnish, Swedish or English

Tfy-99 BIOMEDICAL ENGINEERING

Prof Ari Koskelainen, tel. 451 3177, room F204
 Prof Pekka Meriläinen, tel. 451 3176, room F206
 Prof Risto Ilmoniemi (pro tem), tel. 451 3170, room F207

Courses credited in ECTS

Tfy-99.1291 Individual Studies (1-15 cr) V

Not organised this academic year.
 Additional: This course will replace the course Tfy-99.291 Individual Studies which is organised this academic year.
 Language: Finnish

Tfy-99.2220 Bioengineering laboratory course (3 cr)

Spring
 Lecturers: Prof Ari Koskelainen, Prof Pekka Meriläinen, Prof Risto Ilmoniemi (pro tem)
 Language: Finnish

Tfy-99.2261 Physiology (5 cr)

Autumn
 Lecturer: Pekka Paalasmaa, Docent, Nina Suni, Lic.Phil., Prof Ari Koskelainen
 Contents: The essential mechanisms of human physiology from cellular to systemic level. Physiology of bioelectrical phenomena, mechanisms for motion, nervous system and sensory mechanisms, biological regulatory and maintenance systems.
 Requirements: Written exam and exercise assignment.
 Literature: Tortora & Grabowski: Principles of Anatomy and Physiology, 10th ed., Wiley.
 Additional: Replaces the course Tfy-99.261 Physiology.
 Language: Finnish

Tfy-99.2262 Living State Physics I (Biophysics) (5 cr)

Spring
 Lecturer: Prof Ari Koskelainen
 Contents: Molecular structure, energetics and dynamics of biological systems, physical factors of the environment, kinetics of biological systems.
 Literature: Nelson, Biological Physics
 Prerequisites: Tfy-99.261 is recommended
 Additional: Replaces the course Tfy-99.262 Living State Physics I (Biophysics)
 Language: Finnish

Tfy-99.3226 Classical Theory of Electricity and Magnetism B (5 cr)

Autumn
 Lecturer: Prof Risto Ilmoniemi (pro tem) (responsible), Prof Emer Toivo Katila
 Contents: Static electric and magnetic fields, energy and force in the fields, Maxwell equations, wave solutions, electromagnetic radiation fields. Introduction to other classical fields.
 Literature: Jack Vanderlinde: Classical Electromagnetic Theory, new edition
 Prerequisites: Tfy-3.121/Tfy-0.102 or a corresponding course
 Language: Finnish

Tfy-99.3227 Electromagnetic Field Theory (5 cr)

Autumn
 Lecturer: Prof Risto Ilmoniemi (pro tem) (responsible), Prof Emer Toivo Katila
 Contents: Static electric and magnetic fields, energy and force in the fields, Maxwell equations, wave solutions, electromagnetic radiation fields. Introduction to other classical fields.

Literature: Jack Vanderlinde: Classical Electromagnetic Theory, new edition
 Prerequisites: Tfy-3.121/Tfy-0.102 or a corresponding course
 Language: Finnish

Tfy-99.3249 Biomedical Engineering, special course (1-3 cr) P V

Autumn or spring, not lectured this academic year.
 Additional: This course will replace the course Tfy-99.249 Biomedical Engineering, special course which is lectured this academic year.
 Language: English or Finnish

Tfy-99.3269 Current Methods and Issues in Monitoring Physiological Systems (5 cr) P

Spring (alternate years, not lectured this academic year)
 Lecturer: Prof Pekka Meriläinen
 Contents: Introduction to key physiological systems and functions of human body, including respiration, gas exchange, circulation, oxygenation and metabolism as well as cardiac and brain function. Current measurement methods and technologies will be presented and discussed in each context with special emphasis in applications and problems of modern clinical monitoring.
 Requirements: Exam
 Literature: To be announced
 Additional: Replaces the course Tfy-99.269 Current methods and issues in monitoring physiological systems.
 Language: English

Tfy-99.3274 Medical Physics II (5 cr)

Spring (alternate years, lectured spring 2007)
 Lecturer: N.N.
 Contents: Physics and techniques of Nuclear Medicine including basics of isotope production, imaging devices, applications of radionuclides in medical imaging, modelling of physiological systems and analyses of 3D-imaging.
 Requirements: Exam
 Literature: Lecture hand-outs. Wagner, Szabo, Buchanan: Principles of Nuclear Medicine, W.B. Saunders, 1995; Jacquez: Compartmental Analysis in Biology and Medicine, The Univ. of Michigan Press, 1988.
 Additional: Replaces the course Tfy-99.274 Medical Physics II
 Language: English

Tfy-99.3275 Biosignal Processing (5 cr) P

Autumn, not lectured this academic year.
 Additional: This course will replace the course Tfy-99.275 Signal Processing in Biomedical Engineering which is lectured this academic year.
 Language: English

Tfy-99.3285 Research Seminar on Biophysics and Biomedical Engineering (3 cr) P V

Autumn & spring, not organised this academic year.
 Additional: This course will replace the course Tfy-99.285 Research Seminar on Biomedical Engineering which is organised this academic year.
 Language: English or Finnish

Tfy-99.3298 Biophysics and Biomedical Engineering, special assignment (7 cr) V

Autumn & spring
 Additional: This course will replace the course Tfy-99.298 Biophysics and Biomedical Engineering, special assignment which is organised this academic year.
 Language: Finnish

Tfy-99.4247 Structure and Functioning of the Human Brain (5 cr) P

Spring (alternate years, not lectured spring 2007)
 Additional: This course will replace the course Tfy-99.247 Structure and Functioning of the Human Brain.

Language: Finnish

Tfy-99.4263 Living State Physics II (Electrophysiology)
(5 cr) P

Autumn, not lectured this academic year.

Additional: This course will replace the course

Tfy-99.263 Living State Physics II (Electrophysiology) which is lectured this academic year.

Language: Finnish

Tfy-99.4264 Living State Physics III (Molecular Biophysics)
(5 cr) P

Spring (alternate years, not lectured this academic year)

Additional: This course will replace the course

Tfy-99.264 Living State Physics III (Molecular Biophysics) which is lectured this academic year.

Language: Finnish

Tfy-99.4271 Medical Physics I (5 cr)

Autumn (alternate years, not lectured this academic year)

Additional: This course will replace the course

Tfy-99.271 Medical Physics I.

Language: Finnish

Tfy-99.4273 Seminar on Biomedical Engineering (3 cr) V

Spring, not organised this academic year.

Additional: This course will replace the course

Tfy-99.273 Seminar on Biomedical Engineering which is organised this academic year.

Language: English

Tfy-99.4280 Medical Imaging Methods (5 cr) P

Autumn (alternate years, lectured autumn 2006)

Lecturer: Prof Pekka Meriläinen (responsible)

Contents: Basics of computerized tomography. Fundamentals of digital radiography, x-ray computer aided tomography, nuclear scanning, magnetic resonance imaging, ultrasound imaging, and impedance tomography. Both methodology and instrumentation are reviewed.

Requirements: Exam and synopsis on selected topics.

Additional: Replaces the course Tfy-99.280 Medical Imaging Methods.

Language: Finnish

Tfy-99.4281 Image Processing in Biomedical Engineering
(5 cr) P

Spring (alternate years, not lectured this academic year)

Additional: This course will replace the course

Tfy-99.281 Image Processing in Biomedical Engineering.

Language: Finnish

Tfy-99.4282 Functional Imaging in Biomedical Engineering
(5 cr) P

Spring (alternate years, lectured spring 2007)

Lecturer: Prof Risto Ilmoniemi (pro tem)

Contents: The course describes functional imaging methods, especially functional magnetic resonance imaging of the brain.

Requirements: Exam, assignment and demonstrations.

Literature: To be announced later.

Prerequisites: Tfy-99.280/Tfy-99.4282+-

Additional: This course will replace the course

Tfy-99.282 Functional Imaging in Biomedical Engineering.

Language: Finnish

Tfy-99.4283 Methods in Cellular Biophysics (5 cr) P

Spring (alternate years, not lectured this academic year)

Lecturers: Prof Ari Koskelainen and visiting lecturers

Language: English

Tfy-99.4284 Postgraduate Course in Biophysics (3-6 cr) P V

Autumn (alternate years, not lectured this academic year)

Additional: This course will replace the course

Tfy-99.284 Postgraduate Course in Biophysics.

Language: Finnish

Tfy-99.5111 Biophysics and Biomedical Engineering, special assignment (10 cr) V

Autumn & spring

Intended for those studying under the new ECTS degree regulations for 2005. (The course Tfy-99.298 is intended for those who study under the old degree regulations for 1995.)

Courses credited in ocr

Tfy-99.219 Applied Physics, laboratory course (2 ocr)

Spring

Lecturer: Prof Risto Ilmoniemi (pro tem)

Contents: Getting acquainted with selected laboratory assignments and practical studies on them. A report must be written on every assignment.

Language: Finnish

Tfy-99.225 Classical Theory of Electricity and Magnetism
(5 ocr)

Autumn

Lecturer: Prof Risto Ilmoniemi (pro tem) (responsible), Prof Emer Toivo Katila

Contents: Static electric and magnetic fields, energy and force in the fields, Maxwell equations, wave solutions, electromagnetic radiation fields. Introduction to other classical fields.

Literature: Jack Vanderlinde: Classical Electromagnetic Theory, new edition

Prerequisites: Tfy-3.121/Tfy-0.102 or a corresponding course

Language: Finnish

Tfy-99.247 Structure and Functioning of the Human Brain
(3 ocr) P

Spring (alternate years, not lectured spring 2007)

Lecturer: Prof Risto Ilmoniemi (pro tem)

Contents: Anatomy of the brain, neurons, action potential, synaptic transmission, visual, auditory, sensory and motor cortices, electric and magnetic signals from the brain, transcranial magnetic stimulation, information processing, memory. Part of the material is available on the internet.

Literature: Nicholls, Martin, Wallace, Fuchs: From Neuron to Brain

Language: Finnish

Tfy-99.249 Biomedical Engineering, special course (1-3 ocr) P V

Autumn or spring

Lecturer: N.N.

Contents: The subject changes yearly.

Language: English or Finnish

Tfy-99.263 Living State Physics II (Electrophysiology)

(3-4 ocr) P

Autumn

Lecturer: Prof Ari Koskelainen

Contents: Electrophysiological techniques, transport mechanisms in cell membranes, mechanisms of bioelectrical signals and learning phenomena.

Requirements: Written exam and exercise.

Literature: Johnston & Wu: Foundations of Cellular Neurophysiology and lecture notes.

Prerequisites: Tfy-99.262 is recommended

Additional: Replaces course Tfy-99.268 Electrophysiology

Language: Finnish

Tfy-99.264 Living State Physics III (Molecular Biophysics)
(4 ocr) P

Spring (alternate years, lectured spring 2007)
Lecturer: Prof Ari Koskelainen (responsible), Prof Arto Annala, Prof Ilpo Vattulainen

Contents: Biological and synthetic macromolecules. Structure and basics of physical properties. Molecular interactions and their modification. Functionality of macromolecules.

Literature: M Daune: Molecular Biophysics, Structures in Motion, Oxford University Press Inc., New York, 1999 and lecture notes.

Prerequisites: Tfy-99.262 is recommended

Additional: Replaces course Tfy-99.267 Functional Macromolecules

Language: Finnish

Tfy-99.271 Medical Physics I (3 ocr)

Autumn (alternate years, not lectured autumn 2006)

Lecturer: Mikko Tenhunen, Docent

Contents: Basics of radiation therapy physics and technology. Biological basis of radiation therapy. Quantities in dosimetry and radiation detectors. Principles of radiotherapy equipment. Modelling of radiation beams. Special techniques and optimization methods in radiotherapy.

Requirements: Exam, exercises and demonstrations.

Literature: Handout

Prerequisites: Tfy-99.280 (recommended, not obligatory)

Language: Finnish

Tfy-99.273 Seminar on Biomedical Engineering (2 ocr) V

Spring

Lecturer: Prof Ari Koskelainen (responsible),

Prof Risto Ilmoniemi (pro tem)

Contents: Student seminar on various topics in biophysics and biomedical engineering. The topics change yearly.

Requirements: Active participation, seminar talk including a written report, and acting as an opponent.

Language: English

Tfy-99.275 Signal Processing in Biomedical Engineering

(3 ocr) P

Autumn

Lecturer: Mark van Gils, Docent

Contents: After providing a brief review of the fundamentals of general (digital) signal processing the course concentrates on modern signal processing techniques used in biomedical applications. Spectral analysis (including higher-order spectra), adaptive filters, artificial neural networks, time-frequency methods and wavelets as well as key issues like artifact detection, feature extraction and pattern recognition are dealt with. Use of the methods is illustrated by practical examples.

Requirements: Exam and exercise.

Literature: To be announced + lecture hand-outs

Prerequisites: T-61.246 (compulsory)

Language: English

Tfy-99.281 Image Processing in Biomedical Engineering

(3 ocr) P

Spring (alternate years, not lectured spring 2007)

Lecturer: Juha Ylä-Jääski, Docent, Jyrki Lötjönen, Docent

Contents: Application of image processing to medical technology. Image pre-processing and segmentation; processing and visualization of volume images. Registration and combination of multimodal images.

Requirements: Exam and assignment.

Literature: Lecture notes

Prerequisites: T-61.247

Tfy-99.284 Postgraduate Course in Biophysics (2-4 ocr) P V

Autumn (alternate years, lectured autumn 2006)

Lecturer: Prof Ari Koskelainen (responsible)

Contents: Variable topics of current interest in biophysics.

Language: Finnish

Tfy-99.285 Research Seminar on Biomedical Engineering

(2 ocr) P V

Autumn & spring

Lecturers: Prof Pekka Meriläinen (responsible), Prof Ari Koskelainen, Prof. Risto Ilmoniemi (pro tem)

Contents: Current research problems in biophysics and biomedical engineering.

Requirements: Active participation and written summary reports.

Language: English or Finnish

Tfy-99.291 Individual Studies (0.5 - 10 ocr) V

Lecturers: Prof Ari Koskelainen, Prof Pekka Meriläinen, Prof Risto Ilmoniemi (pro tem)

Contents: Individual assignments, the contents of which have been agreed with the teacher responsible.

Language: Finnish

Tfy-99.298 Biophysics and Biomedical Engineering, special assignment (5 or) V

Autumn & spring

Lecturers: Prof Ari Koskelainen, Prof Pekka Meriläinen, Prof Risto Ilmoniemi (pro tem)

Contents: The special assignments are independent laboratory work, planning tasks, literature surveys etc within the topics of biophysics and biomedical engineering. There are separate instructions for the assignments. The role of the special assignments is explained more closely in the description of the Master's degree.

Language: Finnish

Tfy-125 OPTICS AND MOLECULAR MATERIALS

Prof Matti Kaivola, tel. 451 3151, Micronova-4161

Acad Prof Olli Ikkala (on leave of absence), tel. 451 3154, room F409

Visiting Prof Gerrit ten Brinke

Courses credited in ECTS**Tfy-125.2013 Modern Chemistry for Physicists** (4 cr)

Spring, will be lectured for the first time during the academic year 2006-2007.

Lecturer: Acad Prof Olli Ikkala

Contents: Physics today needs more and more knowledge about chemistry concerning new materials, soft materials, nanomaterials and materials of biochemistry. This course introduces examples of modern chemistry, such as new nanostructures based on carbon, self-assembly, supramolecular chemistry, surface chemistry, organic electronics, and use of biochemistry in new materials.

Literature: Lecture notes and "Nina Hall: The New Chemistry, Cambridge University Press, 2000" as background reading when applicable.

Language: Finnish

Tfy-125.4001 Nanoscience I: Introduction to Nanoscience

(3 cr)

Autumn (Period I)

Lecturer: Acad Prof Olli Ikkala

Additional: Additional: lectured jointly with University of Helsinki (experts from the Kumpula, Viikki and Meilahti campuses)

Tfy-125.4002 Nanoscience II: Nanostructures (5 cr) L

Autumn (Period II)

Lecturer: Acad Prof Olli Ikkala

Additional: lectured jointly with University of Helsinki (experts from the Kumpula, Viikki and Meilahti campuses)

Tfy-125.4003 Nanoscience III: Molecular Nanoscience (5 cr) L

Spring (Period III)

Lecturer: Acad Prof Olli Ikkala

Additional: lectured jointly with University of Helsinki (experts from the Kumpula, Viikki and Meilahti campuses)

Tfy-125.4004 Nanoscience IV: Bionanoscience (5 cr) L

Spring (Period IV)

Lecturer: Acad Prof Olli Ikkala

Additional: lectured jointly with University of Helsinki (experts from the Kumpula, Viikki and Meilahti campuses)

Tfy-125.4313 Microscopy of Nanomaterials (5 cr) P

Spring, will be lectured for the first time during the academic year 2008-2009.

Additional: This course will replace the course Tfy-125.313 Microscopy of Nanomaterials.

Tfy-125.4321 Laser Technology and Optics (5 cr)

Autumn, will be lectured for the first time during the academic year 2008-2009.

Additional: This course will replace the course Tfy-125.321 Laser Technology and Optics.

Tfy-125.4341 Polymer Physics (5 cr)

Autumn, will be lectured for the first time during the academic year 2008-2009.

Additional: This course will replace the course Tfy-125.312 Polymer Physics.

Tfy-125.4423 Modern Optics (5 cr) P V

Spring, will be lectured for the first time during the academic year 2008-2009.

Additional: This course will replace the course Tfy-125.423 Modern Optics.

Tfy-125.4433 Laser Physics (5 cr) P

Spring, will be lectured for the first time during the academic year 2008-2009.

Additional: This course will replace the course Tfy-125.422 Laser Physics.

Tfy-125.4480 Microsensing (5 cr) P

Spring, will be lectured for the first time during the academic year 2008-2009.

Additional: This course will replace the course Tfy-3.480 Microsensing.
Language: English

Tfy-125.5111 Physics, special assignment (10 cr) V

Autumn & spring

Intended for those studying under the new ECTS degree regulations for 2005. (The course Tfy-125.398 is intended for those who study under the old degree regulations for 1995.)

Courses credited in ocr

Tfy-125.312 Polymer Physics (3 ocr)

Autumn (alternate years, lectured autumn 2007), lectured for the last time during the academic year 2007-2008

Lecturer: Janne Ruokolainen, Docent

Contents: This course deals with how the structure of polymers will affect their physical properties. Linear and non-linear deformation mechanics, visco-elastic and mechanical properties.

Literature: U. Gedde: Polymer Physics.

Prerequisites: Classical mechanics, basic statistical mechanics, elementary thermodynamics.

Additional: During the academic year 2008-2009 will be replaced by course Tfy-125.4341 Polymer Physics (5 cr)
Language: Finnish

Tfy-125.313 Microscopy of Nanomaterials (3 ocr) P V

Spring, organized for the last time during the academic year 2007-2008

Lecturer: Janne Ruokolainen, Docent and Prof Matti Kaivola

Contents: The course gives basic knowledge of the microscopy of nanoscale structures of soft materials (such as polymers). The course concentrates on transmission electron microscopy (TEM), atomic force microscopy (AFM), scanning tunneling microscopy (STM) and scanning near-field optical microscopy (SNOM). Methods to prepare samples are studied. As a practical exercise polymeric nanostructures are studied with various methods.

Additional: During the academic year 2008-2009 will be replaced by course Tfy-125.4313 Microscopy of Nanomaterials (5 cr) P

Language: Finnish

Tfy-125.321 Laser Technology and Optics (4 ocr)

Autumn, lectured for the last time during the academic year 2007-2008

Lecturer: Prof Matti Kaivola

Contents: A general course on the foundations of optics with emphasis on lasers and their most important applications. Principles of laser operation, types of lasers, fundamentals of modern optics from an application point of view, laser applications, detection of light, laser safety.

Literature: Pedrotti&Pedrotti, Introduction to Optics,

Prentice Hall, 1992 and lecture notes

Additional: During the academic year 2008-2009 will be replaced by course Tfy-125.4321 Laser Technology and Optics (5 cr)

Language: Finnish or English

Tfy-125.398 Physics, special assignment (5 ocr) V

Autumn & spring

Lecturer: Acad Prof Olli Ikkala, Prof Matti Kaivola

Contents: The special assignments are independent laboratory assignments, planning jobs, literature reviews, etc. from the subject areas of Tfy-125. There are written instructions on how to fulfil these assignments. The role of the special assignments is explained more closely in the description of the Master's degree.

Language: Finnish

Tfy-125.422 Laser Physics (4 ocr) P

Spring (alternate years, not lectured spring 2007), lectured for the last time during the academic year 2007-2008

Lecturer: Prof Matti Kaivola

Contents: Physical foundation for lasers. Interaction phenomena between light and matter, propagation of laser beams, optical resonators, rate equations for lasers, transient phenomena, types of lasers, foundations of non-linear optics.

Literature: O. Svelto, Principles of Lasers, Plenum Press, 1998

Prerequisites: Tfy-125.321

Additional: During the academic year 2008-2009 will be replaced by course Tfy-125.4433 Laser Physics (5 cr) P

Language: Finnish or English

Tfy-125.423 Modern Optics (4 ocr) P V

Spring (alternate years, lectured spring 2007), lectured for the last time during the academic year 2007-2008

Lecturer: Prof Matti Kaivola

Contents: An advanced course in modern optics, dealing with some aspect of physical, statistical, non-linear or quantum optics, and their modern applications.

Prerequisites: Tfy-125.321

Additional: During the academic year 2008-2009 will be replaced by course Tfy-125.4423 Modern Optics (5 cr) L V

Language: Finnish or English

Tfy-125.431 Research Seminar on Experimental Physics
(2 ocr) P V

Autumn

Lecturer: Acad Prof Olli Ikkala and Prof Matti Kaivola

Contents: Modern research problems in experimental physics emphasizing topics in optics, laser physics and physics of molecular materials.

Language: Finnish

Tfy-125.432 Colloquium on New Materials (0-4 ocr) P V

Autumn & spring

Lecturer: Acad Prof Olli Ikkala, Acad Prof Risto Nieminen

Contents: Recent achievements in modern materials science are covered in talks by specialists of their respective fields.

Tfy-125.491 Individual Studies (1-6 ocr) P V

Lecturer: Acad Prof Olli Ikkala and Prof Matti Kaivola

Contents: The contents and scope of the individual course should be agreed upon with the teacher in charge.

Language: Finnish (English on demand)

DEPARTMENT OF FOREST PRODUCTS TECHNOLOGY

Head of Department: Tapani Vuorinen, tel. 451 4236
 Administrative Manager: Marjukka Petänen, tel. 451 2912
 Planning Officer (Study Affairs): Leena Hauhio, tel. 451 4279
 Student Affairs Secretary: Satu Patama, tel. 451 4255
 International Study Adviser: Susanne Salovius, tel. 451 4257, email: pkvopinto@tkk.fi
 Department office: Tekniikantie 3,
 open 9 a.m.-11 p.m. and 1 p.m.-3 p.m.

Chairs:

Puu-19 Forest Products Chemistry
 Puu-21 Paper and Printing Technology
 Puu-23 Chemical Pulping Technology
 Puu-28 Wood Product Technology
 Puu-127 Environmental Technology within Process Industry

Please pay attention to the language of the instruction

Puu-0 DEPARTMENT OF FOREST PRODUCTS TECHNOLOGY

Courses credited in ECTS

Puu-0.1000 Introduction to Forest Products Technology (2 cr)
 (Period) autumn + spring

Teachers: Planning officer, professors and guest lecturers
 Contents: The course provides general information on forest products technology. Wood technology and wood construction, forest products chemistry, pulping technology and paper technology, paper converting technology and printing technology, industrial environmental technology and process control. Processes, products and customers. Studying in the Department of Forest Products Technology.

Requirements: Examination, attendance at lectures, study plan.

Literature: To be announced during the lectures.

Language: Finnish.

Puu-0.1007 Work Safety (0 cr)

(Period) autumn

Teacher: Heikki Tulokas

Contents: The course provides students with principles of work safety legislation, first aid and working safely in the Department of Forest Products Technology.

Requirements: Attendance at lectures, examination.

Literature: To be announced during the lectures.

Language: As agreed.

Puu-19 FOREST PRODUCTS CHEMISTRY

Prof: Tapani Vuorinen, tel. 451 4236, room P 305

Prof: Janne Laine, tel. 451 4233, room P 307

Courses credited in ECTS

Puu-19.1000 Structure and Chemistry of Wood (4 cr)

Spring

Teachers: Prof Tapani Vuorinen, Anna-Stiina Jääskeläinen, D.Sc (Tech.), Raili Pönni, M.Sc.

Contents: Basic knowledge of wood structure and chemistry and their affect on wood characteristics for all the students at the Department of Forest Products Technology.

Literature: Lecture handout.

Prerequisites: Kem-4.1100.

Language: Finnish.

Puu-19.1010 Laboratory Exercises in Forest Products Chemistry (2 cr)

(Period) spring

Teacher: Prof Tapani Vuorinen, assistants

Contents: An overview to the most common basic analysis methods used in forest products chemistry. Complements the course Puu-19.1000.

Prerequisites: Puu-0.1007, Kem-35.9200, Kem-35.1300, Kem-4.1100.

Language: As agreed.

Puu-19.2000 Macromolecules, surfaces and colloids (4 cr)

Autumn

Teacher: Prof Janne Laine, assistants

Contents: Principles of surface and colloid chemistry, macromolecules in solution, Applications in forest products technology.

Literature: Forest Products Chemistry (ed. P. Stenius), FAPET, 2001, chapter 4.

Prerequisites: Puu-19.1000.

Language: Finnish.

Puu-19.3000 Chemistry of Pulping and Bleaching (5 cr)

Spring

Teacher: Prof Tapani Vuorinen, Anna-Stiina Jääskeläinen, D.Sc (Tech.)

Contents: Principles of the chemistry of digestion and bleaching. Provides the students with the ability to understand and develop the chemistry of the processes. Modelling exercises of the pulping and bleaching processes by means of chemical reactions and reaction kinetics.

Literature: To be announced during the lectures.

Prerequisites: Puu-19.1000, Puu-23.2000.

Language: English.

Puu-19.3010 Chemistry of Papermaking (4 cr)

Autumn

Teacher: Prof Janne Laine

Contents: Fundamental mechanisms of chemistry in papermaking, with emphasis on surface and colloid chemistry.

Literature: Forest Products Chemistry (ed. P. Stenius), FAPET 2001, chapter 4. Course notes and scientific papers.

Prerequisites: Puu-19.220/2000.

Language: English

Puu-19.4000 Chemical analysis in pulp and paper industries (4 cr)

Autumn

Teacher: Prof Tapani Vuorinen, Prof Janne Laine, Raili Pönni, M.Sc

Contents: An overview of the chemical analysis methods used in the pulp and paper industries. The course covers the most common chromatographic and spectroscopic methods and their applications at pulp mill, water treatment, and paper machine wet-end. In addition, the course includes the chemical on-line analytics. The course is arranged in co-operation with KCL College.

Requirements: Examination and laboratory work.

Literature: Compendium.

Prerequisites: Puu-19.210/1000, Puu-19.220/2000.

Language: English

Puu-19.4010 Chemical characterisation of wood and paper products (4 cr)

Autumn

Teachers in charge: Eero Kontturi Ph.D., Anna-Stiina Jääskeläinen D.Sc. (Tech.), Leena-Sisko Johansson Ph.D

Contents: An overview of chemical characterisation of wood and paper products. The course covers the application of modern analytical methods for packaging materials as well as paper and wood products. The emphasis of the analysis is set on the influence of the chemical composition on the usage of the materials. The principles of the methods are covered qualitatively. The applications are examined from the perspective of both the production and the researcher. The course is arranged in co-operation with KCL College.

Requirements: Examination and laboratory work.

Literature: Compendium.

Prerequisites: Puu-19.210/1000, Puu-19.220/2000.

Language: English

Puu-19.4020 Surface Chemistry and Nanotechnology in Forest Products Technology (3-4 cr)

Spring

Teacher: Prof. Janne Laine, Monika Österberg, PhD, Markus Korhonen, M.Sc

Contents: Basic properties of surfaces and colloids and experimental research methods to study these. Utilization of nanotechnology in forest products technology. Surface energy, wetting and spreading. Surface forces and their effect on dispersing of particles. Surface modification using polymers. Rheology of colloidal dispersions.

Requirements: Examination and laboratory assignments.

Literature: Compendium.

Prerequisites: Puu-19.220/2000.

Language: English

Puu-19.4030 Advanced Surface and Colloid Chemistry in Forest Products Technology (4 cr)

(Period) spring

Teacher: Prof Janne Laine

Contents: Colloid and surface chemistry applications in paper technology, coating and printing.

Literature: Scientific papers.

Prerequisites: Puu-19.140/4020, Puu-19.152/3010.

Language: English.

Puu-19.4040 Forest Products Chemistry, laboratory course (4 cr)

Autumn, spring

Teacher in charge: Prof Tapani Vuorinen, Prof Janne Laine, assistants

Contents: Individual laboratory task, leading to a deeper knowledge of experimental methods used in forest products chemistry

Requirements: Laboratory assignment.

Literature: As agreed.

Prerequisites: Puu-19.210/1000, Puu-19.220/2000.

Language: As agreed

Puu-19.4050 Forest Products Chemistry, literature course (4 cr)

Autumn, spring

Teacher in charge: Prof Tapani Vuorinen, Prof Janne Laine, assistants

Contents: Individual literature survey, leading to a deeper knowledge in forest products chemistry.

Requirements: Literature survey.

Literature: As agreed.

Prerequisites: Puu-19.210/1000, Puu-19.220/2000.

Language: As agreed

Puu-19.6000 Chemistry of Forest Products Technology, post-graduate seminar (2 cr) P

Autumn + spring

Teacher in charge: Prof Tapani Vuorinen

Contents: Seminars on ongoing research in forest products chemistry.

Prerequisites: M.Sc. (Tech) degree.

Language: English.

Courses credited in ocr

Puu-19.101 Forest Products Chemistry (3 ocr)

(Period) autumn

Teacher: Prof Tapani Vuorinen, Anna-Stiina Jääskeläinen, D.Sc (Tech.)

Contents: The wood in a living tree is composed of specialized tissues and cells for growth, metabolism and storage, water transport and mechanical support. The cells are glued together with lignin. Biogenesis of the wood cell wall follows a peculiar pathway leading to an intelligent composite structure of cellulose, hemicelluloses and lignin. Strong, anisotropically oriented cellulose microfibrils are embedded in a matrix of lignin and hemicelluloses that control the water content and viscoelasticity of the cell wall. In addition to the cell wall polymers, wood contains extractives that preserve it against microbes and serve as a reserve of carbon and energy. In this course the different aspects in the structure, chemistry and functions of wood are discussed in details with links to their technical importance in forest products technology.

Literature: To be announced during the lectures.

Language: English.

This course is part of Linkage Program 1.

Puu-19.134 Chemistry of Forest Products Technology, laboratory course (8 ocr)

Autumn + spring

Teacher in charge: Prof Tapani Vuorinen, Prof Janne Laine

Contents: Laboratory exercises, leading to a deeper knowledge of experimental methods used in forest products chemistry

Prerequisites: Puu-19.210/1000, Puu-19.220/2000, Puu-19.105.

Language: As agreed.

Puu-21 PAPER AND PRINTING TECHNOLOGY

Prof: Hannu Paulapuro, tel. 451 4216, room P 209

Prof: Jouni Paltakari, tel. 451 4218, room P 211

Prof: Patrick Gane

Courses credited in ECTS

Puu-21.2000 Basics of Paper Technology (4 cr)

(Period III-IV) spring

Teacher: Prof Hannu Paulapuro

Contents: The aim of the course is to provide the student with the basic understanding of the structure of papermaking fibres, water sorption, fibre bonds, suspension flow and flocculation of

fibres. The unit operations of papermaking process are described and briefly analysed. The structure and main properties of paper and board are discussed. Main paper and board grades and their manufacturing techniques are described. The course contains 1-2 laboratory work.

Literature: N. Ryti: Paperitekniiikan perusteet, 289 Otakustantamo and B. Norman: Pappersteknik, selected parts. Other material will be announced during the lectures.

Prerequisites: Puu-0.1000. Before starting the laboratory work: Puu-0.1007.

Language: Finnish.

Puu-21.3000 Coating Technology (5 cr)

(Period) autumn

Teacher: Prof Jouni Paltakari

Contents: Basics of pigment coating of paper. Components of coating colour, preparation of coating colour, coating methods, drying, and calendering of coated paper and board. Properties of coating colour and coating layer, the effect of coating on the properties of paper and board. The course includes guided laboratory group work.

Literature: Papermaking Science and Technology, Volumes Pigment Coating and Surface Sizing, E. Lehtinen (Ed.), selected parts and Papermaking Part 3, Finishing, M. Jokio (Ed.), selected parts. Other material will be announced during the lectures.

Prerequisites: Puu-21.2000. Before starting the laboratory work Puu-0.1007.

Language: English.

Puu-21.3010 Fibre and Paper Physics (5 cr)

(Period) autumn

Teacher: Eero Hiltunen, D.Sc (Tech.) (co-ordinator)

Contents: The course will show how fibre and paper physics can be applied for the better understanding and development of pulping and papermaking technology. The course demonstrates the diversity in fibre raw materials, pulps/pulp fractions and fillers showing their effect on the structural, optical, surface and strength properties of paper and board. The course covers the fundamentals of paper optics, strength and dimensional stability. The laboratory work includes basics of fibre identification.

Literature: Papermaking Science and Technology, Vol. 16, Paper Physics, K. Niskanen (ed.), Fapet, Helsinki. Other material will be announced during the lectures.

Prerequisites: Puu-21.2000.

Language: English.

Puu-21.3020 Basics of Printing Technology (4 cr)

Spring

Teacher: Jukka Sahivirta, M. Sc.

Contents: The course will deal with the basics of producing a printed product. The student will learn the how a photo is reproduced on a paper and why does a print look better on a coated paper than on an uncoated paper. It will also be seen how an image is formed in different printing methods and what are the paper demands in these methods. Other subjects are how is the print paper finished into a printed product, how can the print method be identified from a printed product, how is it possible to predict paper performance in laboratory and what are the future prospects and paper's competing medias in information transfer.

Literature: Oittinen, P. Saarelma, H. 1998. Printing, Fapet, to the appropriate extent and handouts from lectures.

Prerequisites: Puu-21.2000.

Language: English.

Puu-21.4000 Mechanical Pulping (4 cr)

(Period I-II) autumn

Teacher: Prof Hannu Paulapuro

Contents: Mechanical pulping from raw materials to end use. Mechanical pulping process is discussed containing defibration,

screening, cleaning and reject refining as well as bleaching. The course includes a literature work performed in groups.

Literature: Book No. 5 Mechanical Pulping (ed. J. Sundholm), Fapet, Helsinki 1999 from the book series Papermaking Science and Technology (eds. J. Gullichsen and H. Paulapuro). Additional material is informed during the lectures.

Prerequisites: Puu-21.2000.

Language: English.

Puu-21.4010 Paper Manufacturing Technology (5 cr)

(Period III-IV) spring

Teacher: Prof Hannu Paulapuro

Contents: The purpose of the course is to give the student a detailed understanding of the paper manufacturing process from beating to reeling, winding and calendering of the paper web. The course includes simulation exercise and excursion/education at the paper mill.

Literature: Selected parts of the book series Papermaking Science and Technology (eds. J. Gullichsen and H. Paulapuro). Other material will be announced during the lectures.

Prerequisites: Puu-21.2000, Puu-21.4000.

Language: English.

Puu-21.4020 Paper Chemistry (4 cr)

(Period III-IV) spring

Teacher: Timo Korpi, Lic. Phil.

Contents: The aim of the course is to introduce the student to the concepts of surface and colloid chemistry, the surface chemistry of fibres and additives and to the fillers and additives used in papermaking. Laboratory and literature group work are included.

Literature: Papermaking Science and Technology vol 4 Papermaking Chemistry, ed. L. Neimo.

Prerequisites: Kem-31.105, Puu-19.1000, Puu-19.2000, Puu-21.2000. Before starting the laboratory work Puu-0.1007.

Language: English.

Puu-21.4030 Paper Technology, laboratory course (7 cr)

Autumn + spring

Teacher in charge: Prof Hannu Paulapuro

Contents: The aim of the course is to deepen students' knowledge about paper technology and practise their ability to solve problems about their own area through individual laboratory literature studies.

Prerequisites: Puu-21.4000, Puu-21.4010, Puu-21.4020.

Language: As agreed.

Puu-21.4050 Paper Converting Technology (7 cr)

Autumn

Teacher: Prof Jouni Paltakari

Contents: The purpose of the course is to provide the students with theoretical and technological background of converting and converted products. In addition, the basics of unit operations within the converting industry will be studied. Laboratory group work and excursion.

Literature: Papermaking Science and Technology, vol. 12, Paper and Paperboard Converting, A. Savolainen (ed.), Fapet, Helsinki 1998. Other material will be announced during the lectures.

Prerequisites: Puu-21.2000. Before starting the laboratory work: Puu-0.1007.

Language: English.

Puu-21.4060 Packaging Technology (5 cr)

Spring

Teacher: Prof Jouni Paltajari

Contents: Introduction to the functions of packages, to the stresses during the use of packages and to the unit operations in packaging. Literature work in group.

Literature: To be announced during lectures.

Prerequisites: Puu-21.4050 recommended.

Language: English.

Puu-21.4070 Paper Converting Technology, laboratory course (8 cr)

Autumn + spring
 Teacher in charge: Prof Jouni Paltakari
 Contents: Individual and group laboratory studies in paper and paperboard converting.
 Prerequisites: Puu-21.4050.
 Language: As agreed.

Puu-21.4100 Printing Machines and Materials (8 cr)

Autumn
 Teacher: Jukka Sahivirta, M. Sc.
 Contents: The course will concentrate on conventional and digital printing processes and materials that are used in these. The students will learn the unit operations in printing presses, what is the composition of ink in different printing methods and how ink raw materials affect its functional properties, what are the important paper properties that affect ink transfer and drying, what kind of varnishes and glues are used in coating and binding.
 Literature: Kipphan, H., 2001: Handbook of Print Media, Springer, to the appropriate extent and handouts from lectures.
 Prerequisites: Puu-21.3020.
 Language: English.

Puu-21.4110 Printability and Runnability (5 cr)

Spring
 Teacher: Jukka Sahivirta, M. Sc.
 Contents: The course will deal with interactions in printing processes. Ink transfer, setting and drying are dynamic phenomena that are affected by the conditions in printing press and properties of ink, paper and other printing materials. The students will learn how these interactions affect print quality and how paper runs through the press. The target is that the student can develop paper grades for different printing processes and solve problems in printing process.
 Literature: Will be announced on home page of the course.
 Prerequisites: Puu-21.3020.
 Language: English.

Puu-21.4120 Printing Technology, Laboratory Course (7 cr)

Autumn + spring
 Teacher: Jukka Sahivirta, M. Sc.
 Contents: The target is that the student will get acquainted with the printing technology through individual literature reviews and experimental laboratory works. This course is meant for major students.
 Prerequisites: Puu-21.4100, Puu-21.4110, Puu-0.1007.
 Language: As agreed.

Puu-21.5190 Economics of Forest Products Industry (2 cr) P (Period III-IV) spring

Teacher: John Fogelholm, DSc (Tech.), Ph.D.
 Contents: The aim of the course is to familiarize students with the economic tools available for the management of paper industries and particularly of paper mills. The course also gives a global picture of the paper industry and its main productivity parameters, but the emphasis is on the development of accurate cost and profitability management models and the applications in profitability and productivity optimisation. Also included are the subjects of Investment Calculations, Kaizen, Benchmarking and Performance Measurement and their applications in the paper industry. The utilization of costing information for pricing and marketing activities is also included in the curriculum.
 Literature: Paper Mill-wide Profitability and Productivity Management. Compendium 2005.
 Prerequisites: Recommended TU-22.1011.
 Language: Finnish and English.

Puu-21.6000 Postgraduate Seminar on Paper Technology (2-5 cr) P

Autumn + spring
 Teacher in charge: Prof Hannu Paulapuro
 Contents: Current research topics and postgraduate projects are discussed in this seminar. Each postgraduate student reports the progress of his/her study.
 Prerequisites: M.Sc. (Tech.) degree
 Language: Finnish, English.

Courses credited in ocr**Puu-21.211 Introduction to Pulp and Paper Industry (2 ocr)**

(Period) Autumn
 Teacher: Prof Hannu Paulapuro
 Contents: The purpose is to give students an overall view of the pulp and paper industry and its technological base. The course discusses the raw materials used, the principles and main features of the unit processes of pulping and papermaking as well as the main end products.
 Literature: Handouts.
 Language: English.
 This course is part of Linkage Program 1.

Puu-21.216 Paper Physics (2 ocr)

Autumn
 Teacher: Prof Hannu Paulapuro
 Contents: Structure of paper, its characterisation and measuring methods. Strength and optical properties of paper.
 Literature: Handouts and selected parts of the book Paper Physics (ed. K. Niskanen) of the book series Papermaking Science and Technology (eds. J. Gullichsen and H. Paulapuro).
 Language: English.
 This course is part of Linkage Program 1.

Puu-21.217 Paper Chemistry (3 ocr)

Autumn
 Teacher: Timo Korpi, Lic. Phil.
 Contents: Basic phenomena in the wet end of the paper machine. Introduction to the purpose and role of different types of functional and process chemicals, which are added to the papermaking furnish. The mechanisms behind retention and retention chemicals. Sizing, hydrophobizing, the control of stickies, precipitates and slime. The contents and origins of dissolved and colloidal substances and the methods of controlling or eliminating them.
 Literature: Handouts and selected parts of the book Papermaking Chemistry (ed. L. Neimo) Fapet Helsinki 1999 in the book series Papermaking Science and Technology (eds. J. Gullichsen and H. Paulapuro).
 Language: English.
 This course is part of Linkage Program 1.

Puu-21.218 Paper Technology (3 ocr)

Spring
 Teacher: Prof Hannu Paulapuro
 Contents: Mechanical pulping including screening, cleaning and reject refining. Beating of chemical pulp. Paper machine operations including approach flow system and short circulation. Stability of papermaking process. The course also includes a seminar
 Literature: Handouts and selected parts of the book series Papermaking Science and Technology (eds. J. Gullichsen and H. Paulapuro).
 Language: English.
 This course is part of Linkage Program 1.

Puu-21.219 Paper Coating (2 ocr)

Spring
 Teacher: Prof Jouni Paltakari

Contents: The course starts with an introduction to the different coated paper grades and then proceeds to the coating process itself. Various coating techniques are discussed, with special emphasis on the formulation of coating colour and on the purpose components in it. A brief insight into various pigment types is also given. Calendering and winding will be treated as the finishing stages of the coating process.

Literature: Handouts and selected parts of the book *Pigment Coating and Surface Sizing of Paper* (ed. E. Lehtinen) *Papet Helsinki 2000* in the book series *Papermaking Science and Technology* (eds. J. Gullichsen and H. Paulapuro).

Language: English.

This course is part of Linkage Program 1.

Puu-21.220 Industrial Economics and Production Management (3 ocr)

(Period) spring

Teacher: John Fogelholm, DSc (Tech.)

Contents: The emphasis is on the economic tools available for the management of paper industries and particularly of paper mills. Included are the economic global picture of the paper industry and its main profitability elements, but the emphasis is on the development of accurate cost and Profitability management models and the applications in Profitability Optimisation, including Budgeting procedures and Investment Calculations. The second main emphasis is on Productivity Management including Performance Measurement, Benchmarking and Kaizen, and their actual applications. Also included is utilization of costing information for pricing and marketing activities.

Literature: Fogelholm, John: *Paper mill-wide Profitability and Productivity Management*. HUT. Department of Industrial Management. 119 p. (2005 Edition).

Language: English.

This course is part of Linkage Program 1.

Puu-21.225 Converting Technology (2 ocr)

(Period) spring

Teacher: Prof Jouni Paltakari

Contents: Introduction to the converting of paper and board and the technology of converted products. This includes the basics of unit operations and descriptions of converting processes. A selection of the most common converted products is studied.

Literature: Handouts.

Language: English.

This course is part of Linkage Program 1.

Puu-21.230 Measurements and Analysis of Pulp and Paper-making Processes (2 ocr)

(Period) autumn

Teacher: Risto Ritala, Docent

Contents: The course gives an overall view of the measurements on paper machines and the pulp production lines, and of the dynamics of measurements. Cross-directional measurements on paper machines, preconditioning of data, statistical analysis for troubleshooting, analysis of regular and irregular variations are other topics dealt with.

Literature: Handouts.

Language: English

This course is part of Linkage Program 1.

Puu-21.108 Paper Technology, laboratory course (5 ocr)

Autumn + spring

Teacher in charge: Prof Hannu Paulapuro

Contents: Individual laboratory and literature studies in the field of paper technology.

The course is intended for students having Paper Technology as their minor.

Prerequisites: Puu-21.103, Puu-21.105, Puu-21.120 or Puu-21.104.

Language: As agreed.

Puu-21.113 Paper Technology, extensive laboratory course (7 ocr)

Autumn + spring

Teacher in charge: Prof Hannu Paulapuro

Contents: The aim of the course is to deepen students knowledge about paper technology and practise their ability to solve problems about their own area through individual laboratory and literature studies. The course is intended for students having Paper Technology as major.

Prerequisites: Mat-2.103/2103, Puu-21.103, Puu-21.105, Puu-21.120 or Puu-21.104.

Language: As agreed.

Puu-21.159 Paper Converting Technology, laboratory course (5 ocr)

Autumn + spring

Teacher in charge: Prof Jouni Paltakari

Contents: Individual and group laboratory studies in paper and paperboard converting.

Prerequisites: Mat-2.103/2103, Puu-21.102/2000, Puu-21.105, Puu-21.153.

Language: As agreed.

Puu-23 CHEMICAL PULPING TECHNOLOGY

Prof: Panu Tikka, tel. 451 4201, room P 136

Courses credited in ECTS

Puu-23.1000 Defibration Technology in the Forest Industry (2 cr)

(Period II) autumn, even years

Teacher: Marjo Määttänen and guest lecturers

Contents: The course provides a general overview of the various chemical and mechanical defibration techniques used in the pulp and paper industry. The course deals with the integrated relationship between the wood products industry and chemical pulping processes, wood chip production, product quality aspects and their effect on final products. The course is intended for wood technology students.

Literature: To be announced during the lectures.

Prerequisites: Puu-19.1000 recommended.

Language: Finnish.

Puu-23.2000 Principles of Pulping Processes (4 cr)

(Period I + II, III) autumn + spring

Teacher: Marjo Määttänen

Instructor for laboratory exercises: Pertti Korppi, Kari Vanhatalo

Contents: The course provides students with basic knowledge of pulp production technology. The areas comprise forest resources, wood species, harvesting and logistics, wood yard, fibre line, and chemicals and energy recovery processes. The course includes laboratory exercises.

Literature: Handouts. KnowPulp.

Prerequisites: Puu-19.1000 recommended. Before starting the laboratory work: Puu-0.1007.

Language: Finnish.

Puu-23.3000 Chemical Engineering in Pulp and Paper Processes (6 cr)

(Period III) spring

Teacher: Juha-Pekka Pokki

Contents: The purpose is to give basic understanding to apply chemical engineering principles and modelling and calculation methods for the most essential unit processes of pulp and paper manufacturing. The course discusses the flow dynamics and heat and mass transfer as well as the unit operations for systems composed of chip and fibrous materials. Calculation exercises and homework give additional support to the practical aspects of the course.

Literature: The written course material will be distributed during the lectures and calculation exercises.
Prerequisites: Kem-42.102/1700, Puu-21.2000 and Puu-23.2000.
Language: English.

Puu-23.3010 High Yield Pulping (3 cr)

(Period III) spring

Teacher: Marjo Määttänen

Contents: The course provides an overview to high yield pulping technology, their end uses and comparison to mechanical and chemical pulps. High yield pulps combine mechanical and chemical pulping. The pulps are for example high yield kraft pulps, "kraftliner"-pulp, semichemical NSSC and chemimechanical CTMP pulps. Teaching methods used are lectures, group exercises and laboratory assignments.

Literature: Papermaking Science and Technology, Vol. 5, Mechanical Pulping (selected parts). Other material will be given during the lectures.

Prerequisites: Puu-23.2000, Puu-21.2000.

Language: English.

Puu-23.3020 Pulping Process Exercises (3 cr)

Autumn + spring

Teacher in charge: Prof Panu Tikka

Teacher: Pertti Korppi, Kari Vanhatalo

Contents: Students familiarize themselves with kraft pulp mill processes and mill unit by using fibre, chemicals and energy balance calculation. Some literature work is also included and simulation exercise..

Prerequisites: Puu-23.2000 (compulsory), Puu-23.3000 (recommended).

Language: English.

Puu-23.4000 Pulp Mill Fibre Line Processes (3 cr)

(Period IV) spring

Teacher in charge: Prof Panu Tikka

Teacher: N.N.

Contents: The target is to provide in-depth knowledge of the fibre line processes. The course emphasizes cooking and bleaching taking account both mill processes in practise and also under research. The course includes modelling and simulation assignments.

Literature: Papermaking Science and Technology, Vol. 6, Chemical Pulping (ed. J. Gullichsen and C.-J. Fogelholm), Fapet, Helsinki 2000 (selected parts).

Prerequisites: Puu-23.2000, Puu-23.3000.

Language: English.

Puu-23.4010 Pulp Mill Chemicals Recovery and Energy Processes (5 cr)

(Period IV) autumn

Teacher in charge: Prof Panu Tikka

Teacher: Kari Parviainen

Contents: The course provides in-depth knowledge on pulp mill's spent liquors, evaporation, combustion and regeneration of active chemicals. The course covers the preparation of bleaching chemicals and organic by-products. In addition intra-process energy and environmental protection issues are presented. Some assignments are included.

Literature: Papermaking Science and Technology, Vol. 6, Chemical Pulping (ed. J. Gullichsen and C.-J. Fogelholm), Fapet, Helsinki 2000 (selected parts).

Prerequisites: Puu-23.2000, Puu-23.3000.

Language: English.

Puu-23.4020 Modelling and Simulation of Pulp Washing and Chemical Cycle (3 cr)

(Period IV) spring

Teacher in charge: Prof Panu Tikka

Teacher: Torolf Laxen

Contents: The course provides an overview on the black liquor and chemical system of modern kraft pulp mills. Theory, modelling and simulation of pulp washing and washer systems as well as forming and simulation of chemical balances are covered. In addition, the behaviour, accumulation and control of NPEs (non process elements) are presented. The course includes compulsory practical exercises.

Literature: To be given during the lectures and exercises.

Prerequisites: Puu-23.4000, Puu-23.4010.

Language: English.

Puu-23.4030 Pulping Technology Research Project (7 cr)

Autumn + spring

Teacher in charge: Prof Panu Tikka

Teacher: Marjo Määttänen

Contents: Individual but at the same time supervised research project from current topic within pulping technology. Definition of research problem, design of experiments, laboratory exercises, processing and evaluation of results and reporting are included.

Prerequisites: Puu-23.3020, Puu-23.4000 and Puu-23.4010.

Language: English.

Puu-23.5000 Planning and Execution of Pulp and Paper Investment Project (3 cr)

Autumn

Teacher: Jorma Halmepuro

Contents: Project planning and management. A part of the lectures are compulsory and are arranged in consultancy firm.

Literature: Pelin R. Projektinhallinnan käsikirja or Robert L. Kimmons Project Management Basics: A Step by Step Approach.

Prerequisites: Puu-21.2000 and Puu-23.2000.

Language: English.

Puu-23.9000 Pulping Technology (9 cr)

(Period) autumn + spring

Teacher in charge: N.N.

Contents: The course teaches the fundamentals and core processes of a modern pulp mill and gives the basics of the sub-processes needed. Forest resources, pulp wood properties, pulp properties and pulp grades vs. paper grades are addressed. Main topics are chemical pulping lines, high-yield and chemimechanical pulping and pulp mill chemicals and energy recovery cycle. The course covers the entire pulping technology in one course, within the frame work of the international Linkage Program. Exams on both fall and spring periods. Course includes assignments and elementary exercises in the laboratory techniques..

Literature: The course is based on lecture material developed and available for the linkage students as pdf-files. Recommended textbook: Papermaking Science and Technology, books 6A and 6B, selected chapters given in the lectures, Fapet Oy, PI/TAPPI, 1999.

Prerequisites: Before starting the laboratory work: Puu-0.1007.

Language: English.

This course is part of Linkage Program 1.

Puu-23.9010 Project Work (4 cr)

Spring/summer

Teacher: N.N.

Contents: As the finishing part of the linkage program year students carry out an individual project work which includes a technical report and presentation. The project work is most often found at forest industry companies, as a summer trainee work, or it can be carried out in research labs or as personal literature study. The subjects can cover widely all areas of forest industry, products, processes and business.

Language: English.

This course is part of Linkage Program 1.

Courses credited in ocr

Puu-23.110 Pulping Processes, laboratory course (4 ocr)
Autumn + spring
Teacher in charge: Prof Panu Tikka
Teacher: Pertti Korppi and Kari Vanhatalo
Contents: Practical R&D work to solve problems in pulping technology by literature and laboratory work.
Prerequisites: Puu-23.103/2000 accepted, Puu-23.104/124/4000, Puu-23.105/125/4010, Puu-23.116/3010.
Language: As agreed.

Puu-23.111 Pulping Processes, advanced laboratory course (6,5 ocr)
Autumn + spring
Teacher in charge: Prof Panu Tikka
Teacher: Marjo Määttänen
Contents: Individual short R&D projects on literature and laboratory work elaborating the aspects highlighted in the lectures of pulping technology and simulation assignment.
Prerequisites: Puu-23.110.
Language: As agreed.

Puu-28 WOOD PRODUCT TECHNOLOGY

Prof: Matti Kairi, tel. 451 5654, room 230
Prof: (pro tem) Pertti Viitaniemi, tel. 451 4261, room 231

Courses credited in ECTS

Puu-28.1000 Introduction to Wood Technology (3-7 cr)
Teacher: Jussi Virtanen
Contents: Self-educating introduction course to wood technology for foreign students and those that need basic information of wood technology. Year-round course. No lectures. Literature study report and oral exam. Option for written exam.
Literature: Wood handbook -Wood as an engineering material. Hoadley, B.: Understanding wood: a craftsman's guide to wood technology. Other additional literature can be defined when the course starts.
Language: English.

Puu-28.2000 Introduction to Forestry (4 cr)
(Period I) autumn
Teacher: Appu Haapio
Contents: The course provides students with basic knowledge of forest resources in Finland and in the world and also forestry and forest technology.
Requirements: Examination, excursion and assignment.
Literature: To be announced during the lectures.
Replaces the course Puu-28.110.
Language: Finnish.

Puu-28.2005 Basics of Wood Product Industry Production Processes (2 cr)
(Period II) autumn
Teacher: prof (pro tem) Pertti Viitaniemi, Olli Paajanen, Katja Vahtikari
Contents: Principles of raw material, wood product industry production processes and products.
Requirements: Examination, excursion and assignments.
Literature: To be announced during the lectures.
Language: Finnish.

Puu-28.2011 Applications of Wood Science (2 cr)
(Period III) spring
Teacher: Olli Paajanen
Contents: The basic properties of wood are examined in practical assignments: the microscopic structure of wood and identification of wood species with different methods.

Requirements: Assignments and examination.
Literature: To be announced during the lectures.
Prerequisites: Puu-28.2000.
Students are recommended to take this course at the same time with the course Puu-19.1000.
Replaces partly the course Puu-28.101. Contact the teacher.
Language: Finnish.

Puu-28.2020 Application Characteristics of Wood (4 cr)
(Period IV) spring
Teacher: Katja Vahtikari, prof (pro tem) Pertti Viitaniemi
Contents: Knowledge of essential application characteristics of wood in wood products. Course includes physical and mechanical properties of wood, moisture stability, rot resistance, weather resistance, wood defects and fire endurance.
Requirements: PBL, lectures, examination and assignments.
Literature: To be announced during the lectures.
Prerequisites: Puu-28.2010.
Replaces partly the course Puu-28.101. Contact the teacher.
Language: Finnish.

Puu-28.2030 Woodworking Theory (4 cr)
(Period III) spring
Teacher: Timo Kotilahti
Contents: The objective is to understand woodworking theory so, that after the course students have qualifications to analyse and change the woodworking events. They get basic knowledge to plan the woodworking process of a new or changed product.
Requirements: Examination. Part of examination can be replaced by presence and assignments.
Literature: To be announced during the lectures.
Prerequisites: Puu-28.2005.
Replaces partly the course Puu-28.125. Contact the teacher.
Language: Finnish.

Puu-28.2040 Woodworking Applications (4 cr)
(Period IV) spring
Teacher: Timo Kotilahti
Contents: Every student gets acquainted in one area of woodworking. The work is reported in a term paper and presented to other students.
Requirements: Examination and assignment.
Literature: To be announced during the lectures.
Prerequisites: Puu-28.2030.
Replaces partly the course Puu-28.125. Contact the teacher.
Language: Finnish.

Puu-28.3000 Moisture Content and the Drying of Wood (4 cr)
(Period II) autumn
Teacher: Pia Lahti
Contents: The course provides students with basic knowledge of moisture and its changes in wood and also principles of wood drying.
Requirements: Examination and assignments.
Literature: To be announced during the lectures.
Prerequisites: Puu-19.1000, Puu-28.2020, Puu-28.3010.
Replaces partly courses Puu-28.149/151, Puu-28.155/156, Puu-28.101. Contact the teacher.
Language: English.

Puu-28.3010 Wood Product Industry Production Processes (4 cr)
(Period I) autumn
Teacher: Jussi Virtanen
Contents: The course provides students with knowledge of production processes of wood product industry in both Finland and the most important export countries of wood product industry. Overview to the background, reasons and limitations of production processes.
Requirements: Assignments, lectures, exam and excursion.
Literature: To be announced during the lectures.

Prerequisites: Puu-28.2020, Puu-28.2040.
Replaces partly courses Puu-28.149/151, Puu-28.155/156, Puu-28.112, Puu-28.160. Contact the teacher.
Language: English.

Puu-28.3020 Wood Product Markets (2 cr)

(Period I) autumn
Teacher: Annika Mauno
Contents: The objective of the course is to provide the basics of wood products, their producers and market areas. The course presents the competitive situation of Finnish wood products industry and factors that affect the use of wood in different market areas.
Requirements: Assignments, lectures and excursion.
Literature: To be announced during the lectures.
Prerequisites: Puu-28.2000.
Replaces partly courses Puu-28.149/151, Puu-28.155/156. Contact the teacher.
Language: English.

Puu-28.3030 Wood Bonding (4 cr)

(Period II) autumn
Teacher: Anti Rohumaa
Contents: The course provides students with bonding theories of wood. In more detail the course concentrates on wood adhesives, their properties and usage, bonding technology, required properties of bonded wood, common defects, testing of bond line, requirements and standards.
Requirements: PBL, examination, excursion and assignment.
Literature: To be announced during the lectures.
Prerequisites: Puu-28.3000.
Replaces partly the course Puu-28.111. Contact the teacher.
Language: English.

Puu-28.3040 Wood Coating (2 cr)

(Period III) spring
Teacher: Anti Rohumaa
Contents: The course provides students with knowledge of wood coating techniques, properties of coating materials and its usage, common defects, requirements and testing.
Requirements: PBL, examination, excursion and assignment.
Literature: To be announced during the lectures.
Prerequisites: Puu-28.3030.
Replaces partly the course Puu-28.111. Contact the teacher.
Language: English.

Puu-28.3050 Wooden Structure Joints (4 cr) P

(Period IV) spring
Teacher: Jukka Honkanen
Contents: Mechanical and moisture technical properties of wood and wood-based materials and their affect on design of constructions and wood products. Mechanical joints and special joints.
Requirements: Lectures, examination and assignments.
Literature: Lecture notes. Timber Engineering STEP1 & STEP 2. Other material will be announced later.
Prerequisites: Puu-28.3030.
Replaces the course Puu-28.170 and partly the course Puu-28.160. Contact the teacher.
Language: English.

Puu-28.4000 Wood Modification (4 cr) P

(Period III) spring
Teacher: Prof (pro tem) Pertti Viitaniemi, Katja Vahtikari
Contents: Modification of the properties of wood in the different applications by using temperature, environmentally friendly chemicals and compression.
Requirements: Lectures, examination and assignments.
Literature: To be announced during the lectures.
Prerequisites: Puu-28.3000, Puu-28.3040.
Language: English.

Puu-28.4010 Production Process Analyses (4 cr)

(Period I+II) autumn
Teacher: Toni Antikainen
Contents: Students are assigned an individual project work in co-operation with wood industry. The project can also be carried out independently.
Requirements: Project work.
Literature: -
Prerequisites: Mat-2.2620, Mat-2.2103, Puu-28.3010.
Replaces the course Puu-28.180.
Language: English.

Puu-28.4020 Production Investment Planning (4 cr)

(Period IV) spring
Teacher: Jukka Honkanen
Contents: The objective is to make students familiar with the principles of economic feasibility analysis plus facility planning in mechanical wood industry. After the course students are capable to make economic calculations of investment. Students will learn about all phases of facility planning process and the most common methods used within these phases. Students will develop a project plan.
Requirements: Examination and assignment.
Literature: To be announced during the lectures.
Prerequisites: Puu-28.3010.
Replaces the course Puu-28.114.
Language: English.

Puu-28.4030 Wood Product Industry Business Models (2 cr)

(Period II) autumn
Teacher: Prof Matti Kairi, Jussi Virtanen
Contents: The objective of the course is to provide practical understanding of wood product industry business models. The course presents business model examples of wood product industry and factors that affect them. Annually changing themes. Case assignments of wood product industry business models.
Requirements: Assignments, lectures, exam and excursion.
Literature: To be announced during the lectures.
Prerequisites: Puu-28.3020, TU-22.1101, TU-91.1002.
Replaces part of the course Puu-28.176. Contact the teacher.
Language: English.

Puu-28.4040 Developing Competitive Wood Products (4 cr) P

(Period II) autumn
Teacher: Prof Matti Kairi
Contents: Methods of R&D in developing competitive wood products. How the R&D connects and business and marketing as well as using the key technology model? Development alone or with a partner. The course presents and compares R&D projects in Finnish wood products industry.
Requirements: Lectures, individual assignment and exam.
Literature: To be announced during the lectures.
Prerequisites: Puu-28.4000, Puu-28.4030.
Replaces part of the course Puu-28.176. Contact the teacher.
Language: English.

Puu-28.4050 Marketing Wood Products (2 cr)

(Period I) autumn
Teacher: Annika Mauno, Jussi Virtanen
Contents: The objective of the course is to provide practical understanding of wood product marketing and its special issues. The course presents marketing examples of wood product industry and factors that effect them. Annually changing themes. Case assignments of wood product marketing.
Requirements: Assignments, lectures, exam and excursion.
Literature: To be announced during the lectures.
Prerequisites: Puu-28.3020.
Replaces part of the course Puu-28.176. Contact the teacher.
Language: English.

Puu-28.5000 Introduction to Wood Properties and Wood products (3 cr)

(Period I) autumn

Teacher: Jussi Virtanen

Contents: Use of wood in different products; wood as a construction material for buildings and furniture, wood species for various products. Wood properties and their behaviour, the nature of wood, figure in wood; wood identification; water, moisture and wood; strength of wood. Machining wood, joining wood, finishing wood and modifying wood. Other wood properties: light, sound and fire. Assignments. Potential excursions.

Requirements: Examination, assignments.

Literature: Hoadley, B.: Understanding wood: A craftsman's guide to wood technology. Wood handbook. Other material will be defined later.

Language: English.

Puu-28.5010 Industrial Wood Construction (3 cr)

(Period II) autumn

Teacher: Jussi Virtanen

Contents: Industrial wood construction materials, structures, products, and production methods. Log house industry and its products. Basis of wood design and material properties for construction. Solid timber and wood-based panels used in construction. Structural wood components and systems. Cases of industrial wood construction.

Requirements: Examination and 1-2 assignments.

Literature: Goetz & al., Timber Design & Construction Sourcebook; Timber Engineering - STEP 1 and 2. Other material will be announced at the first lecture.

Prerequisites: Puu-28.5000.

Language: English.

Puu-28.5020 Great Wood Buildings - case project (4-5 cr) P

(Period III) spring

Teacher: Jussi Virtanen, professional lecturers from architecture and wood product areas

Contents: Analyze wood buildings including music halls, multi store apartment buildings and other wood frame buildings. Analyze perspectives: design, product properties, building component properties. Wood building problems and methods to solve them. Problem based approach and other methods in wood construction. Case analysis of a large house with its components, building physics and other themes. Excursion.

Prerequisites: Puu-28.5000.

Language: English.

Puu-28.5030 Furniture Industry (4 cr)

Autumn The course will be lectured next time during the academic year 2007-2008.

Teacher: Katja Vahtikari

Contents: Products and their structure, materials and production methods in furniture industry. Design and marketing of furniture. Assignments. Excursion.

Literature: To be announced during the lectures.

Prerequisites: -

Language: English.

Puu-28.5040 Marketing Wood Products (4 cr) P

(Period III) spring

Teacher: Prof Matti Kairi

Contents: Interior use of wood as part of a load bearing construction and visual element. Also emissions surface treatment, fire questions and acoustics are included.

Requirements: Lectures, excursion and project work.

Literature: To be announced during the lectures.

Prerequisites: -

Language: English.

Puu-28.5050 Marketing Wood Products (8 cr) P

(Period III+IV) spring

Teacher: Prof Matti Kairi, Ilmari Absetz, Pekka Heikkinen

Contents: Issues related to wooden industrial competitive construction are examined; architecture, construction engineering and production processes are included.

Requirements: Lectures, exercises and seminar works, portfolio and excursions.

Literature: To be announced during the lectures.

Prerequisites: -

Language: Finnish or English.

The course is realized in co-operation with the laboratories of Wood Technology and Building Technology and the Chair of Wood Construction.

Puu-28.6000 Postgraduate Seminar in Wood Technology (4-10 cr) P V

(Period I, II, III, IV) spring + autumn

Teacher in charge: Prof (pro tem) Pertti Viitaniemi

Contents: Lectures on current topics about wood research and special studies in wood technology as well as present subjects of postgraduate studies. Seminar presentations.

Prerequisites: Master of Science degree.

Puu-28.6010 Mathematical Methods in Wood Product Industry (3-8 cr) P V

(Period I, II, III, IV) spring + autumn

Teacher: Jussi Virtanen (coordinator)

Contents: The course is aimed to post graduate students or those master students with a target to post graduate studies. The course aims at helping to apply mathematical methods to the needs of wood product industry. The course covers mathematical assignments from wood product industry. Potential modelling, optimization, programming or analyzing assignment from the industry. Design and taking the first steps to accomplish own work. PBL-sessions, mathematical databases. Potential article or publication. The course can be done whilst at work. Helps to design and accomplish methods and thesis.

Literature: Everyone chooses one or two useful books of his/her field. Presentation of the methods to others on the course. Other literature will be announced at the beginning of the course.

Prerequisites: Mat-2.2103, Mat-2.2104, Mat-2.2105 or Mat-2.3130. Prerequisites will be selected based on one's own research area.

Language: As agreed.

Puu-28.6020 Project Work in Wood Technology (2-10 cr) P V

(Period I, II, III, IV) autumn & spring

Teacher: Prof (pro tem) Pertti Viitaniemi

Contents: Planning, implementation and reporting of a project work in wood technology

Requirements: To be agreed with the lecturer.

Language: As agreed.

Puu-28.V Course with Varying Content (1-10 cr)

(Period) autumn, spring

Teacher: N.N.

Contents: The subject matter of the course is varying. The objective is to discuss actual and forward-looking topics of wood technology. The course is directed for students of wood technology, wood construction and corresponding areas.

Examination: Organized according to special agreement.

Prerequisites: Prerequisites are determined separately.

Courses credited in ocr**Puu-28.178 Seminar in Wood Technology** (2 ocr)

(Period I-IV) autumn + spring The course is lectured for the last time during the academic year 2006-2007.

Teacher in charge: Prof Matti Kairi, Pia Lahti

Contents: Special issues in wood product industry. Subject matter is based on seminar presentations, master's thesis and licenti-

ate thesis as well as current research topics. Seminar presentation. Listening of two (2) master's thesis presentations.
Prerequisites: Puu-28.149 and Puu-28.155.
Language: To be agreed.

Puu-28.180 Special Study in Wood Technology (2 ocr)
(Period I, II, III, IV) autumn + spring The course is lectured for the last time during the academic year 2006-2007.
Teacher in charge: Timo Kotilahti
Contents: Individual assignment on given topic. Attention is paid to information acquisition, making a test plan and statistical examination. Good language and presentation of the work are also essential.
Prerequisites: Puu-28.149 and Puu-28.155.
Language: To be agreed.

Puu-127 ENVIRONMENTAL TECHNOLOGY WITHIN PROCESS INDUSTRY

Prof Olli Dahl, tel. + 358 9 451 2865

Courses credited in ECTS

Puu-127.1000 Principles of Environmental Technology (3 cr)
(Period I) autumn
Teacher: Prof Olli Dahl
Contents: Basic concepts and terms in environmental technology, essential environmental legislation including EU statutory law, environmental permits/authorizations, and control of industrial environmental loads (air emissions, wastewaters, solid wastes and noise).
Requirements: Examination on material from the lectures and literature
Literature: Handouts.
Language: Finnish.

Puu-127.4000 Industrial Environmental Engineering (4 cr)
Spring
Teacher: Prof Olli Dahl
Contents: Industrial environmental hazards and their prevention, waste treatment and waste recovery processes. Management system. Study period has common and special content. Special content will be produced for chemical and mechanical forest products technology and chemical technology and materials science and rock engineering.
Requirements: Examination covering lectures and literature cited during the lectures, exercises.
Literature: Papermaking Science and Technology part 19 Environmental Control (ed. Hynninen, P), Fapet, Helsinki, 1998 and literature named during lectures.
Prerequisites: Puu-127.1000. In addition to the students' own study programme's basic technology courses.
Language: Finnish.

Puu-127.4010 Environmental Management (2 cr)
Spring
Teacher: Gary Watkins
Contents: A broad based introduction to the practical aspects of environmental management in businesses and achieving the objective of continuous improvement in the reduction of significant environmental impacts. Challenges to industry in the context of sustainable development and tools to aid organizational responses. Environmental management systems, the ISO 14000 standards and the application of ISO 14001 and EMAS, the role of life cycle assessment tools (LCA), eco-labelling, and environmental permitting (IPPC). Computer based exercises covering construction of a simple LCA model for a paper industry product and a critical review of a commercially available interactive

environmental management system computer based training package.
Requirements: Exam and exercises.
Literature: Environmental Management in Organizations, The iema Handbook, Earthscan, London, 2005, handouts and other literature to be announced during the lectures.
Prerequisites: Puu-127.1000.
Language: English.

Puu-127.4020 Process Water Treatment (3 cr)
Autumn
Teacher: Prof Olli Dahl
Contents: Treatment of process and white water in industry, wastewater cleaning and reuse of treated water.
Requirements: examination and an exercise.
Literature: Eckenfelder, W.W.Jr. Industrial Water Pollution Control, McGraw International.
Prerequisites: Puu-127.1000.
Language: English.

Puu-127.4030 Process Water Analysis (2 cr)
Spring
Teacher: Mikko Martikka
Contents: Analysis exercises of industrial wastewater and fresh water with standardized and other methods. Exercises target to prepare analyzing skills and to get familiar to special water properties and water quality demand.
Requirements: Pre-exam, laboratory exercises.
Prerequisites: Puu-127.4020, Puu-0.1007
Language: English.

Puu-127.4040 Environmental Technology in the Pulp and Paper Industry (4 cr) P
Autumn
Teacher: Prof Olli Dahl, Gary Watkins
Contents: Factors affecting environmental load (water, air emissions, wastewaters, solid wastes and noise) in the forest products industry, and BAT-systems.
Requirements: Exam and exercise.
Literature: Springer, A.M. Industrial Environmental Control, Pulp and Paper Industry, TAPPI Press. Papermaking Science and Technology part 19 Environmental Control (ed. Hynninen, P), Fapet, Helsinki, 1998.
Prerequisites: Puu-127.1000.
Language: English.

Puu-127.4050 Special Study in Environmental Technology (4 cr)
Autumn + spring
Teacher in charge: Prof Olli Dahl
Contents: Special assignments in environmental technology.
Requirements: Written seminar presentation or an individual exercise.
Language: As agreed.

Puu-127.5000 Control of Regional and Global Environmental Impacts (3 cr)
Spring
Teacher: Ilkka Savolainen, Docent
Contents: Activities producing emissions, environmental impacts and their mutual dependences, emission control by technical and structural measures, costs. Choosing management strategies by using system studies, e.g. concerning acidification and greenhouse effect.
Requirements: Examination.
Literature: Watson, R et al. (eds.), Climate Change 2001: Synthesis Report. Cambridge University Press, Cambridge, UK and New York, USA, 2001.
Prerequisites: Puu-127.1000 recommended.
Language: English.

Puu-127.9000 Environmental Protection Technology in the Pulp and Paper Industry LP1 (3 cr)

Autumn

Teacher: Prof Olli Dahl, Gary Watkins

Contents: Factors affecting environmental load (water, air emissions, wastewaters, solid wastes and noise) in the forest products industry, and BAT-systems.

Requirements: Exam.

Literature: Springer, A.M. Industrial Environmental Control, Pulp and Paper Industry, TAPPI Press. Papermaking Science and Technology part 19 Environmental Control (ed. Hynninen, P), Fapet, Helsinki, 1998 .

Prerequisites: Puu-127.1000.

Language: English.

This course is part of Linkage Program 1. It shares common lectures with course Puu-127.4040.

Courses credited in ocr**Puu-127.209 Air Protection (3 ocr)**

Autumn

Teacher: Risto Lahdes

Contents: Meteorological basics of atmospheric chemistry and air protection, dispersion and conversions in the atmosphere, air pollutants and their physical and biological adverse effects, air quality monitoring, essential concepts of air quality management. Exercises of emission measurement and evaluation and air quality.

Requirements: Attendance at lectures and completed home exercises or/and examination and exercises.

Literature: To be announced during the lectures.

Prerequisites: Ene-47.153.

Language: Finnish

Puu-127.295 Postgraduate Seminar on Environmental Technology (3-7 ocr) P

Autumn + spring

Teacher in charge: Prof Olli Dahl

Contents: Shall be agreed with the supervisor of postgraduate studies.

Requirements: Written report and lecture.

Prerequisites: M.Sc. in Technology or corresponding knowledge.

Language: Finnish, Swedish or English.

Puu-127.297 Individual Postgraduate Studies in Environmental Technology (1-5 ocr) V P

Autumn + spring

Teacher in charge: Prof Olli Dahl

Contents: Individual postgraduate studies in environmental technology. The contents of the course must be discussed with the teacher.

Requirements: The fulfilling of the requirements must be discussed with the teacher (e.g. exam or report).

Literature: The literature must be discussed with the teacher.

Prerequisites: M.Sc. in Technology or corresponding knowledge.

Language: Finnish, Swedish or English.

Puu-127.299 Environmental Technology, Literature (1-7 ocr)

P V

Autumn + spring

Teacher in charge: Prof Olli Dahl

Contents: Shall be agreed with the supervisor of postgraduate studies.

Prerequisites: M.Sc. in Technology or corresponding knowledge

Requirements: Examination on varying lectures and literature.

The course is meant mainly for postgraduate studies.

Language: As agreed.

DEPARTMENT OF INDUSTRIAL ENGINEERING AND MANAGEMENT

Head of department: Paul Lillrank tel.451 3658
 Administrative manager: Paula Enström (leave of absence), deputy Tiia Tuomi tel. 451 3921
 Planning officer(Study Affairs): Tarja Timonen tel. 451 4678
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Chairs:
 TU-22 Industrial Management
 TU-53 Work Psychology and Leadership
 TU-91 Strategy and International Business
 TU-117 Development and Management in Industry
 TU-117a Quality Control

Please pay attention to the language of the instruction

Course credits in ECTS

TU-0 DEPARTMENT'S COURSES

TU-0.1100 Introduction to the philosophy of science (3 cr) P
 Autumn
 Instructor: Saku Mantere
 Content: The course is an introduction to the philosophy of science, especially on the philosophical questions concerning organization studies as a branch of either social science or engineering. Critical attention is directed at the methodological, ontological and epistemological dilemmas encountered by a researcher engaged in organization studies.
 Course requirements: Attendance at lectures, pre-lecture assignments.
 Literature: Readings announced at the course web site/distributed at the first lecture.
 Prerequisites: TU-53.1401/TU-53.401
 Language: Finnish
 For Industrial Engineering and Management PhD students only.
 Replaces the course TU-0.100

TU-0.1111 Orientation Course for Studies in Industrial Engineering and Management (1 cr)
 Autumn
 Teachers: Hannele Wallenius, tutors, visiting lecturers
 Contents: General information on TKK and introduction to Industrial Engineering and Management.
 Requirements: Attending lecturers, library exercise and own study plan for studies.
 Literature: Study Programme and Department's own study guide.
 Language: Finnish

TU-22 INDUSTRIAL MANAGEMENT

Prof: Eero Eloranta, tel. 451 5026
 Prof: Paul Lillrank, tel. 451 3658
 Prof: Kari Tanskanen, tel. 451 3645
 Prof: Karlos Artto, tel. 451 4751

TU-22.1101 Introduction to Industrial Management and Engineering (4 cr)
 Autumn+spring
 Lecturers: Karlos Artto and Tomi Laamanen
 Contents: Operations of an industrial enterprise. Finance, production and logistics, marketing, management of an organisation, quality management; financial calculations and their applications.
 Requirements: Examination
 Literature: To be announced separately.
 Language: Finnish. Exam can be taken in English; please contact course assistant.
 Replaces the course TU-22.101

TU-22.1102 Introduction to Industrial Management and Engineering, Swedish (4-5 cr)
 Autumn (Period I-II)
 Lecturers: Paul Lillrank, John Fogelholm, Jan Holmström
 Contents: Introduction to industrial management, financial management and cost accounting, quality management, logistics, customers and markets.
 Requirements: Examination
 Literature: To be announced separately.
 Language: Swedish
 Replaces the course TU-22.102

TU-22.1103 Exercise Industrial Management and Engineering (1 cr)
 Autumn+spring
 Lecturers: Karlos Artto and Tomi Laamanen
 Contents: Operations of an industrial enterprise. Finance, production and logistics, marketing, management of an organisation, quality management; financial calculations and their applications.
 Requirements: Exercise
 Literature: To be announced separately.
 Language: Finnish. Exercise/report can be written in English; please contact course assistant.

TU-22.1113 Design of Production Systems A (6 cr)
 Autumn (Period I-II)
 Lecturer: Eero Eloranta
 Contents: Operations strategy, service operations, process choices and production layout, production control, product structures, interfaces to supply chain management.
 Requirements: Literature examination, case studies, assignment.
 Literature: To be announced separately.

Prerequisites: TU-22.1101 or TU-22.1102, it is not appropriate to take this course before the 3rd year of studies because of the practical assignments.

Language: English and Finnish

Replaces the course TU-22.113

TU-22.1115 Design of Production Systems (4 cr)

Autumn (Period I-II)

Lecturer: Eero Eloranta

Contents: Operations strategy, service operations, process choices and production layout, production control, product structures, interfaces to supply chain management.

Requirements: Literature examination, assignment

Literature: To be announced separately

Prerequisites: TU-22.1101 or TU-22.1102, the course is not appropriate before the 3rd year of studies because of the practical assignments

Language: English and Finnish

Replaces the course TU-22.115

TU-22.1118 Quantitative Methods in Industrial Management (5 cr)

Autumn

Lecturer: Juha-Matti Lehtonen

Contents: The student will learn modelling and analysis methods for the use in the field of industrial management. Controllability analysis for industrial enterprises. Decision making. Simulation and optimisation and their applications.

Requirements: Examination, lectures, assignment, and computer exercises. The course is meant primarily for students with industrial management as their major subject.

Literature: To be announced separately.

Language: Finnish. Examination and assignments can be taken in English; please contact course assistant.

Replaces the course TU-22.118

TU-22.1120 Introduction to Project Management (3 cr)

Spring

Lecturer: Karlos Artto and Miia Martinsuo

Contents: Project management concepts, practices and tools. Project planning and control, projects in organisations, multi-project situations, project-oriented business of a project organisation. Knowledge areas, practices and applications of project management.

Requirements: Examination, exercises.

Literature: To be announced separately.

Prerequisites: TU-22.1101 or TU-22.1102

Language: Finnish. Can be taken in English; please contact course assistant.

TU-22.1130 Accounting and Profitability (3-4cr)

Autumn (Period I)

Lecturer: Jouko Karjalainen

Contents: The basic accounting methods in order to assess the financial success of a company and its causes: profit and loss statement, balance sheet and cash flow; cost accounting; performance measurement; capital budgeting. Students should learn to understand how accounting methods are applied in decision-making and management control. The English version gives only 3 credits.

Requirements: Examination and exercise.

Literature: Announced in the course brochure.

Prerequisites: TU-22.1101/TU-22.1102

Language: Lectured only in Finnish. English option based on a text book; please contact course assistant.

Replaces the course TU-22.130

TU-22.1135 Cost Management in Paper Industries (3 cr)

Autumn (Period I-II)

Lecturer: John Fogelholm, senior lecturer D.Sc.(Tech.), Ph.D.

Contents: Development and implementation of accurate costing models, budgeting and investments in paper mills, performance measurements and benchmarking. How to utilize productivity and profitability information in the daily activities in paper mills.

Requirements: Examination, attendance at lectures

Literature: John Fogelholm: Paper millwide Profitability and Productivity Management, 2005 Edition

Language: English

Replaces the course TU-22.135

TU-22.1140 Advanced Management Accounting (5 cr)

Spring (Period III)

Lecturer: Jouko Karjalainen

Contents: The course gives a deeper insight of the use of management accounting systems in different decision-making situations. Cost behavior, financial statements, comprehensive performance measurement and investments are topics revisited more theoretically and in more detail than in the course "Accounting and Profitability". The course is intended only for the students of Industrial Engineering and Management (Master's Programme or Operations Management Linkage Programme).

Requirements: Examination + assignments

Literature: To be announced separately

Prerequisites: TU-22.1130/TU-22.130

Language: English

Replaces the course TU-22.130

TU-22.1144 Corporate Finance (3 cr)

Spring (Period III)

Lecturer: Jouko Karjalainen

Contents: Present value, investments, financial instruments, markets and planning, company valuation.

Requirements: Examination and exercises.

Literature: Brealey Myers and Allen: Principles of Corporate Finance, 8th Edition, McGraw Hill

Prerequisites: TU-22.1101/TU-22.1102, TU-22.1130

Language: Finnish. Exam can be taken in English; please contact course assistant.

Replaces the course TU-22.144

TU-22.1149 Characteristics of Different Industries (2 cr)

Autumn

Lecturer: Karlos Artto

Contents: Characteristics of different industries, competitive situation, prevailing corporate culture, future outlook. The goal is to present a holistic picture of few important industries in the Finnish economy.

Requirements: Examination, participation and excursion report.

Literature: To be announced separately.

Language: Finnish

Replaces the course TU-22.149

TU-22.1155 Individual Assignment in Industrial Management (5 cr)

Autumn+spring

Lecturers: Kari Tanskanen, Karlos Artto, Eero Eloranta, Jouko Karjalainen, Paul Lillrank

Contents: Determined by individually defined subject.

Requirements: Progress of individual assignments is followed in seminar sessions. Course is meant for industrial management major students and students in the industrial engineering and management degree program.

Prerequisites: TU-22.1118 or TU-22.1130 and TU-22.1140 and two of the following courses: TU-22.1176, TU-22.1206, or TU-22.1213 or two of the following: TU-22.1426, TU-22.1441, TU-22.432

Language: Finnish. Can be taken in English; please contact course assistant.

Replaces the course TU-22.155

TU-22.1160 Business Game (1-2cr)

Spring

Teacher: Jouko Karjalainen

Content: The course gives an aggregate view of business and financial planning. The game illustrates how different decisions concerning products, production and marketing affect the financial success of a company and how competition complicates planning.

Requirements: Students form a management team for a company and compete against other companies in a simulated environment. Approved game performance. Extended report of the game performance required for 2 credits.

Prerequisites: TU-22.1101, TU-22.1130, TU-22.1113/1115/1202

Language: English

Replaces the courses TU-22.160 and TU-22.164

TU-22.1165 Seminar on Industrial Management (5 cr)

Spring

Lecturers: Karlos Artto, Kari Tanskanen, Eero Eloranta, Jouko Karjalainen, Paul Lillrank

Contents: Seminar topics are chosen from current industrial management topics so that the reports have relevant applications for business. The seminar is divided into different subgroups based on the topic.

Requirements: The student submits a seminar report on a topic agreed upon with the instructor. The report is presented at the seminar. Attendance at the seminars is required. The grading follows the standard procedure. The course is meant for industrial management major students.

Prerequisites: TU-22.1118 or TU-22.1130 and TU-22.1140 and two of the following courses: TU-22.1176, TU-22.1206, TU-22.1213 or two of the following courses: TU-22.1426, TU-22.1441, TU-22.1432.

Language: Finnish. Can be taken in English; please contact course assistant.

Replaces the course TU-22.165

TU-22.1168 Seminar on Industrial Management, exercises in foreign languages (1 cr)

Spring

Lecturer: Karlos Artto, Eero Eloranta, Kari Tanskanen, Jouko Karjalainen, Paul Lillrank

Contents: Writing and presenting the seminar study and serving as an opponent for the course TU-22.1165 in a foreign language. The language can be any major European language.

Requirements: Completed together with the course TU-22.1165.

Replaces the course TU-22.168

TU-22.1177 Practical course in ERP and APS software (5 cr)

Spring (Period IV)

Teacher: Antti Tenhiälä

Contents: The course provides hands-on experience of using enterprise resource planning (ERP) and advanced planning & scheduling (APS) systems in logistics processes and production planning. Guided exercises and an individual assignment are conducted with mySAP ERP and mySAP SCM software. The objective is to gain insights into the uses, opportunities, and constraints of integrated enterprise systems.

Requirements: Participation in the exercises, individual assignment, and examination. The course is primarily aimed at students, who major in industrial management, and who have passed or are simultaneously participating in the course: TU-22.1176 Operations Management. The amount of participants is limited.

Literature: To be announced in the course brochure

Prerequisites: TU-22.1113 or TU-22.1115

Language: Finnish

TU-22.1178 Production and Operations Management (5 op)

Spring (Period III)

Instructor: Juha-Matti Lehtonen

Contents: Demand management, production planning, master production scheduling and capacity management. Independent and dependent inventory management. Production control systems and information processing. Principles of control and their impact on delivery time, capacity and controllability of production. The aim is to provide students an understanding as well as capabilities to work in production planning and control, and system development.

Requirements: Final exam, lectures assignments and calculation exercises. The course is meant primarily for students in the IEM department and those having industrial management minor subject

Literature: Thomas E. Vollmann [et al.]: Manufacturing Planning and Control for Supply Chain Management, McGraw-Hill, 5th international edition (2004).

Prerequisites: TU-22.1113/TU-22.113 or TU-22.1115/TU-22.115

Replaces the course TU-22.176 and TU-22.1176

Language: English and Finnish

TU-22.1185 Industrial Management, Special Topics (1-10cr)

Autumn + Spring

Autumn+spring

Lecturer: Karlos Artto, Eero Eloranta, Kari Tanskanen, Jouko Karjalainen, Paul Lillrank

Contents: Varies. Possibility to complete exams on books. Contact lecturers.

Requirements: See contents

Literature: See contents

Prerequisites: TU-22.1101/TU-22.101. Other industrial management courses are recommended.

Language: Finnish or English

Replaces the course TU-22.185

TU-22.1191 Research Methods in Industrial Management I (for postgraduate students) (4 cr) P

Autumn

Lecturer: Dr. Saku Mantere, guest lecturers

Content: The course is designed to assist the student in making sense of four key questions concerning the methodology of a successful PhD dissertation: 1) What constitutes a good research problem; 2) what the criteria are for scientific knowledge, fit to be used in solving the research problem; 3) what kinds of research designs can be used to produce such knowledge; and 4) how findings are to be reported in order to make a scientific contribution.

Course requirements: For Industrial Engineering and Management PhD students only. Pre-course and post-course essays, attendance on lectures, pre-lecture assignments.

Literature: Readings announced at the course web site.

Prerequisites: Master's degree

Language: English

Replaces the course TU-22.191

TU-22.1193 Research Methods in Industrial Management II (for postgraduate students) (5 cr) P

Instructors: Professors

Student should participate either (a) or (b & c), depending on the supervising professor.

(a) Doctoral seminar (5 cr)

Autumn + Spring, English

Instructor: Eero Eloranta, Kari Tanskanen, Karlos Artto, Miia Martinsuo

Content: The purpose is to develop participants' understanding on the requirements of the doctoral dissertation, and support and guide doctoral students in initiating and developing their thesis topics. Review of earlier PhD theses to develop capabilities for assessing scientific work. Getting acquainted with the scientific body of knowledge in participants' research domain. Prepara-

tion, sharing and review of the research plans of all participants. Assessment of available methodological alternatives to one's research and justified rationale for methodology choice. Acting as opponent to another student's research plan. Discussion and debate in a scientific research community.
Prerequisites: TU-22.1191/TU-22.191

(b) Doctoral seminar (3 cr)

Autumn + Spring, English

Instructor: Paul Lillrank

Content: The purpose is to develop participants' understanding on the requirements of the doctoral dissertation, and support and guide doctoral students in initiating and developing their thesis topics. Review of earlier PhD theses to develop capabilities for assessing scientific work. Getting acquainted with the scientific body of knowledge in participants' research domain. Preparation, sharing and review of the research plans of all participants, at least 2 presentations by participant. Acting as opponent to another student's research plan. Discussion and debate in a scientific research community.
Prerequisites: TU-22.1191/TU-22.191

(c) Methodology modules (1-2 cr)

Autumn & Spring, Finnish or English

Instructor: professors and visiting lecturers

Content: Students participating in (b) must select 1-2 methodology modules that best support their own thesis, to complement the licentiate and doctoral seminar. The topic areas may include: action research, case study, constructive, qualitative, text analysis, statistical research, and scientific writing. The objective is to provide some systematic knowledge of methodological alternatives in management research, to help the participants to become more discerning consumers of research literature, and to help students to become better equipped to make decisions about methodological choices.

Course requirements: attendance at seminar sessions, assignments, seminar presentations, readings

Literature: to be announced separately

Prerequisites: TU-22.1191/TU-22.191

TU-22.1195 Studies in Supplementary Field; Industrial Management (20 cr) I

Instructor: Virpi Turkulainen, Researcher

Intended for PhD candidates who wish to take Industrial Management as studies in supplementary fields.

Literature: See course Web page for details on content: <http://users.tkk.fi/~vturkula/PGMIM/>

Course requirements: Written examinations; see course Web page for details

Prerequisites: Prerequisite essay; see course Web page for details

Language: Finnish or English, although all course material is in English

TU-22.1202 Logistics (3 cr)

Autumn (Period II)

Lecturer: Kari Tanskanen

Contents: The goal of the course is to familiarise the students with the strategic planning, logistics control, material functions and materials management in industry and trade from the view point of company management.

Requirements: Exam

Literature: Lecture notes and Donald Waters: *Logistics - An Introduction to Supply Chain Management*, Palgarve macmillan 2003.

Prerequisites: TU-22.1101 or TU-22.1102

Language: Finnish.

Replaces the course TU-22.202

TU-22.1206 Supply Management (5 cr)

Spring (Period III)

Lecturer: Kari Tanskanen

Contents: The goal of the course is to familiarise the students with supply management of industrial company.

Requirements: Exam, practical assignment

Literature: Arjan J. van Weele, *Purchasing & Supply Chain Management*, 4th edition, Thomson 2005, lecture notes.

Prerequisites: TU-22.1202

Language: Finnish

Replaces the course TU-22.206

TU-22.1213 Demand-Supply Chain Management (4 cr) P

Spring (Period IV)

Lecturer: Eero Eloranta and Kari Tanskanen

Contents: The goal of the course is to deepen the students' demand-supply chain knowledge and skills. Topics include production/delivery chain design, analyzing and improving the demand chains, supply chain management, its standards and techniques like VMI, product identification and CPRF, E-business logistics and customer relationship management.

Requirements: Examination, lectures and assignments

Literature: Hoover, Eloranta, Holmström, Huttunen: *Managing the Demand Chain: Value Innovations for Supplier Excellence*, teaching material.

Prerequisites: TU-22.1202

Language: English

Replaces the course TU-22.213

TU-22.1302 Quality Management (3 cr)

Autumn (Period I)

Lecturer: Paul Lillrank

Contents: The course provides an introduction to the theoretically grounded practice of quality management. Topics to be discussed are: statistical process control (SPC), problem solving and continuous improvement, quality systems, ISO 9000-2000, excellence models - the European quality award.

Requirements: Lectures, four sessions, 8 hours in all, examination based on lectures.

Literature: Oakland, John S.: *Statistical Process Control*. Butterworth-Heinemann, 2004 (earlier editions acceptable), lecture notes

Prerequisites: TU-22.1101 or TU-22.1102 or equivalent

Language: English or Swedish

Replaces the course TU-22.302

TU-22.1306 Quality-A Theoretical Approach (3 cr) P

Autumn (Period II)

Lecturer: Paul Lillrank

Contents: The emerging quality theory is discussed in light of recent literature. Students are provided with a reading package, that will be discussed during the sessions. Special emphasis is put on the question of information and information system quality.

Requirements: Pre-examination based on the reading package. Active participation in the seminar sessions. No final examination will be held, but students should prepare a learning diary or other written summary of what they perceive as the core issues learned.

Prerequisites: TU-22.1101 or TU-22.1102 and TU-22.1302 (or TU-22.302)

Language: English or Swedish

Replaces the course TU-22.306

TU-22.1315 Varying course in Quality Management (1-8 cr) V

Autumn & Spring

Lecturer: Paul Lillrank

Contents: Varies

Requirements: Varies. Contact the lecturer.

Prerequisites: TU-22.1302, other courses of industrial management and quality management recommendable

Language: Swedish and/or English

TU-22.1425 Advanced Project-based Management (3 cr) P
Autumn

Lecturer: Karlos Arto and Miia Martinsuo

Contents: Application of project management procedures and methodologies in organizations. Processes and their management in professional organizations. Project-based business, project portfolio management and program management. Focus is on deepening the practical application aspect of project-based management. Different project types and industry specific approaches and applications.

Requirements: examination

Literature: Turner J.R., *The Handbook of Project-based Management*, Second Edition.

Prerequisites: TU-22.1120, TU-22.1130 and TU-22.1302.

Language: English

Replaces the course TU-22.425

TU-22.1426 Advanced Project-based Management II (5 cr) L
Autumn

Lecturer: Karlos Arto and Miia Martinsuo

Content: Application of project management procedures and methodologies in organizations. Processes and their management in professional organizations. Project-based business, project portfolio management and program management. Focus is on deepening the practical application aspect of project-based management. Different project types and industry specific approaches and applications.

Course requirements: One major assignment, a set of several minor assignments and workshops. The course is only for the students of Dept. of Industrial Engineering and Management.

Literature: Turner J.R., *The Handbook of Project-based Management*, Second Edition, and additional material to be announced separately.

Prerequisites: TU-22.1120, TU-22.1130 and TU-22.1302.

Language: English

Replaces the course TU-22.426

TU-22.1432 Management of Uncertainty (5 cr) L

Spring

Lecturer: Kalle Kähkönen, Jarno Poskela, Karlos Arto, Jouko Karjalainen

Content: The course reviews uncertainty sources and uncertainty phenomena in project-based business. New emerging knowledge is covered by expanding traditional project risk management discipline towards more holistic and situation specific managerial solutions. The starting point is to investigate risk management of a single project and then to expand this view to cover project portfolios and finally to explore management of uncertainty in a company level within project-based business. Other key aspects to be covered are the differences between various main project types (e.g. investment projects, industrial delivery projects, R&D projects) regarding management of uncertainty. The course also includes a group work assignment reflecting strategic decision making situation in modern project business. Furthermore, the objective is to provide capabilities for students to apply this knowledge in real life projects.

Requirements: Examination and course assignment.

Literature: To be announced separately.

Prerequisites: The course is primarily intended for students having Industrial Management as their major subject in the department of Industrial Engineering and Management.

Post-graduate students are also encouraged to take this course.

Recommended courses: TU-22.1120, TU-22.1425, TU-22.420, TU-22.1130, TU-22.1144

Language: English

Replaces the course TU-22.432

TU-22.1439 Project Finance (6 cr) L Spring

Instructor: Jaakko Eskola and Sami Torstila

Content: Basic principles in the project finance area, procedures associated with project finance. Project development, arranging

project schemes in relation to project sales and marketing, finance arrangements and procedures. Real-life case examples. The course is run as a cross-university collaboration course with the primary responsibility for the course and premises provided by Helsinki School of Economics (HKKK).

Course requirements: examination and case assignment

Literature (tentative): John D. Finnerty, *Project Financing, Asset-Based Financial Engineering*. John Wiley&Sons, Inc., New York, 1996, reading package.

Prerequisites: TU-22.1120/TU-53.120

Language: English

Replaces the course TU-22.439

TU-22.1441 Project Marketing and Customer Management II (5 cr) P

Autumn

Lecturer: Jaakko Kujala

Contents: The course discusses the project sales and marketing process. The concepts of project business model, market as milieu, customer relationship management, project marketing logic, project negotiations and contracts are included. Creating and managing project networks, relationship management and buying and selling in different industries with regard to cultural contexts are discussed. Empirical cases highlight current practices related to these areas.

Requirements: Examination or learning journal. Exercise work. Literature: Cova, Ghauri&Salle 2002: *Project Marketing*, reading package and lecture handouts.

Prerequisites: TU-22.1120/TU-22.120, TU-22.1130/TU-22.130 and TU-22.1302/TU-22.302

Language: English.

This course is only for the students of the Department of Industrial Engineering and Management.

Replaces the course TU-22.441

Courses credited in ocr**TU-22.194 Postgraduate Minor in Industrial Management, Basic Module (10 ocr) P**

Lecturer: Virpi Turkulainen, Researcher

Contents: This basic module is intended for postgraduate students who wish to complete the basic version of the postgraduate minor in industrial management (total of 10 ocr)

Requirements: Written examinations, see course Web page for details

Literature: See course Web page for details on content: <http://users.tkk.fi/~vturkula/PGMIM/>

Prerequisites: Prerequisite essay; see course Web page for details

Language: Finnish or English; although all course material is in English

Offered last time during academic year 2007/2008

TU-22.195 Postgraduate Minor in Industrial Management, Extension Module (7 ocr) P

Lecturer: Virpi Turkulainen, Researcher

Contents: This additional extension module is intended for postgraduate students who wish to complete the extended version of the postgraduate minor in industrial management (total of 15ocr)

Requirements: Written examinations

Literature: See course Web page for details on content: <http://users.tkk.fi/~vturkula/PGMIM/>

Prerequisites: TU-22.194

Language: Finnish or English; although all course material is in English

Offered last time academic year 2007/2008

TU-53 WORK PSYCHOLOGY AND LEADERSHIP

Prof: Veikko Teikari, tel. 451 3650
 Prof: Eila Järvenpää, tel. 451 3653
 Prof: Matti Vartiainen, tel. 451 3660
 Prof emeritus: Pekka Haatanen

TU-53.1000 Introduction to research on industrial engineering and management (1 cr)

Autumn (Periods I- II)

Lecturers: Eila Järvenpää and Eerikki Mäki

Content: The course aims to familiarize the participants with conducting scientific research. The course deals with science and research, ethics of science and good scientific practice, research areas and approaches in industrial engineering and management, and provides an overview of research methods.

Requirements: lectures, group works.

Literature: Announced on the www-page of the course

Language: Finnish

TU-53.1100 Basics of Work Psychology and Leadership (4 cr)

Autumn+spring

Lecturers: Paul Buharist and Veikko Teikari

Contents: The course introduces central themes of work psychology and leadership, such as work motivation, leadership, organisation development and change management, teams, learning, communication, organisation structures and processes, etc. The goal is to understand the importance of human action as a success factor of companies.

Requirements: Essays and examination.

Literature: Huzynski, A. & Buchanan, D. (2000, 4th ed., or 5th ed.) Organisational behaviour: an introductory text. Prentice-Hall.

Language: English (autumn term), Finnish (spring term).

Replaces the courses TU-53.100, TU-53.102 and TU-53.300

TU-53.1106 Basics of Knowledge and Competence Management (3 op)

(b) Knowledge management (3 cr)

IV Spring term

Instructors: Eila Järvenpää and Eerikki Mäki

Content: Concepts of knowledge, and knowledge management, knowledge creation, knowledge sharing, knowledge management strategies, development of knowledge management in organizations.

Course requirements: Exam

Language: English

Literature: Jashapara, A. (2004) Knowledge management An integrated approach. Essex: Pearson Education Limited.

Replaces courses TU-53.1105, TU-53.251 and TU-53.301

TU-53.1111 Virtual Work Environment Instruction (2 cr)

Autumn+spring

Lecturers: The course is realised through the Internet tutored by assistant. Content expert: Docent Heikki Laitinen, 3T Ratkaisut Oy.

Contents: The course is based on the "Basics of a good work environment"- The content areas are safe working procedures, order in a working place, safety and ergonomics especially in industry.

Requirements: Theory, applied in a working environment, observation exercises, exam.

Language: Finnish

Replaces the course TU-53.111

TU-53.1113 Ergonomic Design of Work and Workplace (3 cr)

Autumn

Lecturers: Risto Toivonen and Jouni Lehtelä

Contents: Ergonomics knowledge based on physiology and psychology, design methods and design practices used in the design of work environment, working tools and work methods. Seminar work based on company visit.

Requirements: examination, seminar work.

Literature: To be announced during lectures.

Language: Finnish

Replaces the course TU-53.113

TU-53.1115 Safety and Health Management (3-6 cr)

Autumn + spring

Lecturers: Heikki Laitinen

Contents: Occupational health and safety management. Promoting safety and health at work: approaches and methods. Measuring the safety. Identification of accident and other hazards, evaluation and control of risks. Planning of work environment. Promoting safe behavior.

Requirements: Autumn: lectures and examination (3 cr), spring: seminar work and seminars (3 cr).

Literature: H. Laitinen's reading package: Työturvallisuuden mittaaminen ja kehittäminen, Työsuojeluviranomaisen tiedotteet

Language: Finnish

Replaces the course TU-53.115

TU-53.1118 Sociotechnical Systems (2-6 cr) P V

(a) Psychological and Organisational Aspects of Controlling Dynamic Systems (4 cr) P

Spring

Lecturers: Leena Norros and Anneli Leppänen

Contents: Decision-making in natural context. Controlling dynamic processes. Teamwork. Conceptual mastery over work and well-being at work. Controlling work processes.

Requirements: Participation in group work.

Literature: To be announced separately.

Language: Finnish

Replaces the course TU-53.117

(b) Distributed Work and Groupware Technology (4 cr) P

Autumn+spring, timing will be announced in the beginning of the term.

Lecturer: Matti Vartiainen

Contents: Distributed organization and technology. Issues: communication and collaboration tools, telepresence, dispersed project organization, knowledge support of work processes and communication of individuals, teams and organizations.

Requirements: Lectures, assignments, use of groupware. Implemented with Helsinki Business School and Department of Psychology in University of Helsinki, possibly with Delft University of Technology

Literature: Andriessen, J.H.E. (2003) Working with groupware. Understanding and evaluating collaboration technology. London: Springer. 190 p. OR Vartiainen, M., Kokko, N. & Hakonen, M. (2004) Management of dispersed organizations - leading space, time, diversity and communication. Jyväskylä: Talentum. 238 p. (In Finnish).

Language: Finnish. Can be taken in English

A part of the course will be organized as a distance education.

Replaced the course TU-53.1267.

TU-53.1120 Traffic Psychology (3 cr)

Spring (alternate years, available Spring 2006)

Lecturer: Virpi Anttila

Contents: The course provides knowledge about driver behaviour for design of vehicles, road and traffic environment.

Requirements: Examination and seminar work.

Literature: Häkkinen, Luoma: Liikennepsykologia. Otatieto.

Lecture handout.

Language: Finnish

Replaces the course TU-53.120

TU-53.1124 Advanced Driver Behaviour (3 cr) P

Spring (alternate years, available Spring 2007)
 Lecturer: Juha Luoma
 Contents: Theories, research methods, and current research results on traffic behaviour. Specialist lecturers.
 Requirements: Examination and 12 seminar hours.
 Literature: To be announced separately.
 Prerequisites: TU-53.1120 and TU-53.310 recommended.
 Language: Finnish
 Replaces the course TU-53.124

TU-53.1130 Basics of Consulting and Cooperation (3 cr)

Spring term 2007
 Lecturers: Anneli Pulkkis and Eija Vartiainen
 Contents: The construction of a frame of reference of the consulting process, which an engineering and a work psychologist needs as he/she uses his/her professional knowledge in a consulting task.
 Requirements: Literature, lectures and examination.
 Language: Finnish
 Replaces the course TU-53.130

TU-53.1131 Introduction to the Dynamics of Cooperation (3 cr)

Autumn term 2006
 Lecturers: Anneli Pulkkis and Eija Vartiainen
 Contents: Theoretical approach in the systems psychodynamic framework, which is applied to analyze and study collaboration in work structures.
 Requirements: Literature, lectures and examination.
 Language: Finnish
 Replaces the course TU-53.131

TU-53.1136 Dialogical Methods in Consulting (3 cr) P

Autumn term 2007
 Lecturers: Anneli Pulkkis and Eija Vartiainen
 Contents: We study the background, theories and practices of dialogical development methods. We apply in practise and study the Finnish search conference method.
 Requirements: Course task, active participation in the course.
 Language: Finnish
 Prerequisites: TU-53.1130/TU-53.1131
 Replaces the course TU-53.136

TU-53.1138 Team Dynamics (4 cr)

Spring term 2008
 Lecturers: Eija Vartiainen and Anneli Pulkkis
 Contents: An opportunity to study and analyze on team dynamics in the work organization through one's own experience.
 Requirements: Literature. Participation in every workshop. 32 students can participate in the course.
 Language: Finnish
 Prerequisites: TU-53.1136 and TU-53.1130/TU-53.1131
 Replaces the course TU-53.138

TU-53.1140 Leadership in Organizations (3 cr) P

Autumn
 Lecturers: Veikko Teikari and Paul Buhaniist
 Contents: The course highlights the importance of leadership for organizational success both from economical and human viewpoints. On the course leadership is considered as interaction influencing the actions of an individual, team and organisation. Development of leadership conceptions, focusing especially on the importance of leadership in today's dispersed and expert organizations. Also guest lecturers.
 Requirements: Case assignment, examination.
 Literature: Will be announced during the lectures.
 Language: Finnish. Can be taken in English; please see the course web site.
 Replaces the course TU-53.140

TU-53.1142 Advanced course on leadership (4cr)

Lecturer: Paul Buhaniist
 Contents: In-depth familiarity with leadership conceptions and theories. The students learn to identify central phenomenon of leadership, be familiar with related viewpoints and themes, and to make good use of the extensive literature and discussion of leadership.
 Requirements: Case assignments, essays, exam
 Literature: Will be announced during the lectures
 Language: Finnish

TU-53.1147 Personal Leadership (3 cr)

Spring
 Lecturer: Paul Buhaniist and Leena Seppänen
 Contents: The goal is to enhance understanding of leadership as individual action, its essential skill domains in key leadership situations, and to give opportunities to develop personal leadership skills. The course is interactive and is based on active participation by students in small groups.
 Requirements: Active participation and individual & group assignments.
 Prerequisites: TU-53.1100/TU-53.100 and TU-53.1140/TU-53.140
 Language: Finnish
 Restricted participation
 Replaces the course TU-53.147

TU-53.1155 Organization Development (4 cr)

Spring
 Lecturers: Paul Buhaniist, Leena Seppänen and Jouni Virtaharju
 Contents: How organizations change and how can they be developed? What kind of phenomena emerge in change projects? What kind of theoretical models for organizational change have been presented? What are the actions of the organizational change agent? Consultative action research and process consultation approaches.
 Requirements: case assignments, home essays and exercise work.
 Literature: Schein, E.(1999) Process Consultation Revisited, other literature will be announced in the beginning of the course.
 Prerequisites: TU-53.1100/TU-53.100, TU-53.1140/TU-53.140
 Language: Finnish, can be taken in English, see course web site.
 Replaces the course TU-53.155

TU-53.1161 Analysis and Development of Work Systems (6 cr) P

Spring
 Lecturers: Matti Vartiainen and guest lecturers
 Contents: Various methods to analyze and develop workplaces (work systems) from the perspective of modern sociotechnical theory and action research. The development objects are production and knowledge organizations, like virtual organizations. Elements of work systems to analyze: Activity environment, information and communication technology, work and communication processes, organizing, organization and team climate, well-being in work. Change and development paradigms. Roles of a developer. Critical success factors in change.
 Requirements: Examinations and a large exercise including a development plan for the target organisation.
 Literature: Literature will be announced during lectures.
 Prerequisites: TU-53.1100, recommended: TU-53.310, TU-53.150
 Language: Finnish. Can be taken in English; please contact the lecturers.
 Replaces the course TU-53.161

TU-53.1163 Well-being and Stress in Work Organizations (3 cr) P

Spring
 Lecturers: Veikko Teikari and Tanja Kuronen

Contents: Concepts, research and control of well-being, workload and stress. Prevention of negative stress and development of well-being in work organizations. Suitable for both graduate and post-graduate students.

Requirements: Examination and essay.

Literature: Sutherland, Valerie J. & Cooper, Cary L. (2000): Strategic Stress Management - an organizational approach. UK: Macmillan Press. ISBN 0-333-77487-6. and Cooper, Cary L. (1998): Theories of Organizational Stress. Oxford: Oxford UP. ISBN 0-19-852279-7.

Prerequisites: TU-53.1100/TU-53.100, recommended: TU-53.104

Language: Finnish. Can be taken in English; please contact the lecturer.

Replaces the course TU-53.163

TU-53.1164 Organization Theory (3 cr) P

Spring

Lecturers: Saku Mantere and Jouni Virtaharju

Contents: Different perspectives of organization theory. Theorizing in organization studies.

Requirements: Lectures and essays.

Literature: Announced at lectures.

Prerequisites: TU-53.1100/TU-53.100, TU-53.104; or TU-53.1130/TU-53.130; or TU-53.1401/TU-53.401. Course serves both graduate and post-graduate students

Language: Finnish. Can be taken in English; please contact the lecturers.

Replaces the course TU-53.164

TU-53.1167 Reward System in Organizations (5 cr) P

Autumn

Lecturers: Matti Vartiainen and Kiisa Hulkko

Contents: Strategic rewarding. Total Reward: Bases and means. Economic, organizational and psychological bases. Reward systems in various businesses and functions of enterprises. Influences of organization structures on rewarding. Rewarding in dynamic settings. Development of reward systems.

Requirements: Examination and exercises.

Literature: Vartiainen, M. & Kauhanen, J. (toim.) (2005) Basics of Reward Systems in Globalized Finland.. Helsinki: WSOY. (in Finnish)

Prerequisites: TU-53.1100/TU-53.100

Replaces the course TU-53.167

TU-53.1170 Special Assignment in Work Psychology (5 cr)

Autumn+spring, according to agreement

Instructors: Veikko Teikari, Eila Järvenpää, Leenamajja Ojala and Matti Vartiainen

Contents: A literary and empirical study in the following fields: organizational development and leadership (Veikko Teikari), knowledge management (Eila Järvenpää), learning organization and intangible capital (Leenamajja Ojala and Matti Vartiainen) and work environment management and sociotechnical systems (Matti Vartiainen)

Requirements: A written assignment and a seminar presentation. Language: Finnish. Can be taken in English; please contact the instructors.

Replaces the course TU-53.170

TU-53.1200 Advanced Course on Knowledge and Competence Management (4 cr) P

(c) Advanced course on knowledge management (4 cr) L

Autumn (Period I-II)

Instructors: Eila Järvenpää and Eerikki Mäki

Contents: Concepts, models and theories of knowledge management. Changing content areas include knowledge creation and knowledge sharing, knowledge processes, social and intellectual capital, social networks, and innovation management.

Requirements: Term papers.

Literature: Will be announced on course www-page

Prerequisites: TU-53.1106

Replaces courses: TU-53.252, TU-53.306

TU-53.1261 Competence Development and Management (4 cr) P

Autumn

Lecturers: Leenamajja Ojala and Matti Vartiainen

Contents: The management of competence and knowledge resources, especially the explication, definition and analysis of competence resources. The students conduct a competence management case study in an organization. The case reports are published at the end of the course.

Requirements: An essay and a case report as group work.

Language: Finnish. Can be taken in English; please contact the lecturer.

Replaces the course TU-53.261

TU-53.1263 Learning and Learning Environments (3-6 cr) P

Spring

Lecturer: The course is carried out in collaboration with the Laboratory of Telecommunication (S-72.510) and Laboratory of Telecommunication programming and applications (T-110.556). Contact persons: Eija Korpelainen, Matti Vartiainen, Johanna Leppävirta and Ursula Holmstöm.

Contents: a) Bases of learning and learning environments. Individual and group learning. Learning and learning environment approaches and theories. Learning environments' psychological and pedagogical content. Social and technological support of learning. Learning environment technology, design and evaluation. Learning effects. (3 cr)

Contents: b) Learning environments in practice. Technology and design. Evaluation from the viewpoints of pedagogical content, learning effects and usability. (3 cr)

Requirements: (a) and (b) will be carried out simultaneously. Lectures, term paper, exercises, portfolio, visits.

Literature: Will be announced during the course.

Language: Finnish. Can be taken in English; please contact the lecturer.

Replaces the course TU-53.263 and TU-53.1267.

TU-53.1270 Work and technology (4 cr)

Will be lectured first time in 2006-2007

Lecturer: Matti Vartiainen and visiting lecturers.

Content: Interaction of work and technology, border zones of social and technological systems, technology as a driver in work and organizational development, HR management systems, scenarios of work and technology.

Requirements: Will be announced during the course.

Literature: Will be announced during the course.

Language: Mainly Finnish.

TU-53.1308 Organizations and Networks (4 cr) P

Spring (Period IV)

Lecturers: Eila Järvenpää and Stina Immonen

Contents: The course provides the participants with an understanding about new organizational structures, forms of collaboration, and different kinds of organizational networks. Concept, definitions and models of organizations, new organizational structures, and inter- and intraorganizational networks are discussed.

Requirements: Lecture assignments, essay.

Literature: Will be announced on course www-page.

Language: English

Replaces the course TU-53.308

TU-53.1309 Cross-Cultural Management (3 cr) P

Autumn (Period I)

Instructors: Eila Järvenpää and Stina Immonen

Contents: Today many companies and other organizations operate on global market. Individuals, teams and organizations of dif-

ferent nationalities meet in daily business and other activities. Skills in cross-cultural management are becoming increasingly important. The course increases the participants' understanding about different cultures, and working and doing business in multicultural environment.

Course requirements: Exam, written assignment.

Literature: Schneider, S.C. and Barsoux, J.L.: *Managing across cultures*.

Language: English

Replaces the course TU-53.309

TU-53.1401 Research Methods in Industrial Management I (for postgraduate students) (5 cr) P
Autumn

Lecturers: Saku Mantere and guest lecturers

Contents: To assist the student in making sense of four key questions concerning the methodology of a successful PhD dissertation: 1) What constitutes a good research problem; 2) What the criteria are for scientific knowledge, fit to be used in solving the research problem; 3) What kinds of research designs can be used to produce such knowledge; and 4) How findings are to be reported in order to make a scientific contribution.

Course requirements: For Industrial Engineering and Management PhD students only. Pre-course and post-course essays, attendance on lectures, pre-lecture assignments.

Language: English

Prerequisites: Master's degree.

Replaces the course TU-53.401

TU-53.1403 Research Methods in Industrial Management II (for post-graduate students) (7-10cr) P

Lecturers: Professors

Requirements: A student must collect at least three credits from section a and a minimum of two credits from section b.

Note: replaces the course TU-53.403

(a) Licentiate & doctoral seminar (3 cr)

Autumn+spring

Lecturers: Veikko Teikari, Eila Järvenpää and Matti Vartiainen

Content: In licentiate and doctoral seminars, on-going licentiate theses and doctoral dissertations are discussed. The objective is to analyse doctoral dissertations in the field of industrial management, and help participants prepare their own licentiate and doctoral dissertations. Preparation, sharing and review of the research plans of all participants, at least two presentations by participant. Acting as opponent to another student's research plan. Discussion and debate in a scientific research community.

Language: English

(b) Methodology modules (1-7 cr)

Autumn+spring

Lecturers: Professors and visiting lecturers.

Content: Students participating in (b) must select 1-2 methodology modules that best support their own thesis, to complement the licentiate and doctoral seminar. The topic areas may include: action research, case study, constructive, qualitative, text analysis, statistical research, and scientific writing. The objective is to provide some systematic knowledge of methodological alternatives in management research, to help the participants to become more discerning consumers of research literature, and to help students to become better equipped to make decisions about methodological choices.

Requirements: Attendance at seminar sessions, assignments, seminar presentations, readings.

Literature: To be announced separately

Language: English

Replaces the course TU-53.403

Courses credited in ocr

TU-53.104 Seminar of leadership and work psychology (2 ocr)
Autumn

Instructors: Veikko Teikari, Tanja Kuronen and Jouni Virtaharju
Content: Deepens the understanding of leadership and work psychology on individual, group and organisational levels. Scientific writing, original reasoning, relevance, and applicability to working life are emphasized. The seminar will be held in small groups of 10-15 persons in order to enhance an interactive learning environment.

Course requirements: Active participation and a presented paper.

Language: Finnish. Can be taken in English; please contact the instructor.

TU-91 STRATEGY AND INTERNATIONAL BUSINESS

Prof. Tomi Laamanen, tel. 451 3093

Prof. Markku Maula, tel. 451 3085

ma Prof. Annaleena Parhankangas, tel. 451 3081

Prof. Hannele Wallenius, tel. 451 3083

TU-91.1001 Introduction to Economics (5 cr)

Autumn

Instructor: Hannele Wallenius

Contents: Principles of economic theory and analysis. Both microeconomic and macroeconomic issues are discussed: Markets and price theory, consumer behavior, behavior of the firm, economic growth and business cycles, the role of government, economic policy

Requirements: Attendance at lectures, exercises and examination.

Literature: Parkin, M., Powell M., Matthews, K., *Economics*, 6th edition, Addison-Wesley, 2005 and lecture notes.

Language: Finnish

Replaces the course TU-91.111

TU-91.1002 Marketing Management (3 cr)

Autumn (Period I-II)

Instructor: Rami Olkkonen

Contents: The marketing process and the areas it covers as integral elements of a firm's business processes. The course provides a perspective on the theory of marketing and its applications. The topics include the marketing environment, market analysis, and special characteristics of international marketing. The main perspective of the course is on business markets, but also consumer markets are included.

Requirements: Lectures exercises and examination.

Literature: To be announced separately. Lecture presentations.

Language: Finnish

Replaces the course TU-91.108 and TU-91.106

TU-91.1003 Principles of Strategic Management (3-4 cr)

Spring (Period III-IV)

Instructor: Tomi Laamanen

Contents: Overview of key concepts, frameworks and theories of strategic management through lectures and course literature; presentations of visiting strategy professionals.

Course requirements: Depend on the course version (lectures; home assignments, examination)

Literature: To be announced separately.

Language: English

Prerequisites: TU-22.1101

Replaces the course TU-91.131

TU-91.1004 Seminar in Market Research (5 cr)

Autumn

Instructor: Juha Mattsson

Contents: A market study and a marketing plan for a case company's product; the study is conducted in groups of three persons
Requirements: Attending the seminar sessions, literature review, and written assignment; the participants present their market study and review another group's work

Literature: Lecture notes. Other material will be announced separately

Prerequisites: TU-91.1002, TU-53.310

Language: Finnish

Replaces the course TU-91.109

TU-91.1006 ESTIEM Vision Seminar and Summer Academy (1-2 sp)

Autumn & Spring

Instructor: N.N.

Contents and requirements: Active attendance in ESTIEMs Vision seminar or Summer Academy, an individual study of literature and written assignment related to topics of seminar or Summer Academy.

Literature: Will be announced separately.

Language: Finnish and English

TU-91.100C Open code for strategy and international business

Autumn & Spring

Lecturer: Varies

Contents: Varies

Requirements: Varies

Literature: Varies

Prerequisites: Varies

Language: Varies

TU-91.2002 Internationalization of Firms (2 cr)

Spring

Instructor: N.N

Language: English

Contents: The course consists of lectures and company excursions. The lectures will present the most recent research findings on internationalization of firms. Also some relevant research projects of the Institute of Strategy and International Business will be discussed. There will be 4-6 visits to companies that can give a good account on internationalization of Finnish firms.

Requirements: Active attendance to lectures, excursions, and passing the final exam. The course material will be distributed at the first lecture.

Other: Only for major students.

TU-91.2003 New Venture Development I (3 cr)

Autumn

Instructor: Dr. Peter Kelly

Contents: This course provides a general introduction to entrepreneurship and a framework for evaluating the potential of entrepreneurial opportunities.

Requirements: Lectures, individual assignment

Literature: John W Mullins, *The New Business Road Test* (FT Prentice Hall, 2003) and other material delivered in course sessions.

Language: English

Replaces the course TU-91.120

TU-91.2004 Advanced Strategic Management (5 cr)

Autumn

Instructor: Tomi Laamanen

Contents: Lectures on selected advanced topics in strategic management: written assignment completed in a group of students on a strategic problem of an existing company of other kind of organization.

Course requirements: Lectures, written assignment, examination

Literature: To be announced separately

Language: English

Prerequisites: TU-22.1101, TU-91.131/TU-91.1003

Replaces the course TU-91.136

TU-91.2005 Strategic Management of Technology and Innovation (5 cr)

Autumn

Lecturer: Annaleena Parhankangas

Contents: Introduction to technology and innovation management: Innovations, technology and industry evolution, Role of Technology and Innovation Policies, Organizing for Innovation, Protecting Innovation, Corporate Renewal Through Innovation, Technology Acquisition Strategies, Managing New Product Development Process.

Requirements: Completing written assignment, passing the final exam.

Literature: To be announced separately.

Prerequisites: TU-91.1003 and TU-22.1101

Language: English

Replaces the course TU-91.123

TU-91.2006 Strategic Marketing (5 cr) L

Spring (Period IV)

Instructor: Juha Mattsson, Rami Olkkonen, Henriikki Tikkanen

Contents: The course delves into several key areas of marketing as the cornerstones of strategic management. These areas include creating, delivering, and communicating customer value, brand leadership and integrated marketing communications, services and relationship marketing, customer relationship management, new product development and commercialization, distribution management and international marketing. Combining latest scientific literature with real-life company assignments, the course provides a demanding, yet rewarding study package for highly motivated students.

Requirements: passing a pre-examination, lectures, literature summaries, presentations and practical assignment.

Literature: Walker et al. 2006. *Marketing Strategy: A Decision Focused Approach*. 5th International Edition. McGraw-Hill. ISBN: 0071116745. Other literature will be announced during the course.

Language: English

Prerequisites: TU-22.1101/TU-22.101, TU-91.1002/TU-91.106

Replaces the course TU-91.107

TU-91.2008 New Venture Development II: Business Plan (5 cr)

Spring (Period III-IV)

Instructor: Dr. Peter Kelly

Contents: Working in groups, students will prepare a detailed analysis and assessment of an entrepreneurial opportunity identified by them.

Course requirements: Prior permission of the instructor which will require that prospective students have organized a group and have identified an idea(s) to explore before the course commences. Lectures, group assignments, mentoring meetings.

Literature: to be announced separately

Language: English

Replaces the course TU-91.127

TU-91.2009 Entrepreneurial Finance (5 cr)

Spring (Period III-IV)

Lecturer: Dr. Peter Kelly

Content: This course provides a basic overview of the various sources of debt and equity finance available to entrepreneurs to support growth and development. We will discuss a number of topics including sources of equity capital, structuring deals, pricing equity stakes, negotiating the deal, managing the relationship with investors, and realizing value; and exit routes.

Requirements: Individual case write-ups, participation, final assignment.

Literature: Cases and notes delivered in class.

Language: English

Prerequisites: TU-91.2003
Replaces to course TU-91.125

TU-91.2010 Managerial Economics (5 cr)

Spring (Period III)
Instructor: Hannele Wallenius
Content: Introduction to applied microeconomic theory, with emphasis on managerial decision-making: topics to be discussed include demand estimation, the theory of production, cost minimization and profit maximization, behaviour of the firm, the market structure and the impact of the e-economy.
Requirements: Lectures, homework, computer exercises, and final exam
Literature: Keat, P. & Young, P. *Managerial Economics: Economic Tools for Today's Decision Makers*, 5th edition, Prentice-Hall, 2005 and lecture notes.
Prerequisites: TU-91.1001/TU-91.111 or some other introductory course in economics
Language: English
Replaces the course TU-91.113

TU-91.2011 International Economics (3-5 cr)

Spring (Period IV)
Instructor: Hannele Wallenius
Content: Introduction to the theory of international trade, alternative trade theories, trade policy, and economic integration: introduction to international finance, foreign exchange market, balance of payments problems, and policy alternatives.
Requirements: Lectures, follow-up presentation of a specific international macroeconomic topic, web-exercises, final exam
Literature: S. Husted & M. Melvin: *International Economics*, 6th ed., Addison Wesley Longman, 2004.
Prerequisites: TU-91.1001/TU-91.111 or some other introductory course in economics.
Language: English
Replaces the course TU-91.114

TU-91.2012 Elective Studies in Economics (1-8 cr) V

Autumn+spring
Instructor: Hannele Wallenius
Content: Essays or examinations by agreement
Literature: By agreement
Prerequisites: TU-91.1001/TU-91.111, other studies in economics recommended.
Language: Finnish or English
Replaces the course TU-91.115

TU-91.2013 Economics of European Integration (3 cr)

Autumn (Period I-II)
Instructor: Hannele Wallenius
Contents: This course introduces the main concepts behind the economics of European integration and applies them to the current development of European Union and its politics. The course begins with a short historical background of the European Union and its trade policy. After that the following macroeconomic aspects of an economic and monetary union will be covered: theory of Optimum Currency Areas and its critique, the role of European Central Bank and the conduct of monetary policy post-EMU, macroeconomic stabilization, fiscal discipline, and fiscal federalism in a currency union. The course will also help to understand the economic implications of EU enlargement.
Course requirements: Lectures and seminars, term paper.
Literature: De Grauwe, P., *Economics of Monetary Union*, 6th ed., Oxford University Press, 2005, and McDonald, F., Dearden, S., *European Economic Integration*, 4th ed., Prentice Hall, 2005, and selected journal articles.
Language: English
Replaces the course TU-91.116

TU-91.2014 Managing Growth (3 cr)

Autumn (Period II)
Instructor: Dr.Peter Kelly
Contents: In this course students will be introduced to frameworks to understand the dynamic challenges businesses face as they grow. We will explore these challenges in a variety of contexts including new firms, technology-based ventures and family-owned businesses.
Course requirements: Lectures, individual assignments.
Literature: To be announced separately.
Language: English
Replaces the course TU-91.148

TU-91.2015 Advanced Case-Seminar in Strategy (3-5 cr)

Autumn (Period I)
Instructor: Tomi Laamanen
Contents: Solving selected Harvard-type business cases related to strategic analysis; presenting case solutions.
Course requirements: Mandatory attendance in seminar sessions and presentations of case solutions prepared in groups of students.
Literature: To be announced separately.
Prerequisites: TU-22.1101, TU-91.1003/TU-91.131 (TU-91.2004/TU-91.136 also highly recommended).
Replaces the course TU-91.135

TU-91.2017 Advanced Financial Modeling (3 cr) L

Autumn (Period I-II)
Instructor: Markku Maula
Contents: This course introduces theory and practice of the quantitative analyses and financial modeling needed in new business development, venture capital and private equity investments, mergers and acquisitions, and strategy consulting through case readings and real life cases that are solved in small groups and presented and discussed during seminar sessions.
Course requirements: Entry exam, mandatory attendance in seminar sessions, and presentations of case solutions prepared in groups of students.
Literature: To be announced separately.
Prerequisites: TU-22.1144 and TU-91.2009
Other: Limited to max 20 students based on entry exam.

TU-91.2018 Industry Evolution (5 cr)

Autumn (Period I-II)
Instructor: Juha-Antti Lamberg
Contents: Key dilemma in strategic management and in organization studies is to understand how and why industries evolve and develop as they do. In strategy and organization research different evolutionary perspectives have received accumulating attention during the last decades. The aim of this course is to offer insights and frameworks to analyze and understand such issues as survival, industry evolution, dethronement processes and competitive dynamics in general.
Course requirements: Lectures, learning diary and written assignment.
Literature: To be announced separately.
Language: English
Prerequisites: TU-91.1003

TU-91.2019 Strategic Leadership (5 cr)

Spring (Period III-IV)
Instructor: Juha-Antti Lamberg
Content: Current theories and state of the art in strategic leadership; upper echelon theory; network perspective; psychodynamics; strategic change and dynamics.
Requirements: Attendance at lectures, assignment and presentations.
Literature: Specific information in the course brochure.
Language: English

TU-91.2020 Yritysstrategian ja kansainvälisen liiketoiminnan kieliharjoitus, ensimmäinen vieras kieli (2 op)

Autumn & Spring

Instructor: Annaleena Parhankangas

Contents: Writing a report for one of the courses TU-91.155, TU-91.167 in a European language; the language cannot be Finnish or the student's native tongue.

Requirements: The course is recognized only together with the courses listed above.

Replaces the course TU-91.182/TU-91.1005

TU-91.2021 Creative Entrepreneurship (20 cr)

Spring & Autumn

Teacher: Dr Peter Kelly (responsible) + Visiting Lecturers & Professionals

Contents: The objectives of this year long course are: i) to provide students with the tools and skills necessary to be an entrepreneur, ii) to broaden their perspective by working as part of an interdisciplinary team with students from HSE and TaiK, and iii) to hone these skills through "entrepreneurial practice". Experts will deliver content through a series of lectures, workshops and seminars focused in the following areas: i) creative teamwork, ii) project planning and data discovery, iii) due diligence, iv) legal issues, v) sales management training, vi) entrepreneurship process, vii) "designing" the business, viii) technology-based venturing strategy, ix) raising finance, x) business plan writing, and xi) presentation skills. Multidisciplinary student teams will then have the opportunity to "apply" these skills to develop a plan to transform a project with commercial potential into a start-up with growth potential. Each team will be supervised by a Project Board chaired by an experienced business person working with a Director of the Helsinki School of Creative Entrepreneurship and the Idea Originator.

Requirements: Attendance and active participation in all of the lectures, workshops and seminars is compulsory. Teams will be required to meet with their Project Board at least eight (8) times throughout the course of the year and submit a business plan by year end.

Prerequisites: Applicants must be entering their second year of Master's studies and be able to demonstrate that they can complete their studies by the end of the course or shortly thereafter.

Additional information: The number of participant is limited. For admission criteria, please contact responsible teacher.

Language: English

TU-91.2022 Contracting in Venture Capital and M&As (2 cr)

L

IV

Instructors: Jari Lauriala and Markku Maula

Contents: This course introduces current practice of legal structuring related to venture capital investments as well as mergers and acquisitions through lectures and real life cases that are solved in small groups and presented and discussed during seminar sessions. The objective of the course is to give the participants an understanding of the key legal issues of venture capital transactions and M&A's such as analyzing term-sheets, formulating and drafting the representations and warranties, investment agreements, convertible loan agreements, merger agreements, purchase agreements and their derivatives.

Course requirements: There will be no written examination in this course. The course evaluation will be based on individual participation and contribution (10%) and three group assignments (90%).

Literature: To be announced separately.

Prerequisites: TU-91.2009 and TU-91.2017 highly recommended

Other: Limited to max 20 students based on applications.

TU-91.2023 International Networks (2 cr)

I-II, III-IV

Instructor: N.N

Language: English

Contents: The course consists of lectures on international law, negotiations, cross-cultural issues, and social networks. The presentation skills of the participants will also be improved. In addition, the course provides a forum for networking with students from various nationalities, e.g. in the form of Nationality Nights. Requirements: Active attendance to lectures and the group work. The course begins with the lectures at the first period of the fall semester. Other events will take place during the entire academic year.

Other: Only for major students. Replaces TU-91.2001

TU-91.3001 Research Methods in Industrial Management I (for postgraduate students) (5 cr) P

Autumn(Period I-II)

Instructors: Dr. Saku Mantere, guest lecturers

Content: To assist the student in making sense of four key questions concerning the methodology of a successful PhD dissertation: 1) What constitutes a good research problem; 2) What the criteria are for scientific knowledge, fit to be used in solving the research problem; 3) What kinds of research designs can be used to produce such knowledge; and 4) How findings are to be reported in order to make a scientific contribution.

Course requirements: For Industrial Engineering and Management PhD students only. Pre-course and post-course essays, attendance on lectures, pre-lecture assignments.

Literature: Readings announced at the course web site.

Prerequisites: Master's degree.

Language: English

Replaces the course TU-91.197

TU-91.3002 Research Methods in Industrial Management II (5 cr) P

Spring(Period III-IV)

Instructor: Markku Maula

Content: The course is intended mainly for first-year doctoral students majoring in strategy and international business. The course is a continuation for the fall term course Research Methods in Industrial Management I. Students wishing to participate in the course are recommended to take first the fall term course. However, passing the fall term course is not a prerequisite for the participation. The key objective of the course is to help participants create and develop a good dissertation proposal. The course focuses on areas relevant for developing a good research proposal including problem formulation, literature review, theory and hypothesis development, research designs, and methodological choices. The course is intended to be an arena where students can discuss about their research projects and get feedback from the faculty and from their fellow students.

Course requirements: Attendance in seminar sessions, assignments, seminar presentations, readings, exam, and developing a research proposal.

Literature: To be announced separately.

Language: English

Replaces the course TU-91.198

TU-91.3003 Postgraduate Course in Corporate Finance (6-12 cr) P

Autumn&Spring

Instructor: Markku Maula

Contents: A reading package in corporate finance; intended for postgraduate students majoring in Strategy and International Business.

Course requirements: An individual study of assigned literature; worth six credit units; a maximum of five more credit units can be earned by writing an assignment on finance, and one more credit unit by taking part in a seminar on finance; no lectures.

Literature: To be announced separately.

Language: English

Replaces the course TU-91.196

TU-91.3007 Postgraduate Course in Strategy (12 cr) P

Autumn&Spring

Instructor: Tomi Laamanen

Contents: Seminar course on selected themes of academic strategy research for postgraduate students studying strategy as a postgraduate major.

Course requirements: Active participation in seminar sessions, preparation of presentations on selected academic articles, examination.

Literature: To be announced separately.

Language: English

Replaces the course TU-91.900

TU-91.3008 Research Colloquium (5 cr) P

Autumn&Spring

Instructor: Juha-Antti Lamberg

Content: Preparation and presentation of a) research plans of PhD theses, b) chapters / papers of PhD theses or c) post-doctoral / doctoral level scientific article manuscripts.

Requirements: Papers, presentation and acting as a discussant.

Literature: Specific information in the course brochure.

TU-91.3009 Studies in supplementary field: Strategy and International Business (12 cr) P

Autumn&Spring

Instructor: Juha-Antti Lamberg

Content: The obligatory book examinations of the postgraduate minor in strategy and international business. The whole minor is designed to provide for a coherent picture of the conceptual foundations and state of the art of strategy and international business. There is one examination for each of the obligatory book. Each examination covers the whole book.

Literature: 1) Faulkner, David O. and Campbell, Andrew (eds.) (2003). *Oxford handbook of strategy. Vol. 1: A strategy overview and competitive strategy*. Oxford: Oxford University Press.

2) Faulkner, David O. and Campbell, Andrew (eds.) (2003). *Oxford handbook of strategy. Vol. 2: Corporate strategy*. Oxford: Oxford University Press.

3) Rugman, Alan M. and Brewer, Thomas L. (eds.) (2001). *Oxford handbook of international business*. Oxford: Oxford University Press.

Notes: This course replaces TU-91.3004. For completing the postgraduate minor in strategy and international business students need to accomplish TU-91.3009 and to get 8 credit points from the advanced literature and / or offered postgraduate courses. The course offering changes in a yearly basis and the students are encouraged to discuss about the alternatives with the course assistant. The books can only be taken as examinations.

Courses credited in ocr**TU-91.155 Special Study in Business Strategy and International Business (3-5 ocr)**

Autumn+spring

Instructor: Annaleena Parhankangas

Contents: An independent, guided empirical study in the field of strategy and international business.

Requirements: Conducting empirical research in the field of strategy and international business and reporting the results. Before conducting the study, students should contact the instructor for the approval of the research plan.

Prerequisites: TU-91.1003 and TU-22.1101.

Language: Finnish, Swedish or English

TU-91.167 Seminar in Business Strategy and International Business (3 ocr) P

Autumn+spring

Instructor: Annaleena Parhankangas

Content: A literature study in the field of business strategy and international business.

Requirements: Completing a seminar paper, presenting one's own seminar paper, opposing the seminar paper of a fellow student, attending at the seminar sessions

Literature: To be announced separately

Prerequisites: TU-91.1003 and TU-22.1101.

Language: Finnish, Swedish or English

Note: The course begins in the fall term. The seminar sessions are held during the spring term.

LAHTI CENTER**TU-117 DEVELOPMENT AND MANAGEMENT IN INDUSTRY**

Prof. Ilkka Kauranen, tel. 03-5250294

Fixed-term prof. Mikko Mustakallio, tel. 03-525043

Fixed-term prof. Tuula Pohjola, tel. 050-5113703

TU-117.1309 International Marketing Strategy (3 cr)

Will be not lectured during academic year 2006-2007.

Lecturers: Nomen Nescitur and Ilkka Kauranen

Contents: The course introduces the students to special problems of international marketing; the starting points of marketing strategy from the viewpoint of a company's operational strategy; strategy alternatives and market area specific questions; planning process; marketing mix; and marketing channels.

Course requirements: Attendance at the lectures, an examination, and an exercise.

Literature: Will be announced in class.

Language: Finnish

The course will be held in Lahti or Otaniemi, during academic years to be announced separately.

TU-117.1312 Europeanness, and the European Union as an Operating Environment (1-3cr)

Will be not lectured during academic year 2006-2007.

Lecturers: Ilkka Kauranen and Nomen Nescitur

Contents: The course introduces the students to the European Union as a business environment of companies. EU legislation, financing possibilities offered by the EU, European cultures, the official mechanism of the European Commission, seeking and assessment of business opportunities on the home market.

Course requirements: Attendance at the lectures, an examination, an exercise, and attendance at the sessions of a EU Workshop in Brussels.

Language: Finnish

The course will be held in Lahti or Otaniemi, during academic years to be announced separately. The course includes a EU Workshop in Brussels.

TU-117.1502 Entrepreneurship in High Technology Enterprises (4-6cr) P

Will be not lectured during academic year 2006-2007.

Lecturer: Ilkka Kauranen

Contents: Entrepreneurship in practical work and as a topic of research; special features of high technology enterprises; technology transfer; setting up an enterprise; factors affecting the success of an enterprise; internationalization; business plan; risk financing and other forms of financing; business management; and business strategies.

Course requirements: Attendance at the lectures and seminar sessions, exercises, an examination.

Literature: Will be announced in class.

Language: Finnish or English

The course will be held in Lahti or Otaniemi, during academic years to be announced separately.

TU-117.1503 Special Assignment on Development and Management in Industry (5 cr) P

Autumn

Will be lectured during academic year 2006-2007 in Lahti.

Lecturer: Mikko Mustakallio

Contents: An independently executed but supervised special assignment on a specific topic relating to development and management in industry. The topic and the working method are to be agreed upon separately before the starting of the special assignment.

Prerequisites: TU-22.101; other ways of meeting the prerequisites can be discussed with the course instructor.

Language: Finnish or English

TU-117.1506 Seminar on Development and Management in Industry (5 cr) P

Autumn

Will be lectured during academic year 2006-2007 in Lahti.

Lecturer: Mikko Mustakallio

Contents: The topics of the seminar papers are selected from among current topics relating to development and management in industry.

Prerequisites: TU-22.1101 or TU-91.2003; other ways of meeting the prerequisites can be discussed with the course instructor.

Language: Finnish or English

TU-117.1509 Master's Thesis Seminar on Development and Management in Industry (2 cr)

Autumn

Will be lectured during academic year 2006-2007 in Lahti.

Lecturer: Mikko Mustakallio

Contents: In the course, the students are supervised in the preparation of their Master's theses.

Course requirements: During the academic year, each student presents his or her Master's thesis in progress and comments on the theses of the other students.

Language: Finnish or English

TU-117.1512 Varying Course on Development and Management in Industry (1-6cr) PV

Autumn

Will be lectured during academic year 2006-2007 in Lahti.

Lecturer: Mikko Mustakallio

Contents: The course introduces the students to important questions on development and management in industry through topics and work methods that vary from year to year.

Course requirements: An examination and or seminar work, depending on the contents of the course at the given time.

Literature: Will be announced in class.

Language: Finnish or English

TU-117.1550 Competitiveness of industrial enterprise (5cr)

Spring

Will be lectured during academic year 2006-2007 in Lahti.

Instructor: Mikko Mustakallio

Contents: the objectives of the course are to provide participants with the understanding on factors affecting competitiveness of industrial enterprise and to provide tools for improving competitiveness. In addition to theoretical frameworks, learning based on the participant's own experience is emphasized.

Course requirements: Attendance at the lectures, an exercise and examination.

Literature: Will be announced in the class

Language: English or Finnish

TU-117.1603 Workshop on Development and Management in Industry (1-9cr) P

Will be not lectured during academic year 2006-2007.

Instructor: Ilkka Kauranen

Contents: The aim is to provide an overview of research in the field of development and management in industry. Reading and presenting articles published in leading journals of the field.

Course requirements: Presentations of scientific articles, active participation in the seminar sessions and discussions.

Language: English or Finnish

The course will be held in Lahti or Otaniemi, during academic years to be announced separately.

TU-117.1606 Research Seminar on Development and Management in Industry (1-10 cr) P

Will be not lectured during academic year 2006-2007.

Instructor: Ilkka Kauranen

Contents: To introduce a scientific way of thinking, to discuss important scientific approaches and scientific research methods, to analyze doctoral dissertations in the field of development and management in industry, and to help the participants in preparing their own licentiate theses or doctoral dissertations.

Course requirements: Attendance at seminar sessions, formulating and presenting a plan for one's own licentiate thesis or doctoral dissertation, analyzing and presenting doctoral dissertations, and acting as the commentator for seminar presentations.

Literature: Giere, Understanding Scientific Reasoning, second edition, Holt, Rinehart and Winston, Inc 1984; other literature to be announced at the seminar sessions.

Language: English or Finnish

The course will be held in Lahti or Otaniemi, during academic years to be announced separately.

TU-117.1609 Strategic Management of Technology (2 cr) P

Will be not lectured during academic year 2006-2007.

Instructor: Nomen Nescitur and Ilkka Kauranen

Contents: The role of technology in economic development and corporations. How technology can be managed to create competitive advantage at firm level. The problems faced in implementing the process of technology transfer.

Course requirements: Lectures, written assignments, examination.

Literature: Books and scientific articles required for the examination announced during the lectures.

The course will be held in Lahti or Otaniemi, during academic years to be announced separately.

Language: English

TU-117.1613 Cross-Cultural Business (5 cr) P

Will be not lectured during academic year 2006-2007.

Instructor: Nomen Nescitur and Ilkka Kauranen

Contents: The course will familiarise the students with the theoretical background and context of cross-cultural management, general and international context as well as with applications in the work environment. Attention will be paid to the strategic issues related to cross-cultural management at the level of a firm.

Course requirements: Lectures, written assignment, examination.

Literature: Books and scientific articles required for the examination announced during the lectures.

Language: English

The course will be held in Lahti or Otaniemi, during academic years to be announced separately.

TU-117.1700 Language Exercise on Development and Management in Industry; First Foreign Language (2 cr)

Autumn

Will be lectured during academic year 2006-2007.

Lecturer: Mikko Mustakallio

Contents: Credit for the course is attained by writing an exercise, a special assignment or a seminar paper, agreed upon in advance, in a foreign European language. The language must not be Finnish and not the student's native language.

Course requirements: Courses TU-117.1700, TU-117.1701 and TU-117.1702 are to be taken in different languages.

TU-117.1701 Language Exercise on Development and Management in Industry; Second Foreign Language (2 cr)

Autumn

Will be lectured during academic year 2006-2007.

Lecturer: Ilkka Kauranen

Contents: Credit for the course is attained by writing an exercise, a special assignment or a seminar paper, agreed upon in advance, in a foreign European language. The language must not be Finnish and not the student's native language.

Course requirements: Courses TU-117.1700, TU-117.1701 and TU-117.1702 are to be taken in different languages.

TU-117.1702 Language Exercise on Development and Management in Industry; Third Foreign Language (2 cr)

Autumn

Will be not lectured during academic year 2006-2007.

Lecturer: Ilkka Kauranen

Contents: Credit for the course is attained by writing an exercise, a special assignment or a seminar paper, agreed upon in advance, in a foreign European language. The language must not be Finnish and not the student's native language.

Course requirements: Courses TU-117.1700, TU-117.1701 and TU-117.1702 are to be taken in different languages.

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

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MT-37 Metallurgy

Prof: Lauri Holappa tel. 451 2757, room B 361

Prof: Heikki Jalkanen tel. 451 2753, room B 346

<http://metallurgy.tkk.fi/>

MT-45 Materials Science

Prof: Ari Lehto, tel 451 2678, room V 241

Prof: Simo-Pekka Hannula, tel. 451 2675, 040-552 6605, room V221

<http://materiaalitiede.tkk.fi>

MT-46 Mechanical Process Technology and Recycling

Prof: Kari Heiskanen, tel. 451 2789, room B 369

<http://www.tkk.fi/Yksikot/Mekpros/>

MT-65 Processing and Heat Treatment of Materials

Prof: Seppo Kivivuori, tel. 451 2702

Prof: Antti Korhonen, tel. 451 2707

<http://materiaali.tkk.fi/en/Treatment/>

MT-77 Materials Processing and Powder Metallurgy

Prof: Mikhail Gasik, tel. 451 2769

<http://materiaali.tkk.fi/en/LMP/>

MT-85 Corrosion Science and Hydrometallurgy

Prof: Olof Forsén, tel. 451 2745

<http://materiaali.tkk.fi/en/Corrosion/>

MT-0 GENERAL STUDIES

Courses credited in ECTS

MT-0.1001 Experiment design and treatment of results (3 cr)

Spring (Period III)

Teacher: Ilkka Penttinen, teaching research scientist, Jari Aromaa, Docent.

Contents: Experiment design, aim and extent of experiments, selection of test environment. Measurement uncertainty, test of significance, variance analysis. Collecting experimental data, treating results mathematically, reporting.

Requirements: Seven computer-aided exercises.

Literature: Course notes and handouts.

Prerequisites: Mat-K1-K3.

Language: Finnish.

MT-0.1006 Chemical Thermodynamics and Fundamentals of Kinetics (7 cr)

Autumn – Spring (Period II-IV)

Teacher: Prof Heikki Jalkanen.

Contents: The role of thermodynamics and process kinetics in materials manufacturing and application. Fundamentals of

chemical thermodynamics. Thermodynamics of solutions. Phase and chemical equilibria and stability, phase and thermodynamic stability diagrams. Thermochemistry. Thermodynamic fundamentals of electrochemistry and surface phenomena. Matter transformation's driving forces and transportation processes. Thermodynamic fundamentals of reaction, phase transformation and diffusion kinetics. Theory is applied to analysis of phenomena in materials manufacturing, processing and application. Requirements: Examination or several part examinations.

Literature: Handout (in Finnish) or following textbooks to the appropriate extent: D. Kondepudi, I. Prigogine, Modern Thermodynamics, Swalin, Thermodynamics of Solids, Brophy, Rose, Wulff, The Structure and Properties of Materials vol II Thermodynamics of Structure, H-G. Lee, Chemical Thermodynamics for Metals and Materials, Jena, Chaturvedi, Phase Transformations in Materials.

Prerequisites: MT-0.1011 Principles of Materials Science (5 cr).

Additional: This course replaces the course Mak-37.135 Thermodynamic-Kinetic Fundamentals of Materials and Processes (6 ocr).

Language: Finnish.

MT-0.1011 Principles of Materials Science (5 cr)

Spring (Period IV)

Teacher: Ilkka Penttinen, teaching research scientist.

Contents: Properties of technical materials and their theoretical background. The effect of microstructure on properties. Material selection.

Requirements: Examination.

Literature: Compendium; Selected parts of: W.D. Callister Jr.: Materials Science and Engineering, New York, 4th ed., John Wiley & Sons Inc., 1997.

Prerequisites: -

Additional: This course replaces the courses Mak-45.310 Principles of Materials Science and Engineering (4 ocr) and Mak 65.100 Introduction to Materials Science and Engineering (4 ocr).

Language: Finnish.

MT-0.1016 Heat and Mass Transfer Principles (5 cr)

Autumn (Period I-II)

Teacher: Toni Kaskiala, D.Sc. (Tech.)

Contents: Introduction to fluid mechanics and heat transfer. Heat and mass transfer mechanisms, conductivity, diffusion, convection, radiation. Measurement of temperature.

Requirements: Examination or 2 intermediate tests. Literature may be used, but not complete examples.

Literature: Lecture materials, No. 496: A. Jokilaakso: Virtaustekniikan, lämmönsiirron ja aineensiirron perusteet, soveltuvien osien. Exercise tasks.

Prerequisites: -

Additional: This course replaces the course Mak-77.111 Heat and Mass transfer principles (5 ocr).

Language: Finnish.

MT-0.2101 Material Physics (5 cr)

Spring (Period III-IV)

Teacher: Prof Ari Lehto.

Contents: Atomic structure and properties of materials. Physical basis of magnetic, optical, electrical, thermal etc. properties and surface phenomena.

Requirements: Examination and exercise work.

Literature: Rolf E. Hummel, Electronic Properties of Materials, 3rd edn, New York, Springer, 2003.

Peter Wilkes, Solid State Theory in Metallurgy, Cambridge Univ., 1973.

Leonid V. Azaroff & James Brophy, Electronic Processes in Materials, New York, McGraw-Hill, 1963.

Charles Kittel, Introduction to Solid State Physics, Hoboken, NJ, Wiley&Sons, 2005.

M. Alonso-E. Finn, Fundamental University Physics II, Reading (MA), Addison-Wesley, 1983.

Prerequisites: Completion of P-, O- and MT 100-1 modules are required before taking this course.

Additional: This course replaces the course Mak-45.126 Material Physics (4 ocr). See more <http://kerppu.hut.fi/opiskelu/materiaali>

Language: Finnish. Course material available in English. Individual study in English possible.

MT-0.2106 Structural Defects in Materials (5 cr)

Autumn (Period I)

Teacher: Prof Simo-Pekka Hannula, Ilkka Penttinen, teaching research scientist.

Contents: Formation of lattice defects, their interactions and influence on material properties.

Requirements: Examination.

Literature: Compendium: D.Hull and D.J.Bacon, Introduction to dislocations, Oxford: Butterworth-Heinemann, 2001.

Prerequisites: Course MT-0.1011 Principles of Materials Science (5 cr).

Additional: Compensation is to be agreed with the lecturer.

Language: Finnish.

MT-0.2111 Principles of Phase Transformations (5 cr)

Autumn (Period II)

Teacher: Prof Simo-Pekka Hannula, Ilkka Penttinen, teaching research scientist.

Contents: Phase equilibria, metal alloy, phase diagrams, solidification, diffusion controlled phase transformations, martensitic transformations.

Requirements: Examination. Exercise tasks obligatory.

Literature: Compendium, D.A. Porter and K.E. Easterling, Phase Transformations in Metals and Alloys, London, Chapman&Hall 1992.

Prerequisites: Module MT 100-1.

Additional: Compensation is to be agreed with the lecturer.

Language: Finnish.

MT-0.2116 Fundamentals of Forming Technology (5 cr)

Spring (Period IV)

Teacher: Prof Seppo Kivivuori, Leif Eriksson, specialist teacher, Oskari Lytinen, assistant.

Contents: Basics of material formability testing methods and introduction to essential forming techniques. Examples of forming processes including massive deformation and sheet metal forming methods. Examples of computing methods for forming.

Requirements: Examination. Exercise tasks.

Literature: Compendium: Kivivuori, S., Muovaustekniikan perusteet (in finnish).

Additional Reading: E.M.Mielnik, Metalworking Science and Engineering, McGraw-Hill, 1991.

Prerequisites: Kul-49.2200 Mechanics of Materials IB (5 ocr) and MT-0.2106 Structural Defects in Materials (5 cr).

Additional: This course replaces the course Mak-65.110 Fundamentals of Forming Technology (2 ocr).

Language: Finnish. Course materials also available in English.

Individual study in English possible.

MT-0.2201 Basics of Materials Chemistry (5 cr)

Autumn (Period I-II)

Teacher: Prof Mikhail Gasik (1 part, 2 cr), Jari Aromaa, Docent (2 part, 3 cr).

Contents: (1) Principles of manufacturing metallic, ceramic and composite materials. Modern processing technologies and methods. Technological and economic issues in materials processing and properties. (2) Chemical and electrochemical interaction of materials and environments, the driving forces of these processes, equilibrium and factors controlling the reaction rates. The effect of interfaces on materials synthesis and destruction.

Requirements: Lecture diary and laboratory work.

Literature: Lecture materials, literature surveys for different material groups.

Prerequisites: Module MT 100-1.

Additional: This course compensates courses Mak-77.125 High Temperature Processes of Inorganic Materials (4 ocr) and Mak-85.107 Materials Electrochemistry (2 ocr).

Language: Finnish. Individual study in English possible.

MT-0.2206 Surface phenomena (5 cr)

Spring (Period III-IV)

Teacher: Marja Oja, Docent, Prof Heikki Jalkanen.

Contents: The aim of the course is to introduce the basics of the surface phenomena and to go through the effect of surfaces in the different unit operations. In addition the course focuses on the basics of the particle technology and enlightens how the particulate materials affect the surface reactions.

Requirements: Examination.

Literature: Material distributed during the lectures, Allen, T, Powder Sampling and Particle Size Determination, Elsevier

2003 and Lecture Notes on "Surface phenomena in high temperature materials processing".

Prerequisites: -

Additional: This course replaces the course Mak-46.140 Fundamentals of Particle Technology.

Language: Finnish.

MT-0.2211 Hydrodynamics (3 cr)

Autumn (Period II)

Teacher: Prof Kari Heiskanen.

Contents: Viscosity, important dimensionless numbers, hydrostatics, system and control volumes, laminar and turbulent flow, Flow equations, dimensionless size and translational velocity, Flow in pipes, fractures and porous media, external flow, dimensioning principles of pumping lines and mixers, flow modelling examples.

Requirements: Examination.

Literature: Lecture notes.

Prerequisites: Mat-1.1331 KP3-I.

Additional: This course replaces the course Mak-77.104 Fluid Dynamics in Process Industry (2 ocr).

Language: Finnish.

MT-0.2216 Unit processes and mechanisms (7 cr)

Spring (Period III-IV)

Teacher: Prof Olof Forsén, Marja Oja, Docent and Marko Kekkonen, teaching research scientist.

Contents: The aim of the course is to introduce the basics of the mechanical, hydrometallurgical and high temperature unit processes. Mechanical unit processes: grinding, classification and ore beneficiation processes, solid-liquid separation, agglomeration and pelletization. Unit processes in hydrometallurgy: dissolution, solution purification and recovery of metals from aqueous solutions. High temperature processes: roasting, reduction, smelting, converting, refining processes, casting.

Requirements: Examination.

Literature: Material distributed during the lectures.

Prerequisites: Module MT 100-1.

Additional: This course replaces the courses Mak-85.170 Hydrometallurgy (3 ocr) and Mak-37.130 Unit processes in Metallurgy (3 ocr).

Language: Finnish.

MT-0.3101 Materials Characterization (5 cr)

Autumn (Period I)

Teacher: Prof Simo-Pekka Hannula, Erkki Heikinheimo D.Sc (Tech.), Markus Turunen, Docent, Leena-Sisko Johansson Ph.D.

Contents: Specimen preparation, optical microscopy, X-ray metallography and spectroscopy, scanning electron microscopy and microanalysis, surface analysis, hardness measurement.

Requirements: Examination.

Literature: Compendium; B.D Cullity, Elements of X-Ray Diffraction, Addison-Wesley publishing company, second or later edition.

Prerequisites: MT-0.1011 Principles of Materials Science (5 cr) and module MT 201-2.

Additional: This course replaces the course Mak-45.114 Materials Characterization (4 ocr).

Language: Finnish.

MT-0.3106 Transmission Electron Microscopy (2 cr)

Spring (Period IV)

Teacher: Risto Toivanen, laboratory engineer.

Contents: Principles of image formation, electron diffraction and contrast theory. Specimen preparation methods and principles. Applications of electron microscopy.

Requirements: Examination.

Literature: Compendium.

Prerequisites: MT-0.1011 Principles of Materials Science (5 cr) and module MT 201-2.

Additional: This course obligatory before postgraduate studies.

Language: Finnish. Individual study in English possible.

MT-0.3111 Applied Materials Science (5 cr)

Spring (Period III)

Teacher: Prof Simo-Pekka Hannula, Ilkka Penttinen, teaching research scientist.

Contents: Deformation induced microstructural changes, recovery of deformation, applications of precipitation hardening, polymorphism of ferrous materials, effects of alloying elements, stainless and special steels.

Requirements: Examination, industry site visit.

Literature: Compendium; Honeycombe&Bhadeshia, Steels: Microstructure and Properties, London, Edward Arnold, 1995.

Prerequisites: MT-0.1011 Principles of Materials Science (5 cr) and module MT 201-2.

Additional: Compensation to be agreed with the lecturer.

Language: Finnish.

MT-0.3116 Laboratory Exercises in Materials Science (3 cr)

Spring (Period IV)

Teacher: Prof Simo-Pekka Hannula. Specialist lecturers.

Contents: Guided laboratory exercises.

Requirements: Laboratory exercises and obligatory reports.

Literature: Will be announced at the beginning of the course.

Prerequisites: Module MT 201-2 and course MT-0.3101 Materials Characterization (5 cr).

Language: Finnish.

MT-0.3201 Materials production and synthesis (7 cr)

Autumn (Period I-II)

Teacher: Prof Lauri Holappa, Prof Olof Forsén, Prof Mikhail Gasik.

Contents: Central processes for production of metals and inorganic materials with their common thermodynamic, kinetic, physical and electrochemical bases. The course consists of lectures and a seminar contribution. Pyro- and hydrometallurgical processes, chemical and electrochemical methods, solidification and precipitation, powder metallurgical processes, production of composite materials, functional and nano-materials are examined.

Requirements: Lectures, examination, written report (in English), oral presentation in an international seminar.

Literature: Compendium, seminar proceedings.

Prerequisites: Module MT 202-2.

Additional: This course replaces the course Mak-37.145 Seminar Course on Advanced Metallurgical Processes (5 ocr).

Language: Finnish. Individual study in English possible.

MT-0.3206 Laboratory Exercises in Material Production (3 cr)

Autumn (Period I-II)

Teacher: Marko Kekkonen, teaching research scientist, Antero Pehkonen, researcher, Michael Friman, M.Sc.

Contents: The aim of the course is to make the students familiar with the laboratory work and to know common research methods in pyro, hydro and powder metallurgy and corrosion science.

Requirements: Laboratory work and written reports.

Literature: -

Prerequisites: Module MT 202-2.

Additional: This course replaces the course Mak-37.150 Laboratory Exercises in Material Production (3 ocr).

Language: Finnish.

MT-0.3211 Thermodynamic calculation in materials production systems (5 cr)

Spring (Period III-IV)

Teacher: Marko Hämäläinen, Docent.

Contents: General principles of equilibrium and energy balance calculation. Modelling of thermodynamic properties of stoichiometric and solution phases. Demonstration of computer programs HSC and Fact Sage. Exercise using HSC and Chem Sheet.

Requirements: Exerciseworks and examination.

Literature: Compendium; Saunders, N., Miodownik, A.P, Calphad, Pergamon Press, UK, 1998.

Prerequisites: Module MT 202-2.

Additional: This course replaces the course Mak-77.126 Equilibrium calculations (3 ocr).

Language: Finnish.

MT-0.3216 Process Engineering (5 cr)

Spring (Period III-IV).

Teacher: Seppo Louhenkilpi, Docent.

Contents: The aim is to learn to apply theoretical bases of reaction kinetics, heat and mass transfer in materials production. Gas/solid, gas/liquid, solid/liquid and liquid/liquid reaction systems are studied. Gas and liquid flow, heat and mass transfer phenomena are examined by calculation examples of practical processes (blast furnace, flash smelting, converting, continuous casting, leaching reactor).

Requirements: Lectures, calculation exercises, examination.

Literature: Will be announced at the beginning of the course.

Prerequisites: Module MT 202-2.

Additional: This course replaces the course Mak-37.112 Physical Chemistry of Pyrometallurgical Processes (5 ocr).

Language: Finnish.

MT-0.3301 Basis for Corrosion Prevention (5 cr)

Autumn (Period I-II)

Teacher: Prof Olof Forsén, Jari Aromaa, Docent and Antero Pehkonen, researcher.

Contents: Corrosion phenomena of materials, especially metallic materials, based on electrochemical theory. Basics and kinetics of metal dissolution. Properties of metals and environments that affect and prevent corrosion. Introduction to high temperature corrosion.

Requirements: Examination, laboratory exercises and corrosion case.

Literature: Compendium.

Prerequisites: Module MT 201-2 or module MT 202-2 or corresponding knowledge.

Additional: This course replaces the course Mak-85.111 Theoretical Basis for Corrosion Prevention (3 ocr).

Language: Finnish.

MT-0.3306 Surface Engineering (2 cr)

Spring (Period III)

Teacher: Prof Olof Forsén and Esko Harju, specialist teacher.

Contents: Surface cleaning, coating methods, research methods for coatings. Basics of electrolysis, chemical deposition methods, electrochemical polishing and manufacturing, anodizing, apparatus, occupational health and environmental issues.

Requirements: Examination.

Literature: P. Tunturi, Metallien pinnoitteet ja pintakäsittely, MET-julkaisu 3/99 and lecture notes.

Prerequisites: Module MT 201-2 or module MT 202-2 or corresponding knowledge.

Additional: This course replaces the course Mak-85.144 Surface Engineering and Electroplating (KE, P, MK) (3,5 ocr).

Language: Finnish.

MT-0.3311 Manufacturing with Forming and Related Techniques (3 cr)

Spring (Period III)

Teacher: Prof Seppo Kivivuori, Esko Harju, specialist teacher.

Contents: Materials and manufacturing techniques. Product design and planning using mathematical modelling and simulation methods.

Requirements: Examination and exercise tasks.

Literature: Compendium: Kivivuori, Harju, Manufacturing Methods (in Finnish).

Prerequisites: Kon-41.2011 Material Design Basics C (3 ocr) and course MT-0.2116 Fundamentals of Forming Technology (5 cr) recommended.

Additional: This course replaces the course Mak-65.137. Fundamentals of Materials Technology - Manufacturing (3 ocr).

Language: Finnish.

MT-0.3316 Heat Treatment of Materials (5 cr)

Autumn (Period II)

Teacher: Prof Seppo Kivivuori, Ahti Viljamaa, assistant, Oskari Lyytinen, assistant.

Contents: Transformations and control of microstructure and properties. Full annealing, hardening, tempering, quench and temper, normalizing, precipitation, recrystallization annealing. Vacuum heat treatment techniques and diffusion annealing and bonding.

Requirements: Examination. Exercise tasks.

Literature: Kivivuori, S., Härkönen, S., Lämpökäsittelyoppi, Teknologiateollisuus ry, 2004 (in Finnish).

Additional Reading: G. Kraus, Steels - Heat Treatment and Processing Principles. ASM, 1990.

Prerequisites: Module MT 201-2 or MT 202-2.

Additional: This course replaces the courses Mak-65.155 Heat Treatment of Materials (3 ocr) and Mak-65.152 Furnace and Protective Atmosphere Technology (2 ocr).

Language: Finnish.

MT-0.3321 Materials Design (5 cr)

Spring (Period IV)

Teacher: Prof Seppo Kivivuori, Ahti Viljamaa, assistant, Elina Wanne, specialist teacher.

Contents: Material design based on product demands. Selecting and design methods, information sources, material costs. Circumstantial and manufacturing demands.

Requirements: Examination. Exercise and seminar tasks.

Literature: Compendium: Materiaalin suunnittelu (in Finnish). Kivioja and S., Kivivuori, S., Salonen, P., Tribologia – Kitka, kuluminen ja voitelu (in Finnish).

Additional Reading: Selection of Engineering Materials, Prentice Hall, New Jersey, 1991.

Prerequisites: MT-0.3301 Basis for Corrosion Prevention (5 cr), MT-0.3311 Manufacturing with Forming and Related Techniques (3 cr) and MT-0.3316 Heat treatment of Materials (5 cr).

Additional: This course replaces the courses Mak-65.157 Materials Design (3 ocr) and Mak-65.158 Principles of Tribology (3 ocr).

Language: Finnish.

MT-0.3401 Recycling systems (10 cr)

Autumn (Period I-III)

Teacher: Prof Kari Heiskanen, Harri Lehto, teaching research scientist, Marja Oja, Docent.

Contents: Discrete property space, property classification, recycling population balance models, material liberation, recyclability, recycling rate, mass and property balances, separation efficiency, grade-recovery curve, recycling technologies and flow sheets for some important material classes, directives and legislation.

Requirements: Two exams and seminars.
 Literature: Reuter, Boin, Heiskanen and van Schaik, Keeping raw materials in the resource cycle, Elsevier, 2005.
 Prerequisites: MT-0.2216 unit processes and mechanisms (7 cr).
 Language: Finnish.

MT-0.3406 Recycling assignment (5 cr)

Spring (Period III-IV)
 Teacher: Harri Lehto, teaching research scientist, Janne Vuori, assistant.
 Contents: Planning for a recycling system of a given material.
 Requirements: Seminar.
 Literature: Will be announced at the beginning of the course.
 Prerequisites: MT-0.3401 Recycling systems (10 cr) and MT-0.3411 Recycling laboratory exercise (5 cr).
 Language: Finnish.

MT-0.3411 Recycling laboratory exercise (5 cr)

Autumn (Period I-II)
 Teacher: Harri Lehto, teaching research scientist, Janne Vuori, assistant.
 Contents: Four laboratory assignments of different recycling unit processes. Mass balances and population models.
 Requirements: Accepted assignment reports and seminar.
 Literature: Will be announced at the beginning of the course.
 Prerequisites: Module MT 202-2.
 Language: Finnish.

MT-0.4001 Fundamentals of solidification (3 cr)

Autumn (Period I)
 Teacher: Seppo Louhenkilpi, Docent, Jyrki Miettinen, senior researcher.
 Contents: Solidification of pure metals, materials and alloys, phase diagrams, lever rule, constitutional under cooling, Scheil equation, solidification structures and morphologies, phase transformations, segregation, research methods, as-cast properties.
 Requirements: Lectures, examination.
 Literature: Will be announced at the beginning of the course.
 Prerequisites: -
 Additional: This course replaces the course Mak-37.115 Casting and Solidification of Materials (2 ocr).
 Language: Finnish.

MT-0.4006 Solidification phenomena in materials production (4 cr)

Autumn (Period II)
 Teacher: Seppo Louhenkilpi, Docent, Prof Juhani Orkas.
 Contents: Principles of modern casting methods; continuous casting, thin slab and strip casting, rapid solidification processes, high pressure and low pressure casting, precision casting, thixo casting, casting of amorphous materials and single crystals, welding, special and future technique.
 Requirements: Lectures, examination.
 Literature: Will be announced at the beginning of the course.
 Prerequisites: -
 Language: Finnish.

MT-0.4011 Simulation tools for materials production (5 cr)

Spring (Period III)
 Teacher: Seppo Louhenkilpi, Docent, specialist lecturers.
 Contents: Theoretical basis of simulation models and program software are presented, common programs are demonstrated and exercises are performed by applying e.g. TEMPSIMU, CAL-COSOF, CONIFER-CAST, MAGMASOFT and some CFD-models.

Requirements: Lectures, exercises and examination.
 Literature: Will be announced at the beginning of the course.
 Prerequisites: -
 Additional: This course replaces the course Mak-37.123 Principles of Modelling of Metallurgical Processes (3 ocr).
 Language: Finnish.

MT-0.4016 Production of demanding metals and alloys (5 cr)

Spring (Period IV)
 Teacher: Seppo Louhenkilpi, Docent, specialist lecturers.
 Contents: Metals, alloys and materials with exceptional casting problems are examined. Problem solving, influence of materials composition and structure on phenomena in casting, solidification and cooling are described and studied.
 Requirements: Lectures, exercises, examination.
 Literature: Will be announced at the beginning of the course.
 Prerequisites: -
 Language: Finnish.

MT-0.4021 Special materials for materials production (3 cr)

Autumn (Period I)
 Teacher: Prof Lauri Holappa, guest lecturers.
 Contents: Special materials which are needed in materials production, are introduced including materials properties and interaction in process conditions. Ceramic refractory materials, casting powders, covering powders and slag forming materials, mould materials etc are discussed. Interaction phenomena in process circumstances between these materials and liquid metals and slags, wear mechanisms and heat engineering properties are studied as well.
 Requirements: Lectures, exercises, examination.
 Literature: Will be announced at the beginning of the course.
 Prerequisites: MT-0.3201 Materials production and synthesis (7 cr).
 Additional: This course replaces the course Mak-37.111 Refractory Materials in Metallurgical Industry (2 ocr).
 Language: Finnish. Individual study in English possible.

MT-0.4501 Semiconductor technology (3 cr)

Autumn (Period I)
 Teacher: Prof. Ari Lehto.
 Contents: The most important substrates used in microtechnologies, manufacturing of semiconductor wafers and their properties. The emphasis is on the special properties of semiconductor wafers having influence on the manufacturing and properties of microcomponents.
 Requirements: Examination.
 Literature: Handout. Other literature is to be announced in the beginning of the course.
 Prerequisites: Module MT 201-2.
 Additional: Course MT-0.6031 Microsystems (3 cr) is recommended to supplement this course. This course replaces the course Mak-45.151 Silicon Technology, Applications in Electronics and Microsystem Technology (2 ocr).
 Language: Finnish.

MT-0.4506 Electronics materials (5 cr)

Spring (Period III-IV)
 Teacher: Eero Haimi, M.Sc. (Tech.).
 Contents: Materials of electronic components, component integration and material related quality and reliability issues.
 Requirements: Examination, literature survey and oral presentation in seminar.
 Literature: Will be announced at the beginning of the course.
 Prerequisites: Completion of P- and O- modules is required.
 Additional: This course replaces the course Mak-45.170 Electronic Materials (3 ocr).

Language: Finnish.

MT-0.4511 New Materials (5 cr)

Autumn (Period II)

Teacher: Prof Ari Lehto, Prof Simo-Pekka Hannula.

Contents: New materials, their manufacturing, properties and applications.

Requirements: Examination.

Literature: Compendium.

Prerequisites: Module MT 301-3.

Additional: This course replaces the course Mak-45.155 New Materials (2 ocr).

Language: Finnish.

MT-0.4516 Inorganic Composite Materials (3 cr)

Autumn (Period II)

Teacher: Prof Simo-Pekka Hannula.

Contents: Metal and ceramic matrix composites, their major manufacturing methods, properties and applications, Heat treatments, surface treatments and joining of composites.

Requirements: Examination and exercise work.

Literature: Compendium; M.M. Swarz, Composite materials Handbook, 2nd ed., McGraw-Hill, 1992, partly applicable; Metallimatriisikompositit, raportti TKK-MOP-C6; Metallimatriisikomposittien pulverimetallurgiset valmistusmenetelmät, raportti, TKK-MOP-C7.

Prerequisites: MT 301-3.

Additional: This course replaces the course Mak-45.181 Inorganic Composite Materials (2 ocr).

Language: Finnish.

MT-0.4521 Non-waste Technology, Material Economics and Life-cycle Assessment (3 cr)

Spring (Period IV)

Teacher: Ilkka Penttinen, teaching research scientist.

Contents: Presents non-waste technology, its principles, development and projects. The influence of materials on global and national economy. Sustainability in the production and application of materials. Basis of life cycle analysis and eco balance. Evaluation of environmental effects in manufacturing.

Requirements: Examination.

Literature: Compendium; Advanced Environmental Technology from Finland, The Finnish Foreign Trade Association, 1993; Environmental Assessment of Industrial Products, ed. by H. Wenzel, M. Hauschild and L. Alting, ChapmanHall, London 1997; Innovation Systems and Competitiveness, ed. by O. Kuusi, ETLA - The Research Institute of the Finnish Economy, VATT - Government Institute for Economic Research, Taloustieto Oy, Helsinki 1996.

Prerequisites: Module MT 301-3.

Additional: This course replaces the course Mak-45.351 Non-waste Technology, Material Economics and Life cycle Assessment (2 ocr).

Language: Finnish.

MT-0.4601 New Techniques for Processing Metals (5 cr) P V

Autumn (Period I-II)

Teacher: Prof Seppo Kivivuori, specialist lecturers.

Contents: New processing and manufacturing technologies including heat treatment, metal working and forming techniques.

Requirements: Learning journal. Seminar and exercise tasks. Examination.

Literature: Compendium, Materiaalien uudet käsittelytekniikat (in Finnish).

Prerequisites: Module MT 303-3.

Additional: This course replaces the course Mak-65.150 New Techniques for Processing Metals (2 ocr).

Language: Finnish.

MT-0.4606 Advanced Course on Working and Forming of Materials (5 cr)

Spring (Period III-IV).

Teacher: Prof Seppo Kivivuori, Leif Eriksson, specialist teacher and Ahti Viljamaa, assistant.

Contents: The objective of the course is to provide deeper understanding in the field of material processing: rolling, forging, extrusion, bar and wire drawing, pipe processing and thermo mechanical processing.

Requirements: Examination. Exercise tasks.

Literature: Compendium (in Finnish).

Prerequisites: Module MT 303-3.

Additional: This course replaces the course Mak-65.146 Working and Forming of Materials (5 ocr).

Language: Finnish.

MT-0.4611 Modelling and Simulation of Material Forming Processes (2 cr) P V

Autumn (Period II)

Teacher: Prof Seppo Kivivuori, Tuomas Katajarinne, specialist teacher.

Contents: Physical and mathematical modelling methods in actual research fields are studied. Seminar works and exercises tasks in the field of material forming and heat treatment will be considered.

Requirements: Approved seminar work. Exercise tasks, seminar tasks.

Literature: Compendium (in Finnish).

Prerequisites: Module MT 303-3.

Additional: This course replaces the course Mak-65.159 Individual Assignment in Processing and Heat Treatment of Materials (2 ocr).

Language: Finnish.

MT-0.4701 Computational Thermodynamics (5 cr) P

Spring (Period III-IV)

Teacher: Marko Hämäläinen, Docent.

Contents: Real solutions and their computation by computer programs. Solution models and their applications. Experimental and theoretical data comparison and integration.

Requirements: Seminar work.

Literature: Saunders, N., Miodownik, A.P., Calphad, Pergamon Press, UK, 1998.

Prerequisites: Course MT-0.3206 Laboratory Exercises in Material Production (3 cr).

Additional: This course replaces the course Mak-77.161 Thermodynamics of Alloys and Solutions: Special course (2,5 ocr) P.

Language: Finnish.

MT-0.4706 Powder Metallurgy and Composite Materials (5 cr) P

Autumn (Period I-II)

Teacher: Sauli Suominen, Lic.Sc. (Tech.).

Contents: Various metallic, ceramic, carbide powders and materials processing, characterisation, pressing and sintering. Manufacturing of composites and their applications.

Requirements: Seminar work, examination.

Literature: Lecture materials.

Prerequisites: Module MT 301-3, 302-3 or 303-3.

Additional: This course replaces the course Mak-77.133 Powder metallurgy (3 ocr).

Language: Finnish.

MT-0.4711 Special Materials Solutions (5 cr) P

Spring (Period III-IV)

Teacher: Prof Mikhail Gasik (III, 3 cr), Markku Kaskiala, laboratory engineer (IV, 2 cr).

Contents: 1 part - Special classes of inorganic materials and their special production methods are studied (high-temperature composites, biomaterials, thermal barrier coatings, materials for energy conversion and thermonuclear energy, FGM, etc.), aspects of materials selection and materials solution for industry. 2 part - Materials behaviour, oxidation and stability at high temperatures.

Requirements: Examination or seminar work.

Literature: Lecture handouts and numerous literature surveys published.

Prerequisites: Module MT 301-3, 302-3 or 303-3..

Additional: This course replaces the course Mak-77.180 special course in Materials Processing (3 ocr) P.

Language: Finnish. Individual study in English possible.

MT-0.4717 Computational Fluid Dynamics -Theory and Applications (5 cr) L

Autumn (Period I-II)

Teacher: Timo Kankaanpää, M.Sc. (Tech.), Jiliang Xia D. Sc (Tech.).

Contents: Course concentrates on theory and applications of computational fluid dynamics (CFD). These mainly include conservation equations, turbulence modelling, finite-volume method, solution algorithms, commercial software introduction, CFD applications in metallurgical processes.

Requirements: Examination, exercises.

Literature: An introduction to Computational Fluid Dynamics, by H.K. Versteeg and W. Malalasekera, 1995 (main reference book); Numerical Heat Transfer and Fluid Flow, S.V. Patankar, 1980; Virtausten ja lämmönsiirron numeerinen mallinnus, Osa I - Virtausten yhtälöt, TKK-V-C131, T. Ahokainen, 1995; Virtausten ja lämmönsiirron numeerinen mallinnus, Osa II - Numeeriset menetelmät, TKK-V-C132, T. Ahokainen, 1995.

Prerequisites: Modules MT 301-3 and MT 302-3 or MT 303-3.

Additional: This course replaces the courses MT-0.4716 Numerical Simulation of Complex Mass and Heat Transfer Processes (5 ocr).

Language: Finnish and English. Individual study in English possible.

MT-0.6001 Studying techniques (2 cr)

Spring (Period III-IV)

Teacher: Tiina Pylkkönen, planning officer.

Contents: "Studying techniques as professional skills". Improving practical studying skills. Themes e.g. technical writing, studying mathematics and physics, reading techniques, notes and performing. Preparing for exams.

Requirements: Lectures and exercises.

Literature: Will be announced at the beginning of the course.

Prerequisites: -

Additional: This course replaces the course Mak-0.003 Studying techniques (1 ocr).

Language: Finnish.

MT-0.6006 Effect of materials science on society (2 cr)

Autumn and Spring (Period I,III)

Teacher: Jari Aromaa, Docent.

Contents: Review of the effects of materials sciences on the society, historical events, present day, and future.

Requirements: Two large essays.

Literature: Varying, depends on the current topics of the course.

Prerequisites: -

Additional: This course replaces the course Mak-0.001 Introduction to the Materials Science and Rock Engineering (1 ocr). Exact starting time will be announced separately.

Language: Finnish.

MT-0.6011 Corrosion Prevention Technology (5 cr)

Spring (Period III-IV)

Teacher: Prof Olof Forsén, Jari Aromaa, Docent and Antero Pehkonen, researcher.

Contents: Basics, occurrence and types of corrosion phenomena. Materials, their corrosion properties, use and resistance in different environmental conditions. High temperature corrosion. Corrosion prevention. Surface finishing. Water treatment. Practical cases.

Requirements: Exercises, literature work, industry visitings and case-works.

Literature: K.R. Tretheway, J Chamberlain: Corrosion for Science and Engineering Students, Longman 1995.

Prerequisites: Module MT 201-2, MT 202-2 or equal courses.

Additional: This course replaces the course Mak-85.135 Corrosion Prevention Technology (KE, OP, MK) (5 ocr).

Language: Finnish.

MT-0.6016 Electrochemical research methods (5 cr)

Spring (Period IV)

Teacher: Jari Aromaa, Docent.

Contents: Review of central electrochemical phenomena. Theory and applications of research methods.

Requirements: Examination and compulsory exercises.

Literature: Announced at lectures.

Prerequisites: Module MT 201-2, MT 202-2 or equal courses.

Additional: This course replaces the course Mak-85.161 Electrochemical research methods (3 ocr).

Language: Finnish.

MT-0.6021 Fundamentals of Vacuum Technology, Thin Films and Metallurgical Coatings (3 cr) P

Autumn (Period II)

Teacher: Prof Seppo Kivivuori, Esko Harju, specialist teacher.

Contents: Basics of vacuum technology for designers and vacuum device operators. Physical fundamentals, vacuum pumps, pressure measurement, leakage search and device structure. Physical and chemical vapour deposition techniques for manufacturing of tribological, optical and electronical coatings.

Requirements: Examination. Exercise tasks.

Literature: Compendium (in Finnish), Fontell, Tyhjäteknikka, Insinööritieto Oy (in Finnish), 1986, R. Bubnshah, Deposition Technologies for Films and Coatings, M. Ohring, The Materials of Thin Films, Academic Press, 1992.

Prerequisites: Module MT 201-2 or MT 202-2.

Additional: This course replaces the course Mak-65.142 Fundamentals of Vacuum Technology, Thin Films and Metallurgical Coatings (2 ocr).

Language: Finnish.

MT-0.6026 Electron Microscopy (5 cr) P

Autumn (Period I-II)

Teacher: Prof Simo-Pekka Hannula.

Contents: The basis and major applications of image formation, electron diffraction, electron invoked spectroscopy and contrast theory. Applications of electron microscopy, electron spectroscopy and Auger-spectroscopy.

Requirements: Please, contact prof. Hannula.

Literature: Compendium; G. Thomas, M.J. Goringe: Transmission Electron Microscopy of Materials, John Wiley & Sons, 1979; M. Thompson, M.D. Baker, A. Christie, J.F. Tyson: Auger Electron Spectroscopy, John Wiley & Sons, 1985; D.B. Will-

iams, C.B. Carter: *Transmission Electron Microscopy, Textbook for Materials Science*, Plenum Press, New York, 1996.
Prerequisites: P- and O- modules.
Additional: Compensation is to be agreed with the lecturer.
Language: Finnish.

MT-0.6031 Microsystems (3 cr)

Autumn (Period I)
Teacher: Prof Ari Lehto.
Contents: In the beginning the course focuses on the microsystems and their uses. The course then proceeds into explaining the working principles of microsystems and their physical restrictions. The end part of the course deals with the manufacturing technologies of microsystems.
Requirements: Examination.
Literature: Sami Franssila, *Introduction to Microfabrication*, JohnWiley & Sons, 2004 and course handout.
Prerequisites: Completion of P- and O -modules is required.
Language: Finnish.

MT-0.6036 Individual study period (2-10 cr)

Autumn - Spring (Period I-IV)
Teacher: professors: Olof Forsén, Mikhail Gasik, Kari Heiskanen, Simo-Pekka Hannula, Lauri Holappa, Heikki Jalankanen, Seppo Kivivuori, Ari Lehto.
Contents: The study period can include topics not covered by the regular curriculum. The contents and requirements for the individual study period have to be agreed upon by the teacher in charge.
Language: Finnish. Individual study in English possible.

MT -0.7001 Fundamentals of Scientific Research (1-2 cr) P V

Spring (Period III-IV)
Lecturer: Prof Seppo Kivivuori.
Contents: Fundamentals in scientific research. Research philosophy and technique. Research as a project. Reporting. Publishing. Giving presentations. Congress. Financing.
Requirements: Obligatory exercises.
Literature: Given in lectures.
Additional: This course replaces the course Mak-0.002 Fundamentals of Scientific Research (1 ocr) P.
Language: Finnish.

MT-0.7006 Postgraduate Seminar in Materials Science (1-5 cr) P V

Autumn (Period I-II)
Teacher: Antero Pehkonen, researcher.
Contents: Guest lecturers will speak on current research topics related to Materials Science. Topics vary from year to year.
Requirements: The requirements for the course on a case by case basis.
Prerequisites: M.Sc degree within the subject area.
Additional: This course replaces the course Mak-0.004 Postgraduate Seminar in Materials Science and Rock Engineering (1-3 ocr) P V
Language: Finnish. Individual study in English is possible.

MT-0.7011 Postgraduate Seminar on Metallurgy (3-5 cr) P V

Autumn & spring (Period I-II, III-IV)
Teacher: Prof Lauri Holappa, Prof Heikki Jalankanen.
Contents: Experts from universities and industry give seminars concerning current issues in process metallurgy and its applications. The topics are different every year.
Additional: This course replaces the course Mak-37.119 Postgraduate Seminar on Metallurgy (3 ocr) P V.

Language: Finnish.

MT-0.7016 Postgraduate Seminar on Research Activities in Metallurgy (2-5 cr) P V

Autumn & spring (Period I-II, III-IV)
Teacher: Prof Lauri Holappa, Prof Heikki Jalankanen.
Contents: This course goes into research activities in process metallurgy. The topics vary from year to year. The course includes seminars, plant excursions and laboratory demonstrations.
Additional: This course replaces the course Mak-37.120 Postgraduate Seminar on Research Activities in Metallurgy (2 ocr) P V
Language: Finnish.

MT-0.7021 Postgraduate Seminar on Physical Metallurgy and Materials Science (3-6 cr) P V

Spring (Period III-IV)
Teacher: Prof Ari Lehto, Prof Simo-Pekka Hannula.
Contents: Special issues in materials science and physical metallurgy.
Additional: Mak-45.115 Postgraduate Seminar on Physical Metallurgy and Materials Science (2-4 ocr) P V
Language: Finnish.

MT-0.7026 Postgraduate Seminar on Mechanical Process Engineering (3 cr) P V

Autumn (Period I-II)
Teacher: Prof Kari Heiskanen.
Contents: Course with varying content. Deals with latest developments and special questions in mechanical process engineering.
Additional: This course replaces the course Mak-46.151 Postgraduate Seminar on Mechanical Process Engineering (2 ocr) P V
Language: Finnish or English. Individual study in English possible.

MT-0.7031 Seminar on Materials Technology (3 cr) P V

Autumn + Spring (Period I-IV)
Lecturer: Prof. Seppo Kivivuori
Contents: Please contact Professor Kivivuori. Contents will be agreed individually.
Additional: This course replaces the course Mak-65.167 Seminar on Materials Technology (2 ocr) P V
Language: Finnish.

MT-0.7036 Graduate Seminar on Processing and Heat Treatment of Materials (3-7 cr) P V

Spring (Period III-IV)
Teacher: Prof Seppo Kivivuori .
Contents: Please contact Professor Kivivuori. Contents will be agreed individually.
Additional: This course replaces the course Mak-65.176 Graduate Seminar on Processing and Heat Treatment of Materials (5 ocr) P V
Language: Finnish.

MT-0.7041 Postgraduate Seminar in Materials Processing (2-5 cr) P V

Autumn & spring (Period I-II, III -IV)
Teacher: Prof Mikhail Gasik
Contents: Special questions on materials processing (varying content).
Requirements: Seminar work or examination.

Literature: Individually selected
 Additional: This course replaces the course Mak-77.152 Research Seminar in Materials Processing (2 cr) L.V.
 Language: Finnish or English. Individual study in English possible.

MT-0.7046 Thermodynamics of Alloys and Solutions; special course (4 cr) P

Spring (Period III-IV)
 Teacher: Marko Hämmäläinen, Docent.
 Contents: Real solutions and their computation by computer programs. Solution models and their applications. Experimental and theoretical data comparison and integration.
 Requirements: Seminar work.
 Literature: Individually selected.
 Prerequisites: Mak-37.135 Thermodynamic-Kinetic Fundamentals of Materials and Processes (6 ocr).
 Additional: This course replaces the course Mak-77.161 Thermodynamics of Alloys and Solutions; special course (2.5 ocr) P
 Language: Finnish.

MT-0.7051 Numerical Simulation of Fluid Flow and Heat Transfer (5 cr) P

Autumn (Period I-II)
 Teacher: Timo Kankaanpää, M.Sc. (Tech.).
 Contents: High-temperature heat and mass transfer basic phenomena (convection, conductivity, radiation) and their numerical analysis. Principles of balancing equations and their discretisation. Simulation of metallurgical processes, especially oxidation of concentrates and burning. Commercial heat and mass transfer computer programs and their application.
 Requirements: Examination, training.
 Literature: Lecture materials; Kuo, Principles of Combustion; Patankar, Numerical Heat Transfer and Fluid Flow.
 Prerequisites: Mak-77.104 Fluid Dynamics in Process Industry (2 ocr), Mak-77.110 Heat and Mass Transfer, special course (2 ocr), Mak-77.111 Heat and Mass Transfer Principles (3 ocr).
 Additional: This course replaces the course Mak-77.170 Numerical Simulation of Fluid Flow and Heat Transfer (3 ocr) P
 Language: Finnish.

MT-0.7056 Special Course in Materials Technology (5 cr) P
 Spring (Period III-IV)

Teacher: Prof Mikhail Gasik.
 Contents: Special classes of inorganic materials and their specific production methods are studied (high-temperature composites, materials for smart technologies and thermonuclear energy, FGM, etc.), aspects of materials selection and materials solution for industry.
 Requirements: Examination or seminar work.
 Literature: Lecture handouts and numerous literature surveys published.
 Prerequisites: Mak-77.125.
 Additional: This course replaces the course Mak-77.180 Special Course in Materials Technology (3 ocr) P
 Language: English on demand.

MT-0.7061 Research Seminar on Material Chemistry (2-5 cr) P

Autumn-Spring (Period I-IV)
 Teacher: Olof Forsén
 Contents: Review of current topics. Criticism of research methods and results.
 Requirements: Examination or written report.
 Literature: As agree.
 Language: Finnish. Individually study in English possible.
 Additional: This course replaces the course Mak-85.631 Research Seminar on Material Chemistry (3 ocr) P.

MT-0.8001 Graduate School on New Materials and Processes (2-10 cr)

Autumn-Spring (Period I-IV)
 Teacher: Prof Lauri Holappa and responsible professors.
 Contents: Courses with varying content are given by guest lecturers and graduate school teachers.
 Requirements: The requirements for each course are defined by the responsible teacher (participation, exam, literature work).
 Literature: Defined case by case.
 Language: English, in specific cases Finnish.

DEPARTMENT OF MECHANICAL ENGINEERING

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Chairs:

Ene-39 Thermal Engineering
 Ene-47 Energy Engineering
 Ene-58 Heating, Ventilating and Air Conditioning Technology
 Ene-59 Energy Economics and Power Plant Engineering
 Kon-14 Internal Combustion Engine Technology
 Kon-15 Production Engineering
 Kon-16 Automotive Engineering
 Kon-41 Machine Design
 Kon-67 Engineering Materials
 Kon-80 Cast Products Technology
 Kul-24 Naval Architecture
 Kul-34 Aeronautical Engineering
 Kul-49 Mechanics of Materials

Courses credited in ECTS

Kon-0.1100 General Information on Mechanical Engineering (1 cr)

Spring

Lecturer: Leila Kuusela, planning officer (responsible)

Contents: The objective of the course is to present the degree programmes of Mechanical Engineering and Energy and HVAC Technology and their main options, as well as the major and minor subjects and the laboratories; the requirements of the degree programme, the degree regulation, legal protection issues, administration of the department and of the university. Information about practical training will be presented and some guidance in the studies and in the planning of studies will be given.

Additional information: For completing this course in English, please contact the international study advisor of Mechanical Engineering.

Requirements: Active participation and examination.

Literature: Lecture hand-outs and the study guide.

Language: Finnish.

Courses credited in ocr

Kon-0.110 Fortran Programming Language (2 ocr)

Spring

Lecturer: Tommi Mikkola, M.Sc. (Tech.)

Contents: The aim of the course is to provide the basic knowledge of structures of the Fortran-77 programming language. The exercise concentrates especially on problems related to Mechanical Engineering.

Requirements: Programming exercise.

Literature: To be announced separately.

Language: Finnish.

Kon-0.171 History of Technology and Industry, general (2 ocr)

Autumn

Lecturer: Timo Myllyntaus PhD (responsible), information Prof Kalevi Aaltonen

Contents: Main characteristics of the history of technology and industry, with special emphasis on Finland. Contents vary yearly. The course increases in the history of technology and industry, informs about the courses that deepen its contents and direct the interest to special areas of interest, and guides to selfaccess studies.

Requirements: Attendance at lectures and an essay.

Grade: pass/fail.

Literature: Will be notified during the lectures.

Language: Finnish.

Kon-0.210 Mechanical Engineering Design in Wind Energy Converters (2 ocr)

Autumn (alternate years, will not be lectured in 2006-07).

Lecturer: Prof Mauri Määttänen (responsible)

Contents: The course gives mechanical engineering background for wind energy converter design. Static and dynamic wind loads on rotor blades, nacelle and tower, wave and ice loads on offshore foundations. Dimensioning of load bearing structures for strength, fatigue, and vibrations, manufacturing and installation of components. Rotor blade and nacelle turning mechanisms, reduction gear, instrumentation, control and maintenance.

Requirements: Lectures, exercises and examination.

Literature: Wind Energy Handbook and additional material.

Prerequisites: Ene-47.160.

Language: Finnish.

Ene-39 THERMAL ENGINEERING

Prof: Markku Lampinen, Energy Engineering and Fluid Mechanics 407, 451 3582

Prof: Timo Siikonen, Energy Engineering and Fluid Mechanics 254, 451 3426

Courses credited in ECTS

Ene-39.2001 Thermodynamics and Heat Transfer (5 cr)

Autumn

Lecturer: Prof Markku Lampinen

Contents: A general view of basic ideas and applications of thermodynamic analysis. Results are applied to finding out thermal and physico-chemical properties of materials and to analysing the performance characteristics of the most important thermal and flow machines, amongst other things. Fundamentals of heat transfer.

Requirements: Written examination, supporting literature is allowed in part of the examination. The points obtained from the exercises are included into the examination results.

Literature: Markku Lampinen: Termodynamiikan perusteet, Otatiето 582. Lecture notes.

Prerequisites: First year studies.

Language: Finnish.

Ene-39.2007 Exercises in Thermodynamics (2 cr)

Autumn + spring

Lecturer: Prof Markku Lampinen

Contents: Several exercises related to the applied thermodynamics. Alternatively, the course can be passed by doing a single, more extensive exercise.

Requirements: Accepted exercise.

Language: Finnish.

Ene-39.3003 Technical Thermodynamics (3 cr)

Spring

Lecturer: Prof Markku Lampinen, Ralf Wikstén, specialist teacher and Mamdouh El Haj Assad, Docent

Contents: Thermodynamics of humid air. Gas flows in nozzles. Exergy and application of exergy analysis on processes in energy technology. Thermodynamic analysis of non-stationary processes. Absorption chillers and heat pumps.

Requirements: Written examination, supporting literature is allowed but solved problems are not.

Prerequisites: Ene-39.2001 or equivalent.

Language: Finnish.

Ene-39.3004 Chemical Thermodynamics (6 cr) P

Spring

Lecturer: Prof Markku Lampinen

Contents: State diagrams and chemical tables. Combustion, kinetics and emissions of combustion and gasification of solid fuels. Electrochemical processes, fuel cells and electric batteries. Solutions, multi-phase systems and corrosion. Calculating thermodynamic states of equilibrium for chemical systems using a computer program.

Requirements: Written examination, supporting literature is allowed. Points obtained from the exercises are included in the examination results.

Literature: Markku Lampinen ja Ari Seppälä: Kemiallinen termodynamiikka energiatekniikassa. Lecture note. Lab. of appl. thermodynamics.

Prerequisites: Ene-39.2001 or equivalent.

Language: Finnish.

Ene-39.3010 Thermal Power Cycles (3 cr)

Autumn

Lecturer: Ralf Wikstén, specialist teacher

Contents: Introduction to theory of the thermal power cycles. Stream-, gas turbine- and combined power plants. Refrigerators and heat pumps.

Requirements: Written examination, supporting literature is allowed but solved problems are not.

Literature: Wikstén, R.: Lämpövoimaprozessit, Otatiето 572.

Prerequisites: Ene-39.2001

Language: Finnish.

Ene-39.3014 Flow Machines (5 cr)

Spring

Lecturer: Ralf Wikstén, specialist teacher

Contents: Introduction to thermodynamics and flow mechanics of flow machines, such as air motors, nozzles, steam- and gas turbines, compressors, internal combustion engines, pumps, fans, wind- and water turbines. The course includes laboratory measurements of compressor characteristics and analysis and reporting of the results.

Requirements: Written examination, supporting literature is allowed but solved problems are not.

Literature: Wikstén, R.: Virtauskoneet, Lab. of appl. thermodynamics, Report 139.

Prerequisites: Ene-39.2001

Language: Finnish.

Ene-39.3021 Heat Transfer (4 cr)

Autumn

Lecturer: Prof Markku Lampinen

Contents: Different forms of heat transfer, conduction, convection, condensation, boiling and radiation and their application to examples such as the calculation of thermal insulation or heat exchangers are studied. The course includes a laboratory demonstration of measuring the performance characteristics of a heat exchanger.

Requirements: Written examination, supporting literature is allowed but solved problems are not. Points obtained from the exercises are included in the examination results.

Literature: Markku Lampinen, Lämmönsiirto-oppi, Lab. of appl. thermodynamics, Report 138.

Prerequisites: Ene-39.2001.

Language: Finnish.

Ene-39.4006 New Energy Production Processes (5 cr) P

Autumn (alternate years, will be lectured in autumn 2007)

Lecturers: Prof Markku Lampinen, visiting lecturers

Contents: The subject varies yearly.

Requirements: Written examination.

Literature: Lecture notes.

Prerequisites: Ene-39.2001 or equivalent.

Language: Finnish.

Ene-39.4018 Theoretical Assignment in Applied Thermodynamics (5 cr)

Autumn + spring

Lecturers: Prof Markku Lampinen and Prof Timo Siikonen

Contents: A Theoretical study on a given subject, which contains the essential calculation- and analysing methods of thermodynamics. Depending on student's interest, the work can also be oriented to mass transfer or fluid mechanics.

Requirements: Approved work.

Language: Finnish.

Ene-39.4024 Design of Heat Exchangers (6 cr) P

Spring

Lecturers: Prof Markku Lampinen

Contents: Different forms of heat transfer from the point of view of heat exchangers. Different heat exchanger solutions and their connecting systems in various actual conditions. The exchanger types concerned are: fin-tube- and plate exchangers, superheaters, condensers, evaporators and regenerative exchanger. Radiation of gases and its application to calculating the combustion chamber. Design, properties and solutions of heat recovery systems.

Requirements: Written examination, supporting literature is allowed. Homework.

Literature: Lämmönsiirtimien mitoitus. Markku Lampinen (ed.), Lab. of appl. thermodynamics, Report 145.

Prerequisites: Ene-39.3021 or equivalent.

Language: Finnish.

Ene-39.4027 Mass Transfer (5 cr) P

Autumn

Lecturer: N. N., specialist teacher

Contents: Basics of mass transfer and its application possibilities in nature conservation-, drying-, heat- and HVAC-technologies. Humid air heat exchangers, drying processes, distillation, desulphuration of combustion gases.

Requirements: Written examination, also exercises.

Literature: Seppälä, Lampinen: Aineensiirto-oppi. Otatiето 604. Prerequisites: Ene-39.2001 (Recommended Ene-39.3004 and Ene-39.3021).

Language: Finnish.

Ene-39.4030 Advances in Computational Fluid Mechanics and Heat Transfer (7 cr) P V

Spring

Lecturer: Prof Timo Siikonen

Contents: Computational fluid mechanics are applied to some basic flow cases. The basics of a pressure correction method are applied in exercises. Aerodynamic applications. Turbulence models and geometry definition.

Requirements: Homework and written examination.

Literature: Ferziger, Peric: Computational Methods for Fluid Dynamics. Lecture notes.

Prerequisites: Ene-39.4037.

Language: Finnish.

Ene-39.4031 Viscous Flow (5 cr) P

Autumn

Lecturer: Prof Timo Siikonen

Contents: Basics of viscous flow and the derivation of basic flow equations. Applications of Navier-Stokes equations. Mathematical background. The modelling of turbulent flow and boundary layer theory. The course includes a laboratory demonstration of measuring velocity distribution and turbulence characteristics of flow using a Laser-Doppler anemometer. Course is primarily intended for students of aero-, gas- and hydrodynamics and thermal engineering.

Requirements: Written examination and homework.

Literature: White F.M.: Viscous Fluid Flow.

Prerequisites: (Recommended Kul-34.3100.)

Language: Finnish.

Ene-39.4037 Fundamentals of Computational Fluid Mechanics and Heat Transfer (7 cr) P

Autumn

Lecturer: Prof Timo Siikonen

Contents: Control-Volume method used in numerical solution of a flow and temperature field. Finitedifference-methods and their properties. Applications to heat transfer and aerodynamics. Compulsory exercises are included.

Requirements: Exercises and written examination.

Literature: Lecture notes.

Prerequisites: Ene-39.4031.

Language: Finnish.

Ene-39.4043 Individual Assignment in Thermal Engineering, short (5 cr)

Autumn + spring

Lecturers: Prof Markku Lampinen and Prof Timo Siikonen

Contents: A calculation-, design-, or laboratory exercise related to the development and study of a thermal or flow machine or process.

Requirements: Approved assignment. The assignment can also be done as teamwork.

Prerequisites: Ene-39.2001.

Language: Finnish or English.

Ene-39.4044 Individual Assignment in Thermal Engineering, large (10 cr) P

Autumn + spring

Lecturers: Prof Markku Lampinen and Prof Timo Siikonen

Contents: A large calculation-, design-, or laboratory exercise related to the development and study of a thermal or flow machine or process.

Requirements: Approved assignment. The assignment can also be done as teamwork.

Prerequisites: Ene-39.2001.

Language: Finnish or English.

Ene-39.4048 Natural Gas Engineering (5 cr)

Autumn (alternate years, will be lectured in autumn 2006)

Lecturer: Arto Riikonen, specialist teacher

Contents: Design of gasdriven heating systems. Properties and applications of gases, e.g. power production, raw material usage, industrial drying processes, heating, melting, heating of spaces, traffic-, instrument-, burning technology and piping design.

Requirements: Written examination where notes M1, M5, M6 and M18 of Gasum Oy are allowed.

Literature: Lecture notes.

Prerequisites: Ene-39.2001 (or equal).

Language: Finnish.

Ene-39.4052 Postgraduate Seminar on Heat and Fluid Flow (2-5 cr) P V

Spring

Lecturers: Prof Markku Lampinen and Prof Timo Siikonen and visiting lecturers.

Contents: Course is arranged on alternating and current subjects depending on resources and interest.

Requirements: Making a presentation on own research field and listening the presentations of others.

Language: Finnish or English.

Ene-39.4053 Postgraduate Seminar on Energy Technology (2-5 cr) P

Spring

Lecturers: Prof Markku Lampinen and Prof Timo Siikonen

Contents: This seminar is aimed at training researchers in making presentations. The seminar also acts as a discussion forum on current matters.

Requirements: Making a presentation on own research field and listening presentations of others.

Language: Finnish or English.

Ene-39.4054 Use of Computational Fluid Dynamics (6 cr) P

Spring

Lecturers: Prof Timo Siikonen and Ari Miettinen, Lic.Sc. (Tech.)

Contents: Studying a commercial flow solver. Specification of boundary conditions and application of turbulence models. Pre- and post processing of flow simulation. Heat transfer applications. Implementing a physical model into program. Exercises are made using the Fluent-program.

Requirements: Written examination and exercises.

Literature: Shaw, C.T.: Using Computational Fluid Dynamics, lecture notes.

Prerequisites: Kul-34.3100.

Language: Finnish.

Ene-39.4055 Irreversible Thermodynamics (5 cr) P

Autumn (alternative years, will be lectured in autumn 2006)

Lecturers: Prof Markku Lampinen, Mamdouh El Haj Assad, Docent and visiting lecturers.

Contents: A presentation of the methods of irreversible thermodynamics and their applications in various fields of technology including biophysical processes.

Requirements: Written examination.

Literature: Lecture notes.

Prerequisites: Ene-39.2001 or equivalent knowledge.

Language: Finnish.

Ene-47 ENERGY ENGINEERING

Prof. Carl-Johan Fogelholm, Energy Engineering and Fluid Mechanics 355, 451 3630

Courses credited in ECTS

Ene-47.3152 Introduction to Environmental Protection in Energy Technology (3 cr)

Autumn

Lecturer: Prof Carl-Johan Fogelholm

Contents: Formation of the most essential combustion products in energy production. Flue gas, radiation and heat emissions. Emission control and effect on environment.

Requirements: Accepted exercise, excursion and exam.

Literature: Energiätalous ja ympäristönsuojelu, toim. Fogelholm and lecture notes.

Prerequisites: Recommended Ene-47.110, Puu-127.173

Language: Finnish

Courses credited in ocr

Ene-47.100 Studia Teknika (1 ocr) V

Spring

Lecturer: Prof Carl-Johan Fogelholm

Contents: Changing topics.

Requirements: Seminar work.

Literature: Lecture notes.

Language: Swedish.

Ene-47.110 Principles of Energy Engineering (2 ocr)

(Period) autumn

Lecturer: Prof Carl-Johan Fogelholm

Contents: Power Plant concepts, process calculation, basics of boilers, gas- and steam turbines.

Requirements: Compulsory exercises, PBL and examination.

Literature: N.V. Khartchenko: Advanced energy systems and lecture notes.

Prerequisites: Recommended Ene-39.010, Ene-59.003.

Language: Finnish.

Ene-47.121 Turbine Technology) (2 ocr)

(Period) autumn

Lecturer: Prof Carl-Johan Fogelholm

Contents: Theory, operation, construction and design of steam- and gas turbines, compressors and other thermal turbo machinery.

Requirements: Compulsory exercises, PBL and examination and eventually excursion.

Literature: H. Alvarez: Energiteknik del 1-2 and lecture notes.

Prerequisites: Ene-47.110.

Language: Finnish.

Ene-47.122 Individual Assignment and Seminar on Thermal Turbomachines (5 ocr)

(Period) Autumn + spring

Lecturer: Prof Carl-Johan Fogelholm

Contents: The aim of the course is to give an idea about the calculation, designing and construction of modern thermal turbo machinery. It also deals with turbines at different load. The course is carried out in coordination with the course Ene-47.126 and KTH/Department of Energy Technology/Heat and Power Technology. Registration and definition of assignments will be done in December.

Requirements: Shared design project with KTH, video conference, field trips and a common final seminar.

Prerequisites: Ene-47.121 at least in the same year.

Language: Finnish, Swedish or English.

Ene-47.124 Steam Boiler Technology (2 ocr)

(Period) autumn

Lecturer: Prof Carl-Johan Fogelholm

Contents: Theory, operation, construction and design of industrial, district heat and condensing power plants.

Requirements: Compulsory exercises, PBL, examination and excursion.

Literature: S. Teir: Steam boiler technology.

Prerequisites: Ene-47.110.

Language: Finnish.

Ene-47.126 Individual Assignment and Seminar on Steam Boilers (5 ocr)

(Period) Autumn + spring

Lecturer: Prof Carl-Johan Fogelholm

Contents: The aim of the course is to plan a boiler with the help of a supervised project work. The main contents are technical heat, flow and strength calculations, and design solutions. The course is carried out in co-operation with the course Ene-47.122 and KTH/Department of Energy Technology/Heat and Power Technology. Registration and definition of assignments in December.

Requirements: Shared design project with KTH, video conferences, field trips and a common final seminar.

Prerequisites: Ene-47.124 at least in the same year.

Language: Finnish, Swedish or English.

Ene-47.132 Combustion and Gasification Technology (3 ocr) P

Autumn

Lecturer: Loay Saeed, D.Sc. (Tech.)

Contents: Principles of heat and power generation technologies based on combustion and gasification. Fuels, fuel conversion chemistry, thermodynamics. Gaseous, liquid and solid fuels. Pulverised fuel firing, stoker firing, fluidised bed combustion. Gasification, combined cycles, recovery boilers, internal combustion engines.

Requirements: Examination.

Literature: G. L. Borman, K. W. Ragland: Combustion Engineering and material distributed at lectures.

Language: English.

Ene-47.140 Individual Assignment in Energy Engineering (2 ocr) P

Ene-47.141 Individual Assignment in Energy Engineering (3 ocr) P

Ene-47.142 Individual Assignment in Energy Engineering (4 ocr) P

Ene-47.143 Individual Assignment in Energy Engineering (5 ocr) P

Autumn or spring

Lecturer: Prof Carl-Johan Fogelholm

Contents: Exercise (laboratory or EDP) or literature study on a special problem of energy engineering. Agreement with the professor about the individual work.

Language: Finnish, Swedish or English.

Ene-47.153 Pollutant Formation and Control in Combustion (2 ocr) P

Spring

Lecturer: Loay Saeed, D.Sc. (Tech.)

Contents: Principles and practice of pollutant formation and control in combustion and gasification processes. Sulphur compounds (SO₂, H₂S), nitrogen compounds (NO, NO₂, N₂O, NH₃), particulate and other compounds (VOCs, PCDD/Fs, heavy metals, alkali, chlorides, greenhouse gases, O₃) are discussed. Total gas clean-up train configuration. This course gives together with the course Puu-127.209 a good general view of the mechanisms of air pollution and its control.

Requirements: Examination.
Literature: Lecture notes.
Language: English

Ene-47.154 Life-Cycle Assessment and Environmental Auditing (2 ocr) P
Spring

Lecturer: Helena Mälkki, Lic.Sc. (Tech.)
Contents: Life-cycle estimation is a method to describe the influence of a product or an article on the environment in all parts of its life-cycle. The life-cycle assessment includes the acquisition of raw material, the production, the use and final placing of the products. On the course the standardized basics of estimating environment in manufacturing plants and power plants will be discussed.

Requirements: Examination.
Literature: Lecture notes and literature (to be announced at the course).
Prerequisites: Recommended Ene-47.3152.
Language: Finnish.

Ene-47.157 Individual Assignment and Seminar on Environmental Protection in Energy Technology (5 ocr)
(Period) spring

Lecturer: Prof Carl-Johan Fogelholm
Contents: Extensive laboratory, literature or EDP work on environmental protection in energy technology. The work can be done individually or as part of work group. The work will be presented at a seminar.

Requirements: Written seminar work and presentation.
Prerequisites: Ene-47.3152 and Ene-47.154.
Language: Finnish, Swedish or English.

Ene-47.160 Wind Power Technology (2 ocr) P
(Period) spring

Lecturer: Hannele Holttinen, Lic.Sc. (Tech.) (coordinator) + quest lecturers

Contents: The aim of the course is to give an idea of the basics in wind energy, the methods of estimation of wind conditions, the dimensioning, designing and use of plants and costs of wind energy production. Additionally the effects of wind power plants on the grid and the energy system will be discussed, as well as the future market and technology trends.

Requirements: Examination and field trip.
Literature: Lecture notes.
Language: Finnish.

Ene-47.170 Process Integration (2 ocr) P
(Period) autumn

Lecturer: Tor-Martin Tveit, D.Sc. (Tech.)
Contents: In process integration, procedures and analysis methods for definition of possibilities for integrating different partial processes of a process system, are created. In process integration we try to develop energy economical and ecological processes with the help of cost efficient methods. The well-known methods are the "pinch technology", exergy-analysis and mathematical programming.

Requirements: Examination and exercises.
Literature: IChemE: User Guide on Process Integration for the Efficient Use of Energy.
Language: Finnish.

Ene-47.180 Measurements in Power Plants (2 ocr)
Spring

Lecturer: Kari Lammi, M.Sc. (Tech.)
Contents: Students carry out measurements at a boiler, a turbine or a desulphurization plant. From the measured conditions a complete efficiency calculation will be carried out.
Requirements: Approved calculation exercises.
Literature: Lecture notes and H. Alvarez: Energiteknik.
Prerequisites: Ene-47.121 or Ene-47.124.

Language: Finnish.

Ene-47.200 Postgraduate Course on Energy Engineering (1-6 ocr) P V

Lecturer: Prof Carl-Johan Fogelholm
Contents: Chemical Recovery Boilers.
Requirements: Exam: written exam some time after the course.
Literature: Course material handout.
Prerequisites: Courses in combustion engineering and pollutant control.
Language: English.

Ene-47.210 Advanced Combustion and Gasification Technology (2 ocr) P V

(Period), every second year, will be lectured spring 2007.
Lecturer: Loay Saeed, D.Sc. (Tech.), visiting senior lecturer
Contents: As an addition to the basic "Ene-47.132 Combustion and Gasification Technology" course it gives an overview and theoretical background of modern developments and technologies. Fuel conversion routes based on advanced pressurised combustion and gasification, combined cycles using gas turbines or fuel cells, supercritical systems and energy recovery from biomass and wastes are discussed.
Requirements: Attending lectures and exercises.
Literature: Material handed out at the course.
Prerequisites: Ene-47.132 or M.Sc. (Tech.).
Language: English.

Ene-58 HEATING, VENTILATING AND AIR CONDITIONING TECHNOLOGY

Prof. Olli Seppänen, K 303, 451 3600
Prof. Kai Sirén, Energy Engineering and Fluid Mechanics 351, 451 3602

Courses credited in ECTS

Ene-58.3010 Introduction to Energy Technology (2 cr)
Autumn

Teacher: Prof Kai Sirén
Contents: The aim of the course is to introduce students to the basics of energy technology and engineering and to bind basic studies with the applications of energy technology. Additionally, a specific theme of the course is the use of a mass and energy balance. Measurements are made as group work and they are the core of the course in addition to the preceding lectures. The results and conclusions of the measurements are reported and processed with other students and lecturers in common meetings. The course is primarily intended for first year energy technology students. The amount of the participants is limited.
Requirements: Active participation and an approved report.
Literature: To be announced during lectures.
Language: Finnish.

Courses credited in ocr

Ene-58.101 Basic Technology of Building Services (3 ocr)
Autumn

Lecturers: Jarkko Heinonen, M.Sc. (Tech.)
Contents: The aim of the course is to introduce all the most general building service systems, their features, principles of routing, space requirements and methods of building technology for improving the operational preconditions of the systems. The significance of factors affecting the healthiness and comfort of buildings and the influence of building service systems on the energy efficiency of buildings will be evaluated.
Requirements: Examination + exercises.

Literature: Seppänen, O & Seppänen, M.: Rakennusten sisäilmasto ja LVI-tekniikka, Sisäilmayhdistys 1995. Rakentamismääräyskokoelman osat: D 1, D 3-6 and lecture notes.
Language: Finnish.

Ene-58.102 Indoor Climate and Building Services (3 ocr)
Autumn

Lecturer: N. N.

Contents: The aim of the course is to teach the operation of building service systems taking into account, in particular, how a healthy and productive indoor climate is created by using energy efficient means of building technology and services. Integrating building service systems into the building and design processes is an important part of the course. The measurement and assessment of the indoor climate is also included in the course.

Requirements: Examination + exercises.

Literature: Seppänen, O., Ilmastointitekniikka ja sisäilmasto (partly), Sisäilmaluokitus 2000, Rakentamismääräyskokoelman osa D2 and lecture notes.

Prerequisites: Ene-58.101.

Language: Finnish.

Ene-58.103 Economy of Operation and Maintenance of Building Services (3 ocr)
Spring

Lecturer: Jarkko Heinonen, M.Sc. (Tech.)

Contents: This course considers building service systems from the point of view of the building owner. The focus is on economical energy solutions and life cycle costs. The maintenance of the buildings and the monitoring systems are central to the course. The course exercise deals with the assessment of the indoor climate, energy use and environmental impact of buildings.

Requirements: Examination + exercises.

Literature: To be announced at the course.

Prerequisites: Ene-58.101.

Language: Finnish.

Ene-58.109 Principles of Heating, Ventilating and Air Conditioning (for students of Architecture) (2 ocr)
(Period) spring

Lecturer: Prof Kai Sirén

Contents: Typical heating, water, sewage, ventilation and air conditioning systems and components. Indoor climate and its control. Energy economics. Space requirements of HVAC equipment and their integration into building.

Requirements: Examination + design tasks.

Literature: Seppänen, O. & Seppänen, M.: Rakennusten sisäilmasto ja LVI-tekniikka.

Language: Finnish.

Ene-58.113 Introduction to Ventilating and Air Conditioning (3 ocr)
Spring

Lecturer: Jarek Kumitski, D.Sc. (Tech.)

Contents: Indoor climate and demand for ventilation. Ventilation systems and their design. Air conditioning processes, air distribution and filtering of air. Typical air conditioning systems.

Requirements: Examination, exercises and excursions.

Literature: Seppänen, Olli: Ilmastointitekniikka and sisäilmasto, Suomen LVI-yhdistysten liitto ry. Rakennusten sisäilmasto ja ilmanvaihto, Suomen rakentamismääräyskokoelma osa D2.

Prerequisites: Ene-58.115.

Language: Finnish.

Ene-58.115 Space Heating (4 ocr)
Autumn

Lecturer: Jarek Kumitski, D.Sc. (Tech.)

Contents: Factors influencing the heat demand of buildings. Typical heating systems and their design. Heat production. Eco-

nomical principles of heating. Selection of heating system. Control of heating.

Requirements: Examination, exercises and excursions.

Literature: Seppänen, Olli: Rakennusten lämmitys, Suomen LVI-yhdistysten liitto ry. Rakennusten lämmityksen tehon ja energiantarpeen laskenta, Suomen rakentamismääräyskokoelma osa D5.

Language: Finnish.

Ene-58.117 Buildings Water Supply and Sewage Techniques (2 ocr)
Autumn

Lecturer: Tapio Helenius, M.Sc. (Tech.)

Contents: Water distribution system of buildings. Alternative water sources. Components of water distribution system and their design. Saving and recycling of water. Components of sewage system and their design. Corrosion of water and sewage pipes. Treatment of waste water on site. Composting.

Requirements: Exam + design work.

Literature: Lecture notes.

Language: Finnish.

Ene-58.122 Advanced Air Conditioning (4 ocr) P
Spring

Lecturer: Jarkko Heinonen, M.Sc. (Tech.)

Contents: Design of air conditioning systems and components. Cooling load calculation. Selection of system. Noise reduction. Air distribution. Control of air conditioning.

Requirements: Home exercises.

Literature: Lecture notes.

Prerequisites: Ene-58.113.

Language: Finnish.

Ene-58.124 Industrial Ventilating (2 ocr) P
Spring. To be lectured every other year. Will not be lectured in 2006-2007.

Lecturer: Kim Hagström, D.Sc. (Tech.)

Contents: Loads in industrial ventilation. Physiological and hygienic requirements. Air distribution, air circulation and filtering. Local ventilation. Industrial air conditioning systems. Heat recovery. Energy economics.

Requirements: Examination + home exercises.

Literature: Heinsohn, R.J.: Industrial ventilation (partly).

Prerequisites: Ene-58.113 and Ene-58.115.

Language: Finnish.

Ene-58.127 Design of HVAC-Systems (4 ocr)
Autumn + spring

Lecturer: Tapio Jalo, M.Sc. (Tech.)

Contents: HVAC design. Design documents. LVI-RYL. System comparison. Cooperation of designers. Control system adjusting. Inspections by authorities. Exercise: HVAC design of office building.

Requirements: Advanced HVAC design project.

Literature: To be announced at the course.

Prerequisites: Ene-58.113, Ene-58.115 and Ene-58.117.

Language: Finnish.

Ene-58.129 Energy Economy of Buildings (4 ocr)
(Period) autumn

Lecturer: Prof Kai Sirén

Contents: Energy consumption of buildings and energy calculations. Economical comparison calculations. Optimization. Electrical energy use in buildings, energy audits, energy saving actions.

Requirements: Homework, seminar presentation and examination.

Literature: To be announced at the course.

Prerequisites: Ene-58.113 and Ene-58.115.

Language: Finnish.

Ene-58.139 Measurement and Control Technology in HVAC (4 ocr)

(Period) spring

Lecturer: Prof Kai Sirén

Contents: Eight different measurements of the most important variables of HVAC system.

Requirements: Examination and measurement exercises.

Literature: Kai Sirén, Ilmastointitekniiikan mittaukset, lecture notes.

Prerequisites: Ene-58.113 and Ene-58.115.

Language: Finnish.

Ene-58.142 Refrigeration Techniques (3 ocr)

Spring. To be lectured every other year. Will be lectured in 2006-2007.

Lecturer: Esko Kaappola, M.Sc. (Tech.)

Contents: Refrigeration processes, equipment and components and their design. Thermal storages. Compressor types and their characteristics. Heat pumps. Energy economics. Refrigeration in air conditioning.

Requirements: Exam + design work.

Literature: To be announced at the course.

Language: Finnish.

Ene-58.152 Postgraduate Seminar on HVAC (2-6 ocr) P V

(Period) autumn

Lecturer: Prof Olli Seppänen, Prof Kai Sirén

Contents: The subject of the course changes every year. Passing the course: Examination, homework, seminar presentation; each 2 cr.

Literature: To be announced at the course.

Prerequisites: M.Sc. majoring in HVAC-technology or corresponding knowledge.

Language: English.

Ene-58.160 Postgraduate Seminar on Energy Technology (1 ocr) P

Autumn

Lecturers: Seppo Hannus, visiting senior lecturer and Prof Kai Sirén

Contents: One-day seminar, which collects all postgraduate students studying energy technology at HUT together. All participants will write a presentation for seminar publication according to given guidelines. Poster presentation is also possible. Guest lecturers will be invited to participate.

Language: Finnish.

Ene-58.175 Special Course in HVAC Technology (2-6 ocr) P

Autumn + spring

Lecturers: Prof Olli Seppänen, Prof Kai Sirén

Contents: Laboratory or design exercise for postgraduate students.

Requirements: To be discussed with the teacher.

Language: Finnish.

Ene-58.176 Individual Assignment in HVAC (4 ocr)

Autumn + spring

Lecturers: Prof Kai Sirén, Markku Sivukari, laboratory engineer

Contents: Research and work methods in HVAC research. Work plans and schedules.

Requirements: Advanced laboratory, simulation or other more extensive work.

Prerequisites: Ene-58.122, Ene-58.129, Ene-58.139, Ene-39.021.

Language: Finnish.

Ene-58.181 Theoretical Modelling of HVAC Systems (4 ocr) P

(Period) spring

Lecturer: Prof Kai Sirén

Contents: Alternative approaches to thermal modelling, specially the difference method. Hydraulic network models. Distri-

bution models. Modelling of components and systems. Small scale modeling. Suitable computer programs.

Requirements: 2 computer programs and exam.

Literature: Lecture notes.

Prerequisites: Ene-58.122, Ene-58.129, Ene-58.139, Ene-39.021, AS-74.102 and AS-74.111/Kem-90.147.

Language: Finnish.

Ene-59 ENERGY ECONOMICS AND POWER PLANT ENGINEERING

Prof: Pekka Pirilä, K 317, 4513620

Prof: Pekka Ahtila, K 315, 4513622

Courses credited in ECTS**Ene-59.2101 Energy Economics** (3 cr)

Spring (Period IV)

Lecturer: Prof Pekka Pirilä

Contents: Energy use in Finland and worldwide, Finnish and global renewable and nonrenewable energy sources, energy balances, energy transmission and storage, energy trade and price formation, the influence of environmental considerations, long term energy scenarios.

Requirements: Examination.

Literature: VTT Energia; Energia Suomessa, OESD/IEA: World Energy Outlook, lecture notes and public sources on the internet.

Language: Finnish.

Courses credited in ocr**Ene-59.012 Energy Economics, Profitability of Investments** (2 ocr)

Autumn (Period II)

Lecturer: N.N.

Contents: Profitability in accounting and planning, cash flow analysis, criteria of profitability, influence of operating time, uncertainties. The presentation is to a large extent based on examples in energy production and utilisation.

Requirements: Examination.

Literature: Lecture notes.

Language: Finnish.

Ene-59.014 Energy Economics, Investments under Uncertainty (2 ocr) P

Spring (Period IV), every second year, will not be lectured spring 2007.

Lecturer: Prof Pekka Pirilä

Contents: Requirements for rates of return, correlations of risks and diversification, option trees; example of analysis of alternative energy production investments.

Requirements: Examination.

Literature: Lecture notes, Brealy & Myer: Principles of Corporate Finance and Dixit & Pindyck: Investment Under Uncertainty.

Language: Finnish.

Ene-59.016 Energy Markets (2 ocr) P

Spring (Period III)

Lecturer: Prof Pekka Pirilä

Contents: Fuels, markets and availability, Nordic electricity market, competitive markets, price formation in markets, risk management in energy trade.

Requirements: Examination.

Literature: Lecture notes.

Language: Finnish.

Ene-59.020 Design Exercise and Seminar on Energy Economics (5 ocr)

Autumn + spring (Period II-IV). Planning exercise and seminar in spring term 2006, see noticeboard.

Lecturer: N.N., senior lecturer

Contents: Design exercise related to economic comparison of alternative energy purchase possibilities for a community. Seminar of varying content.

Requirements: Design exercise and seminar presentation.

Literature: To be announced separately.

Prerequisites: Ene-59.012 (obligatory), Ene-59.016 (recommended).

Language: Finnish.

Ene-59.022 Special Exercise and Seminar on Energy Economics (5 ocr) P

Autumn + spring

Lecturer: Prof Pekka Pirilä

Contents: Individually selected special exercise. Seminar of varying content in common with Ene-59.020.

Requirements: Special exercise and seminar presentation.

Literature: To be announced separately.

Language: Finnish or English.

Ene-59.036 Integration of Energy Production and Industrial Processes (4 ocr)

Autumn + spring (Period II-III)

Lecturer: Prof Pekka Ahtila

Contents: The course focuses on the planning of an industrial power plant concept. Special attention is paid to the design of combined heat and power production from the viewpoint of industrial processes. Central topics are: determining the industrial process and its performance characteristics, selection of fuel, fuel treatment (especially biofuel), integration of energy production and consumption, energy efficiency and CO₂-efficiency.

Requirements: Two examinations.

Literature: Course handouts.

Prerequisites: Ene-39.010 (obligatory).

Language: Finnish.

Ene-59.043 Special Exercise and Seminar on Power Plant (5 ocr) P

Autumn + spring

Lecturer: Prof Pekka Ahtila

Contents: Individually selected special exercise.

Requirements: Special exercise and presentation in seminar.

Literature: To be announced separately.

Prerequisites: Ene-59.036 (obligatory).

Language: Finnish.

Ene-59.050 Applications of Mathematical Methods in Energy Economics (3 ocr) P

Spring (Period IV), every second year, will be lectured spring 2007.

Lecturer: Prof Pekka Pirilä

Contents: Linear optimisation in energy planning and energy models. Dynamic programming with application in electricity price formation. Mathematical economics in the analysis of energy investments and risk management in energy markets.

Requirements: Obligatory exercises and examination.

Literature: Lecture notes.

Language: Finnish.

Ene-59.055 Special Topics in Energy Economics and Power Plant Engineering (3-5 ocr) P V

Autumn or spring

Lecturer: Prof Pekka Pirilä

Contents: Course with varying content.

Requirements: Examination.

Literature: Lecture notes.

Language: Finnish.

Ene-59.060 District Heating Engineering (3 ocr)

Autumn

Lecturer: Kari Sipilä, Lic.Sc. (Tech.)

Contents: Use of district heating in heating of buildings, technologies for heat transfer and distribution, technologies for heating stations and power plants. Preplanning of systems, estimation of consumption, planning of operation. Costs of district heating production and distribution, profitability. District cooling.

Requirements: Three obligatory exercises and one computer exercise. Examination.

Literature: Lecture notes.

Language: Finnish.

Ene-59.071 Fundamentals on Industrial Energy Engineering (3 ocr)

Spring

Lecturer: Prof Pekka Ahtila

Contents: Processes in energy intensive industry in respect to energy use and production (pulp and paper, metal, chemical). Energy efficiency, conservation of energy and nature. Overall survey of energy purchase and energy distribution in industry.

Requirements: Examination (both theory and exercise)

Literature: Lecture notes.

Prerequisites: Ene-39.010 (obligatory).

Language: Finnish.

Ene-59.075 Exercise in Industrial Energy Engineering (3 ocr)

Spring

Lecturer: Prof Pekka Ahtila

Contents: The effects of the process solutions on the design of the power plant process in pulp and paper mills are analysed in this exercise. The exercise is done using the balance calculation program Balas.

Requirements: Simulation and exercise instructions

Literature: Description of exercise.

Prerequisites: Ene-59.081 at latest during the same year and AS-74.111 or Kem-90.147 (obligatory).

Language: Finnish.

Ene-59.081 Industrial Energy Engineering (4 ocr)

Autumn + spring

Lecturer: Prof Pekka Ahtila

Contents: Design and use of industrial energy systems. Energy-intensive processes and industrial utility systems. Energy and environmental efficiency, heat recovery and use of secondary energy in industry. Pricing of produced and conserved energy. Balancing and controlling of industrial energy use and production. Industrial electrical system.

Requirements: Examination (both spring and autumn).

Literature: Lecture notes.

Prerequisites: Ene-59.071 (obligatory).

Language: Finnish.

Ene-59.090 Design Exercise and Seminar on Industrial Energy Engineering (4 ocr)

Autumn + spring

Lecturer: Prof Pekka Ahtila

Contents: Design exercise consists of dimensioning of a forest industry integrate (integrated cellulose and paper manufacturing), selection of main process values and process lay-out. Energy consumption is calculated, and energy production system and energy purchase are designed based on process values. In the seminar a topical theme in industrial energy technology is studied.

Requirements: Design exercise and presentation in seminar.

Literature: To be announced separately.

Prerequisites: Ene-59.081 (at least during the same year).

Language: Finnish.

Ene-59.092 Special Exercise and Seminar on Industrial Energy Engineering (4 ocr) P

Autumn + spring (Period II-IV)

Lecturer: Prof Pekka Ahtila

Contents: Individual or group work about some theme in industrial technology. The work can be detailed laboratory work, literature study or ADP-work. In the seminar some topical theme in industrial energy technology is under scrutiny.

Requirements: Special exercise and presentation in seminar.

Literature: To be announced separately.

Prerequisites: Ene-59.081 (at least during the same year).

Language: Finnish.

Ene-59.095 Special Topics in Industrial Energy Engineering (3-5 ocr) P V

Autumn

Lecturer: Prof Pekka Ahtila

Contents: Every year new topical issues in industrial energy technology, energy effectiveness and energy consumption.

Requirements: Examination.

Language: Finnish.

Ene-59.100 Visions for Future Energy Technology (1 ocr) P V

Autumn

Lecturer: Seppo Hannus, Docent

Contents: The course is a studia genera type of a lecture series. The lecturers will be from industry and other energy related organisations. The titles for each lecture can be found at the web-site of the Center for Energy Technology.

Requirements: Presents at least during 7 lectures and s writing a 5 page summary of the lectures.

Literature: Material distributed by the lecturers.

Language: Finnish.

Kon-14 INTERNAL COMBUSTION ENGINE TECHNOLOGY

Prof: Martti Larmi, Internal Combustion Engine Lab. 224a, 451 3459

Courses credited in ECTS**Kul-14.3200 Experimental Methods** (5 cr)

Spring, will be lectured in spring 2008

Lecturer: Pekka Rantanen, senior research scientist , guest lecturers.

Contents: Planning of an experimental study. Measurement and analysis methods and devices used in mechanical engineering. A research project and experimental measurements put into practice.

Requirements: Research and calculation exercises, and examination.

Literature: Wheeler, A., Ganji, A.R.: Introduction to Engineering Experimentation, Pearson, 2004.

Prerequisites: Basics in statistical mathematics.

Language: Finnish.

Courses credited in ocr**Kon-14.001 Principles of Internal Combustion Engines** (3 ocr)

Autumn

Lecturer: Prof Martti Larmi

Contents: Internal combustion engine operation fundamentals, gas exchange and, combustion basics, emissions.

Requirements: Laboratory exercises, calculation exercises and examination.

Literature: Heywood, J. B.: Internal Combustion Engine Fundamentals. McGraw-Hill (partly).

Prerequisites: Ene-39.001 (obligatory, approved), Kem-35.108 (obligatory, approved).

Language: Finnish.

Kon-14.002 Piston Engine Design (3 ocr)

Spring

Lecturer: Prof Martti Larmi and N. N. , university teacher

Contents: Piston engine mechanics and dynamics. Piston engine techniques.

Requirements: Laboratory exercise, computer simulation exercises and seminars.

Literature: Heisler, H.: Advanced engine technology, Butterworth-Heinemann. 1995 (partly), van Basshuysen, R., Schäfer, F.: Internal Combustion Engine - Handbook.

Prerequisites: Kon-14.001 (obligatory, approved), Kon-41.003 (obligatory, approved), Kul-49.010, Kul-49.014.

Language: Finnish.

Kon-14.004 Processes of Internal Combustion Engines (3 ocr) P

Autumn

Lecturer: Prof Martti Larmi and N. N. , university teacher

Contents: Id simulation of engine performance. Computation of cylinder processes and gas exchange.

Requirements: Simulation exercises, calculation exercises, examination.

Literature: Merker, G.P. & Schwarz, C.: Technische Verbrennung, Simulation Verbrennungsmotorischer Prozesse. Heywood, J. B.: Internal Combustion Engine Fundamentals (partly).

Prerequisites: Kon-14.001 (obligatory, approved), Kon-14.002 (obligatory, approved).

Language: Finnish.

Kon-14.005 Experimental Methods (3 ocr) P

Spring

Lecturer: Pekka Rantanen, senior research scientist, guest lectures.

Contents: Planning of experimental study. Measurement and analysis methods and devices used in mechanical engineering. The electric measurement techniques of mechanical quantities in the scope of mechanics of materials, machine design, automotive engineering and internal combustion engines.

Requirements: Calculation exercises, laboratory exercise and examination.

Literature: Wheeler, A., Ganji, A.R.: Introduction to Engineering Experimentation, Pearson 2004.

Prerequisites: Basics in statistical mathematics are recommended.

Language: Finnish.

Kon-14.008 Advanced Project of Internal Combustion Engines (3-5 ocr) P

Autumn & spring

Lecturers: Prof Martti Larmi and N. N. , university teacher

Contents: Demanding design exercise or research study of internal combustion engine design, engine processes or experimental research. The subjects will be arranged individually.

Requirements: Seminars and report.

Prerequisites: Kon-14.004 or Kon-14.005.

Language: Finnish.

Kon-14.009 Design of Internal Combustion Engines (5 ocr)

Autumn + spring

Lecturer: Prof Martti Larmi and N. N. , university teacher

Contents: Basic engine design or the design of some components using modern simulation tools.

Requirements: Design project carried out in groups. No examination.

Prerequisite: Kon-14.001 (obligatory, approved) and Kon-14.002 (obligatory, approved), Kon-14.004.

Language: Finnish.

Kon-14.010 Advanced Engine Modelling (6 ocr) P
(Period) Spring, even years.
Lecturer: Prof Martti Larmi and Doc Pia Kilpinen
Contents: 3d modelling of in-cylinder phenomena: flow field, fuel spray, combustion, emissions, heat transfer.
Requirements: Attending lectures, exercises, examination.
Literature: Stiesch, G.: Modeling Engine Spray and Combustion Processes.
Prerequisite: Good knowledge of internal combustion engines and fluid dynamics. The course is intended for post-graduate students.
Language: English.

Kon-15 PRODUCTION ENGINEERING

Prof. Kalevi Aaltonen, Lab. of Production Engineering 209, 451 3522, 050-551 3522
Prof. Esko Niemi, Lab. of Production Engineering 202, 451 3520, 040-503 1384

Courses credited in ECTS

Kon-15.3215 Manufacturing Processes and Methodology (2 cr)
Spring
Lecturer: Prof Esko Niemi
Contents: General features of machine workshop industry. Standardization. Modular tooling systems. Cutting tools. Tool materials. Clamping. Tool construction and manufacturing. Manufacturing. It is highly recommended to attend the lectures before course Kon-15.3157.
Literature: To be announced separately.
Language: Finnish.

Kon-15.3116 Seminar on Production Technology (2 cr)
Spring
Lecturer: Pekka Kyrenius, Lic. Sc. (Tech.) (responsible)
Contents: Seminar lectures about production techniques and manufacturing trends. It is highly recommended to attend these lectures before course Kon-15.3157.
Requirements: Approximately 10 compulsory seminars, literature research and acting as an opponent in one seminar.
Prerequisites: Kon-15.3142.
Language: Finnish.

Kon-15.3118 Production Systems (1 cr)
(Period) autumn
Lecturers: Pekka Kyrenius, Lic. Sc. (Tech.)
Contents: Workshop departments' routines and cooperation, alternative production methods and production organizing. Standardization. Principle of JOT. Workshop automation.
Requirements: Examination.
Literature: Schonberger, R.J.: World class manufacturing. The lesson of simplicity applied. The free press. New York and London 1986. 252 p. Nieben, B.W., Draper, A.B., Wysk, R.A.: Modern Manufacturing Process Engineering McGraw-Hill Book Company, Singapore p. 746 - 986. Groover, M.P.: Automation, production system, and computer-aided manufacturing. Prentice-Hall, Englewood Cliffs NJ, 1980, 601 p. (selected pages). Groover, M.P.: Automation, production system, and computer integrated.
Language: Finnish.

Kon-15.3122 Quality Management and Metrology (5 cr)
Spring
Lecturer: Prof Kalevi Aaltonen
Contents: Quality management and principles of metrology in workshop: measuring instruments. Applications of measuring and quality control of different products.

Requirements: Examination and 8 exercises. Exercises include practical measuring.
Literature: Collect, C.V., Hope, A.D.: Engineering Measurements. Pitman Publishing Ltd., London, 1983, 391 p.
Language: Finnish.

Kon-15.3133 Tooling Technology and Design Project (3 cr)
Autumn
Lecturer: Prof Kalevi Aaltonen
Contents: Planning and manufacturing of tools. Includes molds, dies, fixtures and robot grippers.
Requirements: Examination and exercises on mold or die construction.
Literature: Menges Georg, Mohren Paul.: How to make injection molds. Second Edition. Hanser Publishers, Munich, Vienna, New York, Barcelona, 1993, 535 p.
Language: Finnish.

Kon-15.3142 Machine Tools, Accessories and Manufacturing Processes (1 cr)
Autumn
Lecturer: Prof Esko Niemi
Contents: Basic theory of cutting, structure of machine tools, features and effectiveness. Current trends.
Requirements: Examination.
Literature: To be announced separately.
Language: Finnish.

Kon-15.3151 Practical Work Training with Machine Tools (3 cr)
(Period) autumn
Lecturer: Janne Peuraniemi
Contents: Manufacturing exercises.
Requirements: Exercises and report.
Literature: To be announced separately.
Language: Finnish.

Kon-15.3157 Research Basics of Production Engineering (7 cr)
(Period) autumn
Lecturer: Pekka Kyrenius, Lic. Sc. (Tech.) (responsible)
Contents: Measurement & analysis of cutting forces. CAD/CAM exercise, NC & robot programming.
Prerequisites: Kon-15.3151 and Kon-15.3116.
Language: Finnish.

Kon-15.4119 Production Automation (3 cr)
Autumn
Lecturer: Prof Kalevi Aaltonen
Contents: Applications and realization of production automation in workshop. Flexible production automation systems: manipulators, robots, CAD/CAM, storage automation and CIM.
Requirements: Examination, exercise.
Literature: Groover, M.P.: Automation, production system, and computer integrated manufacturing. Prentice-Hall, Englewood Cliffs NJ, 1987, 808 p.
Language: Finnish.

Kon-15.4126 Production Technology, special topics (3 cr) V
(Period) spring
Lecturer: Prof Kalevi Aaltonen
Contents: Content of course varies annually. Special knowledge of workshop engineering.
Requirements: Examination and exercises.
Literature: To be announced separately.
Language: Finnish.

Kon-15.4135 Sheet Metal Technologies (3 cr)
(Period) spring
Lecturer: Prof Esko Niemi

Contents: Sheet metal and steel construction tasks. Materials. Methods, machines and layout. Safety at work. Production oriented planning.

Requirements: Examination and demonstration.

Literature: Metals Handbook Desk Ed. Ch. 26 Forming, Metals Handbook 9th Ed. Vol. 14 Forming and Forging.

Language: Finnish.

Kon-15.4158 Industry Project (5 cr)

(Period) spring

Lecturer: Pekka Kyrenius, Lic. Sc. (Tech.) (responsible)

Contents: Industry Project including a case study and literature research.

Prerequisites: Kon-15.3157.

Language: Finnish.

Kon-15.4159 Design for Manufacturing and Product Design (6 cr)

(Period) autumn + spring

Lecturer: Pekka Kyrenius, Lic. Sc. (Tech.) (responsible)

Contents: Product design, Design for Manufacturing, Production planning. Selection of tools and tool setting.

Prerequisites: Kon-15.3142.

Language: Finnish.

Kon-15.5150 Postgraduate Seminar on Production Engineering (0 - 3 cr) P

(Period) autumn + spring

Lecturer: Pekka Kyrenius, Lic. Sc. (Tech.)

Contents: Special programme related to postgraduate studies.

Language: Finnish

Kon-16 AUTOMOTIVE ENGINEERING

Prof. Matti Juhala, Vehicle Engineering and Machine Design
112, 451 3470

Courses credited in ECTS

Kon-16.4201 Machine Acoustics (3 cr) P

Spring

Lecturer: N.N.

Contents: In this course we discuss machine originated noise, its prevention and measurement. Also we go over the principles of acoustics, hearing and noise related legislation. Subjects are presented in practical terms, examples are from mechanical and vehicle engineering areas.

Requirements: Pre-examination, learning diaries, exercises and final examination.

Literature: Textbook and materials from lecturers.

Prerequisites: No prerequisites. Recommended for third study year.

Language: Finnish.

Courses credited in ocr

Kon-16.101 Introduction to Automotive Engineering (6 ocr)

Autumn and spring

Lecturer: Prof Matti Juhala

Contents: The basics of vehicle motion mechanics, car electronics and structural studies.

Requirements: Final examination or two mid term examinations, laboratory practices, calculation practices, construction analysis. The requirement to get to examination is to pass all practices.

Literature: Lecture notes, Genta: Motor Vehicle Dynamics, Juhala, Suominen, Tammi: Moottorialan sähköoppi, SATL: Autotekniikan taskukirja.

Language: Finnish.

Kon-16.116 Structural Systems in Automotive Vehicles (3 ocr)

Autumn

Lecturer: Prof Matti Juhala

Contents: To introduce students to ground vehicle technics related machine design and the specific design instructions of the different subsystems.

Requirements: Examination.

Literature: Lecture notes.

Prerequisites: Kon-16.101.

Language: Finnish.

Kon-16.118 Design Exercises in Automotive Vehicles, short course (2.5 ocr)

Spring

Lecturer: N.N.

Contents: The goal is to familiar students with the design duties in machine engineering. The course consists of a design assignment in the field of ground vehicle engineering.

Requirements: Design assignment, no examination.

Prerequisites: Kon-16.116.

Language: Finnish.

Kon-16.121 Seminar on Automotive Engineering (3 ocr)

Autumn + spring. The course is lectured every other year and will be lectured in 2006-2007.

Lecturer: Prof Matti Juhala

Contents: The goal is to acquaint students with the special characteristics of the branch and the writing of a report.

Requirements: Attending seminars and making a development situation study in pairs on a specified field.

Language: Finnish.

Kon-16.141 Simulation of Mechanisms (3 ocr)

Autumn

Lecturer: Tero Lehtonen, M.Sc. (Tech.)

Contents: The course is to give ideas how to make dynamic simulations and show some possibilities and to familiarize to use ADAMS software. The course consists of the basics of simulating and simulations of some complex mechanical systems. This is done through lectures and practices.

Requirements: Passed practices and participation to lectures.

Literature: Lecture notes.

Prerequisites: Kon-16.142.

Language: Finnish.

Kon-16.142 Design of Mechanisms (3 ocr)

Spring

Lecturer: Prof Matti Juhala

Contents: The objective is to give needed basic information on analysis and synthesis of mechanisms and the function of a heat engine. Managed subjects are the most common mechanisms of machine building, the dynamics of piston engine, the processes of heat engines and the mechanics of mobile machines.

Requirements: In addition to lectures and examination there are 7 calculation practices and the introduction to ADAMS - software. To gain the right for examination one must pass the calculations and take part in ADAMS-intro. The coefficient for the examinations is 2 and for the calculations 1.

Literature: Lecture notes.

Prerequisites: Kon-41.003.

Language: Finnish.

Kon-16.146 Introduction to Rail Vehicle Technology (3 ocr)

(Period) autumn. The course is lectured every other year and will not be lectured in 2006-2007.

Lecturer: Prof Matti Juhala

Contents: Theoretical basics of motion mechanics of rail vehicles, the characteristics of acquiring and making of rail vehicles, the vehicle types and transport methods. The structural techniques of pull- and other rail vehicles. A review into environmental effects and the future of rail vehicles.

Requirements: Examination, practices and two local excursions.
Literature: Lecture notes.
Language: Finnish.

Kon-16.151 Design Exercises in Rail Vehicle Technology (2.5 ocr)

Spring. The course is lectured every other year and will not be lectured in 2006-2007.

Lecturer: Prof Matti Juhala

Contents: The goal of the course is to familiar students to designing rail vehicles. The contents of the course is a design assignment on the field of rail vehicles.

Requirements: No examination, passed design work.

Prerequisites: Kon-16.146.

Language: Finnish.

Kon-16.155 Seminar on Rail Vehicle Technology (3 ocr)

(Period) spring. The course is lectured every other year and will not be lectured in 2006-2007.

Lecturer: Prof Matti Juhala

Contents: The goal is to familiarize students into the special questions and problems of the field and into writing report.

Requirements: Seminars are compulsory, and a paper made in pairs on some special field of rail technology.

Prerequisites: Kon-16.146.

Language: Finnish.

Kon-16.161 Mobile Work Machines (3 ocr)

Spring

Lecturer: Prof Matti Juhala

Contents: The requirements established to mobile working machines. Different types, characteristics, structural solutions and ergonomics of mobile working machines.

Requirements: Examination and exercise.

Literature: Lecture notes.

Prerequisites: Kon-16.101.

Language: Finnish.

Kon-41 MACHINE DESIGN

Prof: Mauri Airila, K 226, 451 3552

Prof: Petri Kuosmanen, K 224, 451 3544

Prof: Kalevi Ekman, K 222, 451 3566

Prof: Matti Pietola, K 223, 451 3572

<http://www.machina.tkk.fi>

Courses credited in ECTS

Kon-41.2008 Machine Design Basics A (10 cr)

Autumn + spring

Lecturer: Markku Kuuva, lecturer (responsible), Prof Kalevi Aaltonen, Prof Hannu Hänninen

Contents: The course is intended for first year students and gives (mechanical) engineering design, manufacturing technology and materials science basic knowledge and skills required in practical design work and later studies. The aim is to build up readiness for communication in design and manufacturing contexts and for simple design tasks. E.g. the following topics are included; reading technical drawings, producing drawings with CAD (Solid Edge), the most typical manufacturing methods and basics for manufacturing method selection, basics in materials science and selection of materials, engineering design terminology, use of standards, production of machine components and making of construction drawings and selection of typical machine parts and components.

Requirements: Teaching includes a lecture series, exams, and compulsory personal exercises.

Literature: Pere: Koneenpiirustus korkeakouluja varten and Ihalainen, et.al.: Valmistustekniikka, Otatieto 487 and, Ashby

MF Jones DRM: Engineering materials I an introduction to their properties and applications, lecture notes.

Additional: Replaces courses Kon-41.008 Engineering Design A 5 ocr, Kon-15.107 Manufacturing Technology 3 ocr and Kon-67.104 Introduction to Materials Science and Selection of Materials 4 ocr, the difference in study credits awarded is compensated in other courses/modules according to the new study structure.

Language: Finnish.

Kon-41.2010 Machine Design Basics B (4 cr)

Autumn

Lecturer: Markku Kuuva, lecturer (responsible), Seppo Kivioja, lecturer

Contents: The course is intended for first year students and gives (mechanical) engineering design basic knowledge and skills required in practical design work and later studies. The aim is to build up readiness for communication in design and manufacturing contexts and for simple design tasks. E.g. the following topics are included: reading technical drawings, producing drawings with CAD (Solid Edge), engineering design terminology, use of standards, production of machine components and making of construction drawings and selection of typical machine parts and components, selected basics in pipeline drawings and process schemes. Selected basics in engineering design calculations are also included.

Requirements: Teaching includes a lecture series, an exam, and compulsory personal exercises.

Literature: Pere: Koneenpiirustus korkeakouluja varten; Kivioja: Konetekniikka. Lecture notes.

Additional: Replaces the course Kon-41.010 Engineering Design B 3 ocr.

Language: Finnish.

Kon-41.2011 Machine Design Basics C (3 cr)

Autumn

Lecturer: Markku Kuuva, lecturer (responsible)

Contents: The course is intended for first year students and gives (mechanical) engineering design basic knowledge and skills required in practical design work and later studies. The aim is to build up readiness for communication in design and manufacturing contexts and for simple design tasks. E.g. the following topics are included: reading technical drawings, producing drawings with CAD (Solid Edge), engineering design terminology, use of standards, production of machine components and making of construction drawings and selection of typical machine parts and components, selected basics in pipeline drawings and process schemes.

Requirements: Teaching includes a lecture series, an exam, and compulsory personal exercises.

Literature: Pere: Koneenpiirustus korkeakouluja varten. Lecture notes.

Additional: Replaces the course Kon-41.011 Engineering Design C 2 ocr.

Language: Finnish.

Kon-41.2012 Machine Design Basics E1 (5 cr)

Autumn

Lecturer: Markku Kuuva, lecturer (responsible)

Contents: Machine Design Basics A -course autumn term module in the Degree Programme of Energy Engineering and HVAC (ENE), (please see Kon-41.2008 common lecture program)

Language: Finnish.

Kon-41.2013 Machine Design Basics E2 (5 cr)

Spring

Lecturer: Markku Kuuva, lecturer (responsible)

Contents: Machine Design Basics A -course spring term module in the Degree Programme of Energy Engineering and HVAC (ENE), (please see Kon-41.2008 common lecture program)

Language: Finnish.

Kon-41.3003 Machine Elements (8 cr)

Autumn + spring

Lecturer: Seppo Kivioja, lecturer

Contents: Function and dimensioning of most common machine elements: joining methods, bearings, mechanical power transmission and pressure vessels. Exercises and design projects.

Requirements: Exercises, design projects and examination. Exercises must be passed before final exam. The final grade depends on calculation and design exercises and final exam.

Literature: Airila & al.: Koneenosien suunnittelu, WSOY.

Prerequisites: Kon-41.2008 and Kul-49.2100 or Kul-49.2200 (obligatory, accepted).

Language: Finnish.

Kon-41.3006 Computer Aided Design Basic Course (5 cr)

Autumn & spring

Lecturer: Petri Makkonen, teaching research scientist

Contents: The intention of the course is to give basic skills in the use of 3D Computer Aided Design software for mechanical design. The topics treated are e.g. the special features of mechanical design and its requirements in modelling, assembly and visualisation. The course contents or corresponding knowledge are necessary in later 3D course work for professional topics.

Requirements: Attendance at the practical exercises, intermediate exam and project work.

Literature: Lecture notes.

Prerequisites: Kon-41.3003/003, Kon-41.2008/008, T-106.001 (all obligatory, accepted).

Language: Finnish.

Kon-41.3023 Hydraulics and Pneumatics (5 cr)

Spring

Lecturers: Prof Matti Pietola and Heikki Kauranne, Lic.Sc. (Tech.)

Contents: Introduction to hydraulic and pneumatic components and systems.

Requirements: Examination and exercises.

Literature: Lecture notes and Kauranne - Kajaste - Vilenius: Hydraulitekniiikan perusteet, WSOY.

Language: Finnish.

Kon-41.3130 Mechatronics Exercises (4 cr)

Spring, available for the first time in spring 2008.

Lecturer: Panu Kiviluoma, teaching research scientist

Contents: A team project in mechatronics, improving the overall understanding of functions of mechatronics devices by hands-on exercises.

Literature: Lecture notes.

Requirements: Accepted exercise assignment.

Prerequisites: Min. 15 cr in the Mechatronics I module (K150-1).

Language: Finnish.

Kon-41.3140 Mechatronics Sensors and Actuators (4 cr)

Spring

Lecturer: Prof Mauri Airila

Contents: After the course the student is able to describe a mechatronic system and the physical phenomena, basic theory, operating principles, essential features applications for conventional sensors and actuators. The student is able to select feasible sensors, actuators and the necessary peripherals for a simple mechatronic system.

Requirements: The preliminary examination, the final examination; The exercises must be passed before the final examination.

Prerequisites: The other courses of the module "Mechatronics I" should be passed (recommendation).

Language: Finnish.

Kon-41.3180 Tribology (5 cr)

Spring

Lecturer: Seppo Kivioja, lecturer

Contents: Interaction of surfaces acting upon one another in relative movement: contact of surfaces, friction and wear theories, mechanics of rolling motion, lubrication theories and applications on machine design.

Requirements: Laboratory work, exercises, seminar work and examination.

Literature: S. Kivioja et al.: Tribologia - kitka, kuluminen ja voitelu. Otatieto n:o 574.

Prerequisites: Kon-41.3003.

Language: Finnish.

Kon-41.4001 Product Development (5 cr)

Autumn

Lecturer: Prof Kalevi Ekman

Contents: Research and development in industry. Successful process. Linking strategy and R&D. Identifying and developing of ideas. Conceptual design. Product development methods and tools.

Requirements: Homework, team exercises, seminar, exam.

Literature: Ulrich, Eppinger: Product Design and Development (3rd edition 2003), course readings given at lectures.

Prerequisites: Master level. Designed for simultaneous studying with Kon-41.4002.

Language: Finnish (partly English). The course can be studied in English.

Kon-41.4002 Product Development Project (10 cr)

Autumn + spring

Lecturer: Prof Kalevi Ekman

Contents: Project work in team settings of roughly 10 students. The development projects are mostly offered and sponsored by industrial companies. The projects include all phases from planning to introducing of a fully functional prototype or demonstrator.

Requirements: The course starts (period) with introductory lessons and by working out the project plans. Students read selected chapters from the course book and prepare student presentations. The development project continues (periods II, III-IV) for the whole winter and the final results are introduced at the end of April. The grade is composed of practical results, project management, applying of proper methods and tools, and of mastering communication and documentation during the project. There is no final exam.

Literature: Ulrich, Eppinger: Product Design and Development, selected chapters (3rd edition 2003 recommended, but other editions are valid at this course, too).

Prerequisites: The course is aimed at students of technology, marketing, or industrial design who are interested in product development of investment or consumer products. Also, students from other disciplines are welcomed to the appropriate extent. The course is intended for the final stage of studies. For practical reasons, the number of students must be limited to roughly 120. Therefore, we suggest to enrol already in June.

Language: English.

Kon-41.4027 Modelling and Simulation of Fluid Power Systems (3 cr) P

Autumn

Lecturer: Prof Asko Ellman

Contents: Virtual testing. Modelling and simulation of fluid power systems with Simulink program.

Requirements: Examination and exercises.

Literature: Lecture notes.

Prerequisites: Kon-41.3023 (or Kon-41.023)(obligatory).

Language: Finnish.

Kon-41.4029 Mobile Hydraulics (2 cr)

Spring

Lecturer: Prof Matti Pietola
 Contents: Characteristic features of mobile hydraulic components and systems. Hydrostatic transmission. Construction of fluid power systems in mobile machines.
 Requirements: Examination and exercises.
 Literature: Lecture notes.
 Prerequisites: Kon-41.3023 (or Kon-41.023)(obligatory).
 Language: Finnish.

Kon-41.4030 Pumping Technology (2 cr)
 (Period) spring

Lecturer: Hannele Pietola, M.Sc. (Tech.)
 Contents: Basics of pump technology and pump system design.
 Requirements: Examination and exercises.
 Literature: Lecture notes and Lazarkiewicz - Troskolanski: Impeller Pumps.
 Prerequisites: Kul-34.3100 (recommended).
 Language: Finnish.

Kon-41.4102 Special Course on Product Development Project Management (2 cr)

Autumn + spring
 Lecturer: Prof Kalevi Ekman
 Contents: Planning, leading and managing of a real product development project.
 Requirements: Intensive training days. Acting as project manager on Kon-41.4002 Product Development Project.
 Prerequisites: No prerequisites, but studying of Kon-41.4001 is an advantage.
 Additional information: The number of participants is limited. Selection is based on personal interviews. The most important selection criteria are the progress in the studies, the training experience in industry, and the motivation.
 Language: Finnish or English.

Kon-41.4169 Industrial Design (5 cr)

Spring
 Lecturer: Prof Kalevi Ekman
 Contents: Industrial design - profession, research, and education. Industrial design approach, methods, and tools. The role of industrial designer in integrated product development. Developing of break through products. Viewpoints to design platforms - technology, industrial design, and brand.
 Requirements: Oral exam of course literature. Writing a course diary. Practical design exercise as team work. No final exam.
 Literature: Ekman, K. & Sääskilähti, M. (ed.): Teollinen muotoilu tuotekehityksessä. Koneensuunnittelun julkaisu C 269, Otaniemi 2002, or substituting literature in English.
 Prerequisites: No prerequisites. Recommended for third study year.
 Language: Finnish or English.

Kon-41.4190 Mechatronics and Hydraulics (5 cr)

Spring
 Lecturer: Prof Matti Pietola
 Contents: The purpose of the course is to give a general view of the technologies and future trends of mechatronic machines and fluid power systems. The most important topics are the relevant technologies, technical solutions and electric and hydraulic control and servo systems.
 Requirements: Lectures, calculation sessions, laboratory exercises and intermediate or final examination are included in the course. All other parts must be passed before taking the final examination.
 Literature: Lecture notes.
 Language: Finnish.

Kon-41.4199 Methods in Machine Design (5 cr)

Autumn
 Lecturer: Prof Petri Kuosmanen

Contents: The aim of this course is to achieve understanding of the systematic approach of machine design. After the course the student has ability to design a new mechanical device. The course consists of lectures and a team project work.
 Literature: To be announced later.
 Requirements: Examination/intermediate examinations and accepted construction exercise assignment.
 Prerequisites: Kon-41.2008 and Kon-41.3003.
 Language: Finnish.

Kon-41.5000 Research Scientist Basic Course (5 cr) P

(Period) autumn
 Lecturer: Prof Mauri Airila
 Contents: Scientific research and scientific knowledge; scientific research methods; principal research methods within the own research field; publication and publication forums; publication structure and writing of publication; good scientific practice; dissertation formats and basic requirements.
 Prerequisites: M.Sc. degree or eligibility for postgraduate studies.
 Language: Finnish.

Kon-41.5167 Patents (3 cr) P

Spring
 Lecturer: Panu Kuosmanen, specialist teacher
 Contents: Protecting ideas in Finland and abroad. Patent, model right, trademark and copyright. Inventions during employment at company and at university. Disagreement situations.
 Requirements: Examined at the beginning of the course. Writing a patent application.
 Literature: Haarmann, P-L.: Immateriaalioikeuden oppikirja, Teollisuuden Keskusliitto: Työsuhdekeksinnöt. Course material.
 Language: Finnish.

Kon-41.5216 Postgraduate Seminar on Product Development (5 cr) P

(Period) spring
 Lecturer: Prof Kalevi Ekman
 Contents: The subject of the seminar varies. The objective is to discuss the most interesting new methods and tools of product development.
 Requirements: Activity in seminars. Preparation of a state-of-the-art report, a presentation based on it and acting as an opponent.
 Literature: To be defined.
 Prerequisites: M.Sc. degree and good knowledge of product development.
 Language: Finnish.

Kon-41.5217 Postgraduate Seminar on CAE (5 cr) P

Spring, lectured when required.
 Lecturer: Petri Makkonen, teaching research scientist
 Contents: The topic of the seminar varies from year to year
 Requirements: Active participation in the seminars, preparation of a state-of-the-art report, a presentation based on it and acting as an opponent.
 Literature: To be defined.
 Prerequisites: Good understanding of CAE is required.
 Language: Finnish.

Kon-41.5219 Research Scientist Advanced Course (15 cr) P V

Autumn + spring
 Lecturer: Prof Mauri Airila
 Contents: Basic principles in scientific research work and good scientific practice; practical research work; principal research methods in machine design; administration of research projects; essential funding instruments; conference practice and presentation of scientific research results; international research contacts; peer review practice; younger colleague mentoring.
 Prerequisites: M.Sc. degree or eligibility for postgraduate studies.
 Language: Finnish.

Kon-41.5220 Postgraduate Seminar on Fluid Power (5 cr) P V
Autumn & spring
Lecturer: Prof Matti Pietola
Contents: A postgraduate seminar on varying subjects within the field of fluid power.
Requirements: Active participation in seminars and presentations on given subjects. No examination.
Literature: Will be announced at the beginning of the course.
Prerequisites: M.Sc. degree and a good basic knowledge of fluid power.
Language: Finnish.

Kon-41.5221 Postgraduate Seminar on Fluid Power, exercises (5 cr) P V
Autumn & spring
Lecturer: Prof Matti Pietola
Contents: An exercise task on a varying subject discussed with the lecturer.
Requirements: An exercise task.
Prerequisites: Kon-41.5220.
Language: Finnish.

Kon-41.5230 Postgraduate Seminar on Paper Machinery (5 cr) P
Autumn
Lecturer: Prof Petri Kuosmanen
Contents: The theme of the seminar varies. The seminar treats the machines and maintenance and upkeep of paper manufacturing line, and the related new techniques.
Examination: Active participation in the seminars, preparation of a state-of-the-art report, a presentation based on it and acting as an opponent. The start of the next course will be notified separately.
Literature: Notified in the beginning of the seminar.
Prerequisites: M.Sc. degree and a good basic knowledge of paper machine technology.
Language: Finnish or English.

Courses credited in ocr

Kon-41.007 3D-design in Product Development (6 ocr)
Autumn + spring
Lecturer: Petri Makkonen, teaching research scientist
Contents: The objective is to give deep insight into the use of computer aided design in product development work. The utilisation of new methods, the use of data transfer between co-operative partners in design and production, the utilisation of 3D modelling methods. The course includes acquaintance with CAD-based simulation software.
Requirements: Attendance at lectures, assignments and group work.
Prerequisites: Kon-41.3006 (obligatory, accepted).
Language: Finnish.

Kon-41.028 Fluid Power in Industrial Applications (2.5 ocr)
Autumn
Lecturer: Prof Matti Pietola
Contents: The course provides advanced knowledge of fluid power systems and industrial control techniques. Logic element technology in fluid power.
Requirements: Examination and exercises.
Literature: Fonselius - Rinkinen - Vilenius: Hydraulikka II and lecture notes.
Prerequisites: Kon-41.023 (attending lectures).
Language: Finnish.

Kon-41.107 3D-Design in Product Development, short course (2 ocr)
Autumn
Lecturer: Petri Makkonen, teaching research scientist

Contents: The objective is to give insight into the use of computer aided design in product development work. The utilisation of new methods and the use of data transfer between co-operating partners in design and production. The course includes the examination of module in course Kon-41.007.
Requirements: Attendance at lectures, project assignment.
Prerequisites: Kon-41.006/3006 passed.
Language: Finnish.

Kon-41.190 Mechatronics (6 ocr)
Autumn + spring
Teacher: Prof Petri Kuosmanen
Contents: The objective is to give the student a good insight and a multi-technical knowledge base for product development, research and project planning tasks. The course entity is built up of partly optional modules. The most important topics are basic design of mechatronic machine, most important technologies, technical solutions, technical development visions and product development methodology.
Requirements: The course includes a preliminary exam, computation and design sessions, laboratory seminars, a written seminar work or state-of-the-art report and intermediate exams or final exam. The prerequisite for final exam is that all other modules are completed.
Literature: Airila, M.: Mekatronikka, Otatieto 1997 and lecture notes.
Prerequisites: at least 10 credits completed in mechatronics major subject.
Language: Finnish.

Kon-41.218 Paper HiTech Seminars (3-15 ocr) P
The scope of the course is agreed, autumn + spring
Lecturer: Prof Petri Kuosmanen
Contents: The seminars give a comprehensive view of pulp and paper manufacturing and the machines and systems used in the processes. The objective is to strengthen cross-technical skills by diversified treatment of newest technologies and research results. The seminars give a comprehensive view of the theory and practice of the branch. The requirements of postgraduate minor studies are fulfilled, if the course is performed with a scope of 15 credit points (incl. seminars and exercises). The course's applicability to student's own postgraduate programme must be agreed with the supervising professor. The course is performed as cooperation between HUT, TUT, LUT, University of Oulu and Åbo Akademi. The start of the next course will be notified separately.
Language: Finnish.

Kon-67 ENGINEERING MATERIALS

Profr: Hannu Hänninen, Lab. of Mater. Tech. 203, 451 3530
<http://dislokaatio.tkk.fi/>

Courses credited in ECTS

Kon-67.3100 Materials Science in Mechanical Engineering (6 cr)
Autumn
Lecturer: Prof Hannu Hänninen
Contents: Introduction to materials science. Most important materials in mechanical engineering. Factors which influence in materials selection.
Requirements: Examination.
Literature: Callister, W.D.: Materials Science and Engineering - an Introduction.
Language: Finnish; Individual study in English possible.

Kon-67.3101 Physical Metallurgy of Light and Colour Metals (3 cr)
Autumn
Lecturer: Risto Ilola, senior assistant

Contents: Metallurgy and use of light metals. The effect of composition on microstructure and properties. Phase diagrams and transformations, especially precipitation heat treatment, Joining of light metals. The properties of different colour metals and use in mechanical engineering.

Requirements: Examination.

Literature: Will be given in lectures.

Prerequisites: Kon-67.3100.

Language: Finnish; Individual study in English possible.

Kon-67.3110 Structure and Properties of Steels (4 cr)

Spring

Lecturer: Prof Hannu Hänninen

Contents: Introduction to different steels, their properties and the effect composition and heat treatments. Most important steels in mechanical engineering and their usage.

Requirements: Examination and attendance to exercises.

Literature: Will be given in lectures.

Prerequisites: Kon-67.3100.

Language: Finnish; Individual study in English possible.

Kon-67.3301 Non-Destructive Testing (5 cr)

Autumn

Lecturer: Juha Toivonen, M.Sc. (Tech.)

Contents: An introduction to different NDT -techniques, particle ultrasonics, radiography, liquid penetrant, magnetic flux, eddy current. Also, basics of visual inspections, acoustic emission, infrared radiation etc.

Requirements: Examination + exercises.

Literature: Lecture notes.

Prerequisites: Kon-67.2008.

Language: Finnish; Individual study in English possible.

Kon-67.3401 Engineering Materials under Stress and Environmental Influence (5 cr)

Autumn

Lecturer: Prof Hannu Hänninen

Contents: Behaviour of engineering materials under stress and environmental influence. The basic mechanisms of plastic deformation, fracture, fatigue and creep. Materials testing techniques.

Requirements: Examination + seminar works.

Literature: Hertzberg, R.W.: Deformation and Fracture Mechanics of Engineering Materials.

Prerequisites: Kon-67.3100 and Kon-67.3110.

Language: Finnish; Individual study in English possible.

Kon-67.4101 Laboratory Exercises in Material Science (5 cr)

Autumn

Lecturer: Risto Ilola, senior assistant

Contents: Introduction to different metallurgical techniques. Students will perform three different laboratory exercises based on their main topic.

Requirements: Approved reports on exercises.

Literature: Will be given in lectures.

Prerequisites: Studies of Engineering Materials level 2.

Language: Finnish; Individual study in English possible.

Kon-67.4120 Selection of Engineering Materials (5 cr)

Spring

Lecturer: Prof Hannu Hänninen

Contents: Introduction to materials selection. Use of different engineering materials knowledge bases. Different selection criteria and the systematics of selection methods. Use product life-cycle assessment and cost analysis on material selection.

Requirements: Examination + seminar work.

Literature: Ashby, M.F.: Materials Selection in Mechanical Design.

Prerequisites: Kon-67.3100.

Language: Finnish; Individual study in English possible.

Kon-67.4200 Welding Technology (6 cr)

Autumn

Lecturer: N. N.

Contents: Introduction to common welding processes, weldability, weldable metals and their use.

Requirements: Examination.

Literature: Suomen hitsaustekniikan yhdistys. Hitsauksen materiaalioppi. Rautaruukki. Hitsaajan opas.

Language: Finnish; Individual study in English possible.

Kon-67.4201 Welding Metallurgy (4 cr)

Spring, odd years

Lecturer: N. N.

Contents: Advanced studies in welding thermal cycle and metallurgy. Welding parameters and heat flow, melt solidification and solidification, structure of the heat affected zone and cracking. Properties of the weld zones.

Requirements: Examination, literature study.

Literature: Sindo Kou: Welding metallurgy.

Prerequisites: Kon-67.4200.

Language: Finnish; Individual study in English possible.

Kon-67.4202 Welding Methods and Production (4 cr)

Spring

Lecturer: N. N.

Contents: Fusion- and pressure welding, brazing, soldering and combined methods. Quality assurance and welding procedure test. Safety at work.

Requirements: Examination, excursion.

Literature: Luha Lukkari: Kaasuhiatus, lecture notes.

Language: Finnish; Individual study in English possible.

Kon-67.4203 Welding laboratory exercises (3 cr)

Autumn

Lecturer: N. N.

Contents: Practical welding exercises: MIG/MAG, TIG, SAW, PAW, FSW and spot welding. Weld surfacing. Bend test.

Requirements: Practical exercises.

Prerequisites: Kon-67.4200 obligatory (can be carried out in parallel).

Language: Finnish.

Kon-67.4204 Design of Welding Structures (3 cr)

Spring, even years

Lecturer: N. N.

Contents: Design of welded structures. Manufacturing, structural integrity, static and fatigue strength, impact toughness and corrosion.

Requirements: Examination.

Literature: Lecture notes.

Prerequisites: Kon-67.4200.

Language: Finnish; Individual study in English possible.

Kon-67.4402 Advanced Course in Engineering Materials under Stress and Environmental Influence (3 cr) P

Spring

Lecturer: Kim Wallin, Docent

Contents: Broadens the knowledge of fracture mechanics. Use of fracture mechanical design methods in materials selection and use.

Requirements: Examination + seminar works.

Literature: Will be given in lectures.

Prerequisites: Kon-67.3401.

Language: Finnish; Individual study in English possible.

Courses credited in ocr

Kon-67.107 Physical Metallurgy of Cast Iron (1 ocr)

(Period) spring odd years

Lecturer: Matti Johansson, M.Sc. (Tech.)

Contents: The microstructure and properties of cast irons. The effect of composition and cooling on the microstructure. Heat treatment and use of different cast iron types.

Requirements: Examination + attendance at seminars.

Literature: Lecture notes.

Prerequisites: Kon-67.104 and Kon-67.116.

Additional: Will be lectured last time 2007.

Language: Finnish.

Kon-67.112 Advanced Non-Destructive Testing (2 ocr) P

Lectured when necessary

Lecturer: Jorma Pitkänen, Lic.Sc. (Tech.)

Contents: The purpose is to broaden students knowledge of NDT-techniques. Special topics include NDT of new materials, development trends of NDT-techniques, special techniques, automation of NDT and measurement of material properties with NDT.

Requirements: Examination.

Literature: Lecture notes.

Prerequisites: Kon-67.111 or equivalent knowledge.

Language: Finnish.

Kon-67.115 Heat Treatment of Metals (3 ocr)

Autumn

Lecturer: Kari Blomster, D.Sc. (Tech.)

Contents: The effects and targets of different heat treatments on steels, used equipment and approaches.

Requirements: Examination + laboratory exercises + attendance at industry visit.

Literature: Lecture notes, other literature will be announced in lectures.

Prerequisites: Kon-67.104 (obligatory) and Kon-67.116 (obligatory).

Additional: Will be lectured last time 2006.

Language: Finnish.

Kon-67.117 Powder Metallurgical Materials and Manufacturing Techniques (2 ocr)

(Period) spring, odd years

Lecturers: Antti-Pekka Nikkilä, Lic.Sc. (Tech.), Eero Sirviö, M.Sc. (Tech.) and Jari Liimatainen, visiting senior lecturer

Contents: Manufacturing techniques and properties of ceramics and hard metals. Use in mechanical engineering.

Requirements: Examination.

Literature: Lecture notes.

Prerequisites: Kon-67.104 and Kon-67.116.

Additional: Will be lectured last 2007.

Language: Finnish.

Kon-67.123 Design Exercises in Selection of Engineering Materials (3 ocr)

Spring

Lecturer: Prof Hannu Hänninen

Contents: Every student will carry out a design exercise.

Requirements: Design exercise.

Prerequisites: Kon-67.102, Kon-67.118 and Kon-67.121 (simultaneous).

Language: Finnish.

Kon-67.200 Postgraduate Seminar on Engineering Materials (2-6 ocr) P

Lecturer: Prof Hannu Hänninen (responsible)

Contents: Course with annually varying content. Currents topics and advance in materials technology. Seminars deal with special problems of materials technology.

Requirements: Attendance at seminars and literature work.

Literature: Literature will be given at lectures.

Prerequisites: Studies of materials technology or equal knowledge.

Language: Finnish.

Kon-67.201 Postgraduate Seminar on Engineering Materials (2-6 ocr) P

See Kon-67.200

Kon-67.202 Postgraduate Seminar on Engineering Materials (2-6 ocr) P

See Kon-67.200

Kon-67.203 Postgraduate Seminar on Engineering Materials (2-6 ocr) P

See Kon-67.200

Kon-67.204 Postgraduate Seminar on Engineering Materials (2-6 ocr) P

See Kon-67.200

Kon-67.300 Postgraduate Seminar on Welding Technology (2-6 ocr) P V

Lecturer: Risto Karppi, Docent

Contents: Course with annually varying content. Current topics and advances in welding technology. Seminars deal with special problems of welding technology.

Requirements: Attendance at seminars and literature work.

Literature: Literature will be given later.

Prerequisites: Studies of welding technology or equivalent knowledge.

Language: Finnish.

Kon-67.301 Postgraduate Seminar on Welding Technology (2-6 ocr) P V

See Kon-67.300

Kon-67.302 Postgraduate Seminar on Welding Technology (2-6 ocr) P V

See Kon-67.300

Kon-67.303 Postgraduate Seminar on Welding Technology (2-6 ocr) P V

See Kon-67.300

Kon-67.304 Postgraduate Seminar on Welding Technology (2-6 ocr) P V

See Kon-67.300

Kon-80 CAST PRODUCTS TECHNOLOGY

Prof: Juhani Orkas, K 138, 451 3515

Courses credited in ECTS

Kon-80.3107 Casting as a Manufacturing Method (2 cr)

Spring

Lecturer: Prof Juhani Orkas

Contents: The course objective is to give basic knowledge in casting technology, cast materials and casting.

Prerequisites: Kon-41.2008 or equivalent knowledge.

Additional: Will be lectured for the first time during academic year 2007-2008 as a part of the course Kon-80.107.

Language: Finnish.

Courses credited in ocr

Kon-80.107 Casting as a Manufacturing Method (3 ocr)

(Period) spring

Lecturer: Prof Juhani Orkas

Contents: The course objective is to give basic knowledge in casting technology, cast materials and casting.

Requirements: Exam, seminars, exercises and excursion.

Literature: Lecture notes and material announced during course.

Prerequisites: Kon-41.2008

Language: Finnish.

Kon-80.113 Manufacturing Techniques of Castings (5 ocr)
(Period) autumn

Lecturer: Prof Juhani Orkas

Contents: The course objective is to familiarize students with the manufacturing process of cast components.

Requirements: Exam, literature study, exercises and excursion.

Literature: Lecture notes, Autere - Ingman - Tennilä: Valimotekniikka 1 and 2.

Prerequisites: Kon-80.107.

Language: Finnish.

Kon-80.116 Casting Technology, laboratory exercises (3 ocr)

(Period) autumn & spring

Lecturer: Prof Juhani Orkas

Contents: The course's objective is to give capabilities of solving problems related to casting product development, production and usage.

Requirements: Completing the work and attending supervision discussions.

Prerequisites: Kon-80.113, Kon-80.121 and Kon-80.136.

Language: Finnish, English

Kon-80.121 Design of Castings (3 ocr)

(Period) autumn

Lecturer: Prof Juhani Orkas

Contents: Design of castings, design differences between sand moulds and permanent moulds, properties of cast metals, light alloy castings vs. plastics, compilation of quality criteria of castings.

Requirements: Lecture notes and design exercise. No final examination.

Prerequisites: Kon-80.107 (obligatory, accepted), student is expected to know the basics of 3D modelling.

Language: Finnish.

Kon-80.136 Running and Feeding Systems of Castings (3 ocr)

(Period) spring

Lecturer: Prof Juhani Orkas

Contents: Basic principles of running and feeding systems, pattern, running and feeding system design with CAD/CAM -techniques and computer simulations.

Requirements: Lecture notes and design exercise. No final examination.

Prerequisites: Kon-80.107, Kon-80.121.

Language: Finnish.

Kon-80.160 Castability of Metals (3 ocr)

Spring

Lecturer: Prof Juhani Orkas

Contents: Castability of different metals. Effects of composition, treatments of liquid metal and morphology of properties of a cast component.

Requirements: Completing the course: exercise and lecture notes.

Literature: Course material will be announced during lectures.

Prerequisites: Kon-80.107, Kon-67.104.

Language: Finnish.

Kon-80.201 Postgraduate Seminar on Foundry Engineering (1-3 ocr) P

Spring & autumn

Lecturer: Prof Juhani Orkas

Contents: Postgraduate course deals with specific subjects related to ongoing studies.

Language: Finnish.

Kul-24 NAVAL ARCHITECTURE

Prof: Petri Varsta, 451 3500

Prof: N.N.

Prof: Pentti Häkkinen, 451 3496

Prof: Jerzy Matusiak, 451 3480

<http://www.tkk.fi/Yksikot/Laiva/>

Courses credited in ECTS

Kul-24.3000 Introduction to Vehicle Engineering (3 cr)

Autumn

Lecturers: Prof Pentti Häkkinen, Prof Martti Larmi, Prof Matti Juhala and Prof Jaakko Hoffren

Contents: Transport flows, traffic planning and development potential. Prime movers and fuels in vehicles. Road and rail transport. Sea transport and ships. Air transport and airplanes. Security and ergonomic aspects. Total cost and environmental impact analysis. Visits to industrial plants and transport terminals.

Requirements: Examination.

Literature: Lecture notes, available in English.

Language: Finnish.

Courses credited in ocr

Kul-24.102 Foundations of Marine Hydrodynamics (4 ocr)

Spring

Lecturer: Prof Jerzy Matusiak

Contents: Ship's resistance. Propellers and propulsion of a ship. Interaction between hull, propeller and main engine. Introduction to ship's dynamics.

Requirements: Examination. Compulsory exercises (10h).

Literature: Lecture notes, Matusiak: Laivan propulsio (Propulsion of a Ship, in Finnish).

Language: Finnish.

Kul-24.103 Ship Stability (3 ocr)

Autumn

Lecturer: Prof Jerzy Matusiak

Contents: Hydrostatics. Stability of an intact and a damaged ship. Special features of the stability of fast ships. Rolling motion of a ship. Subdivision of a ship.

Requirements: Examination. Compulsory group exercise (20h). Compulsory exercises (10h).

Literature: Matusiak: Laivan kelluvuus ja vakavuus. (Buoyancy and Stability of a Ship, in Finnish).

Language: Finnish.

Kul-24.113 Computational Marine Hydrodynamics (4 ocr) P

Autumn

Lecturer: Prof Jerzy Matusiak

Contents: Potential flow models. Approximations of viscous flows. Turbulence modelling. Numerical methods in hydrodynamics. Ship's wavemaking and resistance.

Requirements: Examination. Compulsory exercises.

Literature: Lecture notes.

Prerequisites: Kul-24.102, Kul-24.103 (compulsory, passed).

Language: Finnish.

Kul-24.116 Ship Model Testing, exercises (2 ocr)

Autumn

Lecturer: Keijo Hanhiova M.Sc. (Tech.)

Contents: Ship model experiments in ship technology.

Requirements: Laboratory exercise (26 h).

Grade: Pass/Fail.

Prerequisites: Kul-24.102 (obligatory, accepted).

Language: Finnish.

Kul-24.117 Marine Hydrodynamics, advanced course (4 ocr) P
Spring

Lecturers: Kai Happonen, M.Sc. (Tech.) and Antonio Sanchez-Caja, Ph.D.

Contents: Hydrodynamics of lifting surfaces (lifting line and lifting surface theory, hydrofoil theory). Mathematical models of marine propeller flows. Ship manoeuvring.

Requirements: Examination. Compulsory personal literature survey or programming exercise (30h). Compulsory group exercise (20h). The group exercise consists of model experiments that verify numerical methods. Numerical calculations of ship hydrodynamics are also performed.

Literature: Lecture notes.

Prerequisites: Kul-24.102, Kul-24.103, Kul-24.113 (compulsory, passed).

Language: Finnish.

Kul-24.132 Ship-Wave Interaction (4 ocr) P

Autumn

Lecturer: Senior ass. Jussi Martio

Contents: Linear wave theory. Wave groups and the energy of waves. Wave loads. The motions of floating bodies in regular and irregular waves.

Requirements: Examination.

Literature: Lecture notes.

Prerequisites: Kul-34.115 or Mat-5.140 (compulsory, passed).

Language: English.

Kul-24.141 Small Craft Fluid Mechanics (2 ocr)

(Period) spring, odd years

Lecturer: Markku Hentinen M.Sc. (Tech.)

Contents: The foundations of the hydrodynamics of motorboats. The foundations of the hydro- and aerodynamics of sailboats.

Requirements: A compulsory personal literature survey that will be presented at a seminar. Examination.

Literature: Lecture notes.

Prerequisites: Kul-34.115 or Mat-5.140 (recommended).

Language: Finnish.

Kul-24.201 Principles of Naval Architecture (5 ocr)

Autumn

Lecturer: Prof Petri Varsta

Contents: Concepts in naval architecture. Hull form and associated hydrostatic calculations. Main dimensions and sectors of initial design. Ship safety and definitions, rules of authorities. Administration of a new vessel construction. Ship types and their special features.

Requirements: Intermediate examinations and examination, compulsory design exercise and exercises.

Literature: Lecture notes.

Prerequisites: Courses of the first part of the study programme (compulsory, passed).

Language: Finnish.

Kul-24.211 Ship Project (4 ocr)

Spring

Lecturers: Prof Petri Varsta and assistants

Contents: An extensive design assignment that is carried out in groups of two persons. The assignment contains definition of the main dimensions using a synthesis model, lines plan and associated calculations, design of general arrangement, hull structure, limited weight- and cost calculations. In the last phase of the assignment the lines plan and associated calculations can be carried out using a computer program (NAPA or comparable) that is considered as a partial completion of the course Kul-24.252. The result of the assignment is presented at a seminar.

Prerequisites: Kul-24.201 (compulsory, passed).

Language: Finnish.

Kul-24.215 Shipyard Engineering (5 ocr)

Autumn, spring

Lecturer: Johan Fransman, Lic.Sc. (Tech.)

Contents: The lectures cover the organisation of, and the methods for all phases of the shipbuilding process. Design, Material administration, Hull construction, and Outfitting. Production planning. Visit to a shipyard. Production plans for a ship project are prepared in the assignment.

Requirements: Examination. Assignment, which affects the final grade by 50%.

Literature: Räisänen (ed.): Laivatekniikka (Ship Technology), chapters 30-41 (in Finnish).

Prerequisites: Kul-24.201 (compulsory, passed).

Language: Finnish.

Kul-24.220 Ship Structural Design (4 ocr) P

Spring

Lecturer: Prof Petri Varsta

Contents: The basics of structural technology in ship's hull. Statistical analysis of loads. Calculation methods of the response of ship's hull. Application of element method. The failure modes of ship's hull structure and its modelling. The dimensioning of the main structural members and choice of materials. Visit to a structural design office.

Requirements: Intermediate examinations or examination, compulsory design exercise and exercises.

Literature: Lecture notes and Hughes: Ship Structural Design.

Prerequisites: Kul-24.201, Kul-49.121, Kul-24.261 (compulsory, passed), Kul-49.131 recommended.

Language: Finnish.

Kul-24.237 Merchant Shipping (2 ocr)

(Period) autumn

Lecturer: Ilkka Iittiläinen M.Sc. (Tech.), Master of Laws

Contents: Concept of merchant shipping, different types of cargo handling and logistics, the main principles of transport law and the economy of shipping companies. The course consists of 15 hours lectures and a merchant shipping exercise. During the presentation of the exercise, the students will act as opponents.

Requirements: Examination, seminar exercise, and participation in seminars.

Literature: To be announced during the lectures.

Language: Finnish.

Kul-24.240 Small Craft Design (2 ocr)

Spring, even years

Lecturer: Markku Hentinen, M.Sc. (Tech.)

Contents: Small craft types, their materials and loads. National and international rules. Resistance, propulsion and other characteristics of hull types. Sailboats. Excursion to a boatyard.

Requirements: Examination.

Literature: Lecture notes.

Language: Finnish.

Kul-24.245 Small Craft Design, exercise (2 ocr)

(Period) spring, even years

Lecturer: Markku Hentinen, M.Sc. (Tech.)

Contents: Construction exercise of either a motor- or a sailboat project. Alternatively an experimental or computational exercise. Exercise can be carried out independently or in a group.

Prerequisites: Kul-24.240 (compulsory, passed).

Language: Finnish.

Kul-24.252 CAD in Naval Architecture (3 ocr)

Spring & autumn

Lecturer: Assistants

Contents: A naval architectural design work with the NAPA and NAPA Steel software. The work can be associated with the courses Kul-24.211 ShipProject and Kul-24.215 Shipyard Engineering.

Requirements: Examination and exercise.

Literature: Lecture notes.

Prerequisites: Kul-24.201 (compulsory, passed).

Language: Finnish.

Kul-24.261 Introduction to Statistical Methods in Naval Architecture (3 ocr) P

Autumn

Lecturer: Pentti Kujala, Docent

Contents: Calculation of probabilities and statistical processes. Uncertainty factors in structural design. Calculation methods for reliability analysis. Application of reliability analysis in ship structural design. Partial safety factors. Reliability analysis and classification society rule formulations.

Requirements: Examination and compulsory exercises and design exercise.

Literature: Lecture notes and Thoft-Cristensen & Baker: Structural reliability and its applications.

Prerequisites: Mat-2.091 (obligatory, accepted).

Language: Finnish.

Kul-24.291 Postgraduate Seminar on Naval Architecture (2-5 ocr) P V

Autumn + spring when needed

Lecturer: Prof Petri Varsta

Contents: The licenciate seminar is aimed at postgraduate studies and researchers. The course concentrates on research problems, research methods and current matters in offshore technology and naval architecture.

Requirements: Sufficient participation, a seminar lecture and examination.

Language: Finnish.

Kul-24.300 Ship Machinery, basic course (4 ocr)

Autumn

Lecturer: Prof Pentti Häkkinen

Contents: What a naval architect should know about ship machinery items. How machinery plant is observed during ship design phases. Propulsion machinery. Machinery and ship auxiliary systems. HVAC. Noise and vibration control. Environmental emissions. Engine room production technology. Design project exercise focusing on machinery selection and system dimensioning. Excursion to ship engine room.

Requirements: Examination. Exercise affects the grade almost as much as the examination.

Literature: Lecture notes. Also available in English.

Language: Finnish.

Kul-24.305 Ship Propulsion Machinery (4 ocr) P

Spring

Lecturer: Prof Pentti Häkkinen

Contents: Propulsion machinery main components and system architecture. Selection criteria. Prime movers and power transmission systems. Shaft line dynamics. Manufacture, installation and operation of the main components. Exercise consists of propulsion shaftline torsional vibrations.

Requirements: Examination. Exercise affects the grade with weight 1/3.

Literature: Lecture notes.

Prerequisites: Kul-24.300 (recommended).

Language: Finnish.

Kul-24.310 Pipe Systems in Ships (3 ocr)

Autumn

Lecturer: Prof Pentti Häkkinen

Contents: Design and manufacturing of piping systems. Heavy fuel oil and its treatment. Thermal balance calculations. Heat recovery. Dimensioning of pipe system, material selection and corrosion. Technical and economic aspects in pipeline manufacturing and installation. Exercise comprises the dimensioning of one specified flow circuit.

Requirements: Examination. Exercise affects the grade with weight 1/3.

Literature: Lecture notes.

Prerequisites: Kul-24.300 (recommended).

Language: Finnish.

Kul-24.315 Electric Systems in Ships (2 ocr)

Spring, even years

Lecturer: Prof Pentti Häkkinen

Contents: Electric power net in ship. Power generation, distribution and consumers. The design and dimensioning of components and distribution system. Lighting. Emergency systems. Seminar study on a specified subject.

Requirements: Examination.

Literature: Lecture notes.

Prerequisites: Kul-24.300 (recommended).

Language: Finnish.

Kul-24.320 Ship Automation and Control Systems (2 ocr)

Spring, odd years

Lecturer: Prof Pentti Häkkinen

Contents: Automation in ship machinery and bridge operation including the related instrumentation, monitoring and actuation. Integrated systems. Expert (AI) and communication systems. Effect on ship safety and economics. Seminar study on a specified subject.

Requirements: Examination.

Literature: Lecture notes.

Prerequisites: Kul-24.300 (recommended).

Language: Finnish.

Kul-24.401 Mechanics of Ice Conditions (3 ocr) P

Autumn

Lecturers: N.N.

Contents: Structure and formation of ice and ice conditions. Thermodynamical and other properties of ice and ice features. Deformation and strength of ice features like multi-year ice, ice ridges and brash ice. Formation of ice cover. Development of navigation channels in ice. Statistical description of ice conditions. The ice observations and remote sensing techniques.

Requirements: Examination and group assignments.

Literature: Lecture notes.

Language: Finnish.

Kul-24.405 Winter Navigation (3 ocr) P

Spring

Lecturer: N.N.

Contents: Ice resistance of ships. Model and full-scale tests. Machinery, manoeuvrability, propulsion, propellers. Icebreaking vessels. Ice loads. Ice class rules. Icebreaker assistance modes. Economic calculations of winter navigation. An excursion to an operating icebreaker will be made.

Requirements: Examination.

Literature: Lecture notes.

Language: Finnish.

Kul-24.410 Arctic Offshore Structures (3 ocr) P

Autumn

Lecturer: N.N.

Contents: Exploitation of oil and gas in arctic areas. The main types of offshore structures and main design factors. Technical features of structures. Special requirements of arctic areas.

Requirements: Exercises and examination.

Literature: Lecture notes.

Language: Finnish.

Kul-24.414 Calculation of Ice Forces (4 ocr) P

Autumn

Lecturer: N.N.

Contents: The calculation of ice forces on ships. Determination of design ice forces starting from ice conditions and interaction scenarios. The simulation of the contact between a structure and ice. The interaction between a deformed ice cover and a structure.

Requirements: Examination and assignment.
Literature: Lecture notes.
Language: Finnish.

Kul-24.420 The Performance of a Ship and a Transportation Fleet in Ice (3 ocr) P

Spring
Lecturer: N.N.
Contents: The modelling of navigation in ice. The equipment to detect ice and assist ship navigation in ice. Transit simulation and its use in fleet analysis. The impact of ice in transport system design.
Requirements: Examination and design assignment.
Literature: Lecture notes.
Language: Finnish.

Kul-24.425 Laboratory Assignment in Ice Model Techniques (2 ocr)

Spring
Lecturer: Topi Leiviskä, M.Sc. (Tech.)
Contents: A group assignment about ship model tests in ice, two ice sheets per group and 2-3 students in a group.
Requirements: Laboratory assignment (26 h).
Language: Finnish.

Kul-34 AERONAUTICAL ENGINEERING

Prof. Olli Saarela, K 209, 451 3507
Prof. Jaakko Hoffren, K 210, 451 3520

Courses credited in ECTS

Kul-34.3100 Introduction to Fluid Mechanics (5 cr)

Spring
Lecturer: Tellervo Brandt, Lic.Sc. (Tech.)
Contents: Applications of Bernoulli equation, the linear momentum equation, potential flow, dimensional analysis, pipe flow. Course includes laboratory demonstrations.
Requirements: Two mid-term examinations.
Literature: Young, Munson and Okiishi: A brief introduction to fluid mechanics 3. edition.
Prerequisites: Mat-1.1310, Mat-1.1320 and Kul-49.1100.
Language: Finnish.

Courses credited in ocr

Kul-34.110 Aircraft Engines (5 ocr)

Autumn + spring (given every other year, will be lectured in 2006-2007).
Teacher: Prof Martti Larri
Contents: Fundamentals of aircraft power plants, design and performance. Their maintainability, reliability and requirements. Piston and jet engines.
Requirements: Examination and three project tasks.
Literature: Lecture notes and Cohen et al.: Gas Turbine Theory
Prerequisites: Ene-39.001, Kul-34.129.
Language: Finnish.

Kul-34.117 Experimental Fluid Mechanics (2 ocr)

(Period) spring (given every other year, will not be lectured in spring 2007).
Teacher: Mikko Korhonen, M.Sc. (Tech.)
Contents: Fundamentals of experimental fluid mechanics, windtunnels and windtunnel testing.
Requirements: Examination and three project tasks.
Literature: Barlow, Rae, Pope: Low Speed Wind Tunnel Testing.
Prerequisites: Kul-34.115 (obligatory), Kul-34.129, Kul-34.130 (attending lectures).
Language: Finnish.

Kul-34.124 Aeroplane Aerodynamics Applications (1 ocr)

Lecturer: prof. Jaakko Hoffren
Contents: Experimental/computational aerodynamic exercise related to course Kul-34.131.
Prerequisites: Kul-34.131 (attending lectures).
Language: Finnish.

Kul-34.125 Aeroplane Aerodynamics, extensive applications (3 ocr) P

Lecturer: Prof Jaakko Hoffren
Contents: Extensive experimental/computational aerodynamic exercise related to course Kul-34.131.
Prerequisites: Kul-34.131 (attending lectures).
Language: Finnish.

Kul-34.129 Gas Dynamics (1.5 ocr) P

Autumn (Period I)
Lecturers: Prof Jaakko Hoffren
Contents: Fundamentals of gas dynamics: continuity, energy and momentum equations. Flow in a duct and in a nozzle. Basics of two-dimensional flow. Shock waves. Small-disturbance theory.
Requirements: Examination.
Literature: Lecture notes (in Finnish), or sections of Liepmann & Roshko: Elements of Gas Dynamics.
Prerequisites: Kul-34.115, Ene-39.001, Mat-1.433 (all obligatory).
Language: Finnish.

Kul-34.130 Applications of Boundary-Layer Theory (1.5 ocr) P

Autumn (Period II)
Lecturer: Antti Hellsten, D.Sc. (Tech.)
Contents: The aim is to give an insight into viscous boundary-layer flow past streamlined bodies. The Navier-Stokes equations are revisited. Equations for 2-dimensional incompressible boundary-layer flow. The influence and modelling of turbulence. Transition from laminar to turbulent flow.
Requirements: Examination.
Literature: Lecture notes.
Prerequisites: Kul-34.115, Ene-39.031 (recommended).
Language: Finnish.

Kul-34.131 Aeroplane Aerodynamics (3 ocr) P

Spring
Lecturer: Prof Jaakko Hoffren
Contents: The aim is to describe theoretical and computational methods for determining of flow past aircraft and aerodynamics forces on aircraft. The topics are: aerofoil section and wing theory, aerodynamics of bodies and wing-body combinations, propeller theory.
Requirements: Three assignments and three intermediate examinations.
Literature: Lecture notes.
Prerequisites: Kul-34.129 (obligatory), Kul-34.130 (obligatory).
Language: Finnish.

Kul-34.132 Aircraft Systems and Maintenance (3 ocr)

Autumn + spring (given every other year, will be lectured in 2006-2007).
Lecturer: Pertti Heikkinen, M.Sc. (Tech.)
Contents: Common requirements for aircraft maintenance. Main systems in aeroplanes such as hydraulics and control systems etc. Aircraft fatigue and its prevention.
Requirements: Seminar presentation and examination.
Language: Finnish.

Kul-34.140 Aviation Electronics (3 ocr)

(Period) autumn + spring (given every other year, will not be lectured in 2006-2007).
Lecturers: Mikko Koskentalo, M.Sc. (Tech.), Heikki Härtsiä, M.Sc. (Tech.)

Contents: Common requirements for avionics systems. Electronic systems in aeroplanes, such as navigation, communication and flight control systems. Their maintainability, reliability and certification. Ground systems needed for flight navigation and landing.

Requirements: Seminar presentation and examination.

Literature: Lecture notes.

Language: Finnish.

Kul-34.142 Aviation Electronics, S (3.5 ocr)

(Period) autumn, spring (given every other year, will not be lectured in 2006-2007).

Lecturers: Mikko Koskentalo, M.Sc. (Tech.), Heikki Härtsiä, M.Sc. (Tech.)

Contents: Introduction to aeronautical engineering. Common requirements for avionics systems. Electronic systems in aeroplanes, such as navigation, communication and flight control systems. Their maintainability, reliability and certification. Ground systems needed for flight navigation and landing.

Requirements: Seminar presentation and examination.

Literature: Lecture notes.

Language: Finnish.

Kul-34.146 Flight Mechanics, extensive applications (3 ocr) P

Lecturer: Prof Jaakko Hoffren

Contents: Extensive application related to course Kul-34.147 or Kul-34.148.

Prerequisites: Kul-34.147 and Kul-34.148 (both attending lectures).

Language: Finnish.

Kul-34.147 Aeroplane Performance (2 ocr)

Autumn

Lecturer: prof. Jaakko Hoffren and Matti Rahikainen, M.Sc. (Tech.)

Contents: Aeroplane drag polar, optimal performance

Requirements: Examination and project work

Literature: Lecture notes.

Prerequisites: Kul-49.010 (obligatory), Kul-49.014 (obligatory).

Language: Finnish.

Kul-34.148 Aeroplane Stability and Control (3 ocr) P

Spring

Lecturer: Prof Jaakko Hoffren

Contents: Static stability and control, changes in the conditions for stable equilibria, changes in them and the associated control forces. In the dynamic section, the small-disturbance theory is derived, and the natural modes for an aircraft with fixed controls are studied. In addition, the basics of flight control systems and airworthiness regulations are briefly discussed.

Requirements: Examination and project work. Certain exercises are compulsory.

Literature: Roskam, J.: Airplane Flight Dynamics and Automatic Flight Controls, Part I.

Prerequisites: Tfy-3.161, Kul-49.010, Kul-49.014, Kul-34.147 (all obligatory).

Language: Finnish.

Kul-34.150 Lightweight Structures (4 ocr) P

Spring

Lecturer: Prof Olli Saarela

Contents: Shell theory. Stability of structures. Analyses of sandwich structures, joints and structural discontinuities. Design of lightweight structures.

Requirements: Lectures, exercises and examination.

Literature: Lecture notes.

Prerequisites: Kul-34.155, Kul-49.121 (obligatory), Mat-1.433.

Language: Finnish.

Kul-34.152 Lightweight Structures, application (3 ocr) P

Lecturer: Prof Olli Saarela

Contents: Design and/or analysis exercise focused on lightweight structures.

Requirements: Report and seminar.

Prerequisites: Kul-34.150 (attending lectures).

Language: Finnish.

Kul-34.155 Polymer Composites in Lightweight Structures (3 ocr)

Autumn

Lecturer: Prof Olli Saarela

Contents: Polymer composites in lightweight structures: materials, manufacturing techniques, mechanics of composite structures, applications.

Requirements: Lectures, exercises and examination

Literature: Saarela et al.: Komposiittirakenteet, Muoviyhdistys 2003, lecture notes.

Prerequisites: Kul-49.121 (obligatory), Mat-1.433.

Language: Finnish.

Kul-34.165 Aerodynamic Design of Aeroplanes (4 ocr) P

Autumn

Lecturers: Prof Jaakko Hoffren

Contents: The aim is to teach methods for determining the external shape of an aircraft. The selection of wing area, planform and location is discussed, and the sizing of tail surfaces and jet engine inlets are considered. The multidisciplinary design constraints are reviewed, and a number of sample cases are briefly studied.

Requirements: Examination and three project tasks.

Literature: Lecture notes and sections of Torenbeek: Synthesis of Subsonic Airplane Design.

Prerequisites: Kul-34.131, Kul-34.147, Kul-34.148 (all obligatory).

Language: Finnish.

Kul-34.175 Structural Design of Aeroplanes (4 ocr) P

Autumn + spring

Lecturer: Prof Olli Saarela

Contents: Conceptual design of aeroplanes, introduction to structural design, load analyses, materials and manufacturing techniques, design principles, analysis methods, design process.

Requirements: Lectures, exercises and two examinations.

Literature: Torenbeek: Synthesis of Subsonic Airplane Design, Niu: Airframe Structural Design, lecture notes.

Prerequisites: Kul-34.150, Kul-34.147, Kul-34.148, Kul-34.155 and Kon-67.113 (all obligatory).

Language: Finnish.

Kul-34.176 Structural Design of Aeroplanes, application (3 ocr) P

Lecturer: Prof Olli Saarela

Contents: Design and/or analysis exercise focused on aircraft structures.

Requirements: Report and seminar.

Prerequisites: Kul-34.175 at the same time.

Language: Finnish.

Kul-34.185 Aeroelasticity (1 ocr)

Spring

Lecturer: Prof Jaakko Hoffren

Contents: Aeroelastic phenomena and their analysis are introduced, including static aeroelasticity, fundamentals of unsteady aerodynamics, flutter and the determination of critical speed, implications of flutter for preliminary design, and dynamic response.

Requirements: Examination.

Literature: Lecture notes (in Finnish).

Prerequisites: Kul-34.131, Kul-34.175, Kul-49.170 (all obligatory).

Language: Finnish.

Kul-34.195 Spacecraft Structures (2 ocr)

(Period) autumn (given every other year, will be lectured in autumn 2006).

Lecturer: Timo Brander, M.Sc. (Tech.)

Contents: Introduction to spacecraft structures. Requirements: loads, environment, transportation etc. Design and verification. Design process. Applications.

Requirements: Lectures, exercises and examination.

Literature: Lecture notes.

Prerequisites: Kul-34.150 (obligatory).

Language: Finnish.

Kul-34.202 Postgraduate Seminar on Composite Structures (2-6 ocr) P V

Spring

Lecturer: Prof Olli Saarela

Contents: Specific topics on analysis/design of lightweight polymer composite structures (to be agreed in the beginning of the course).

Requirements: Report and seminars.

Language: Finnish.

Kul-34.211 Postgraduate Seminar on Aeronautical Engineering (2-6 ocr) P V

Spring

Lecturers: Prof Olli Saarela and Prof Jaakko Hoffren

Contents: Important research topics in the field of aerospace technology are reviewed. The topics are agreed in the beginning of the course. Seminar sessions with oral presentations, discussion and criticism are arranged.

Requirements: Written report and participation in seminar sessions, possibly an examination.

Language: Finnish.

Kul-34.221 Physics of Turbulence (2-4 ocr) P V

Spring

Lecturer: Antti Hellsten, D.Sc. (Tech.)

Contents: Fundamentals of turbulent flow. Turbulence modeling. (Contents vary.)

Requirements: To be announced.

Literature: Lecture notes.

Prerequisites: Kul-34.115 and Ene-39.031 or Kul-34.130.

Language: Finnish.

Kul-49 MECHANICS OF MATERIALS

Prof: Mauri Määttänen, Vehicle Engineering and Machine Design 212, 451 3440

Prof: Jukka Tuhkuri, Vehicle Engineering and Machine Design 211, 451 3450

Courses credited in ECTS**Kul-49.1100 Dynamics I (4 cr)**

Spring

Lecturer: Jouni Freund, senior lecturer

Contents: Basic course in particle and rigid body dynamics. After the course, a student (1) knows the usual concepts, material models, basic laws, constitutive equations and coordinate systems of mechanics, (2) knows how to determine position, velocity and acceleration in different coordinate systems and apply kinematical constraints, (3) is able to write the equations of motion of a particle, a system of particles, and a rigid body in plane motion, and solve for the unknown quantities in simple cases.

Requirements: Exercises, mid-term examinations or final examination.

Literature: To be announced later.

Additional: Replaces Kul-49.010 Dynamics I.

Prerequisites: Rak-54.1100 or corresponding course.

Language: Finnish.

Kul-49.2100 Mechanics of Materials IA (5 cr)

Spring

Lecturer: Prof Jukka Tuhkuri

Objectives: This course is for students who are going to study other courses of Mechanics of Materials.

Contents: Definition of fundamental concepts, stress, deformation, strain, and the relationships between them, strength, bending of beams, torsion. This introductory course is for student who are going to study also other courses of Mechanics of Materials.

Requirements: Exercises, mid-term examination or final examination.

Literature: Parnes: Solid Mechanics in Engineering, Wiley.

Additional: The course is for students who are going to study

Prerequisites: Rak-54.1100 or a corresponding course (obligatory).

Language: Finnish.

Kul-49.2200 Mechanics of Materials IB (5 cr)

Spring

Lecturer: Kari Santaoja, senior lecturer

Objectives: This course is for students who will not study other courses of Mechanics of Materials.

Contents: Definition of the fundamental concepts, beam bending, stress and strain states and the relationship between them, yield and fracture criteria, measurements by strain gauges, torsion of a circular shaft.

Requirements: Exercises, mid-term examination or final examination.

Literature: Kari Santaoja, lecture notes.

Additional: Replaces Kul-49.117.

Language: Finnish.

Kul-49.3100 Dynamics II (4 cr)

(Period) autumn

Lecturer: Jouni Freund, senior lecturer

Contents: The course is intended to supplement Kul-49.1100 Dynamics I on the following themes: three-dimensional motion of a rigid body, Lagrange's equations of motion. After the course,

a student (1) knows the coordinate systems, concepts and basic laws important in treatment of the three dimensional motion of a rigid body, (2) is able to write the equations of motion in terms of the Euler angles, (3) knows how to apply the Lagrange's formalism in writing the equations of motion.

Requirements: Exercises, examination.

Literature: To be announced later.

Prerequisites: Kul-49.1100 (obligatory)

Additional: Replaces Kul-49.014 Dynamics II

Language: Finnish.

Kul-49.3200 Mechanics of Materials II (5 cr)

Autumn

Lecturer: Prof Jukka Tuhkuri

Requirements: Exercises, mid-term examination or final examination.

Additional: Replaces Kul-49.121

Language: Finnish.

Kul-49.3300 Finite Element Method I (5 cr)

Spring

Lecturer: Prof Mauri Määttänen

Contents: To learn the theoretical background for reliable utilization of the finite element method.

Requirements: See the homepage of the course.

Prerequisites: Kul-49.3200 or corresponding courses.

Additional: Replaces Kul-49.131.

Language: Finnish.

Courses credited in ocr

Kul-49.144 Plate and Shell Theory; lectures and exercises (4 ocr) P

Spring, alternate years, will be lectured spring 2007.
Lecturer: Kari Santaoja, senior lecturer
Contents: The stresses and deformation of plates and shells. The classical theory approximate methods.
Requirements: See the requirements to pass the Mechanics of Materials courses. The course can also be held as a seminar.
Literature: K. Ikonen: Levy-, laatta- ja kuoriteoria, Otatieto 874, K. Girkmann: Flächentragwerke, S.P. Timoshenko & S. Woinowsky-Krieger: Theory of Plates and Shells.
Prerequisites: Kul-49.3200 or corresponding courses.
Language: Finnish.

Kul-49.145 Plate and Shell Theory; applications (2 ocr) P

(Period) autumn, alternate years, will be lectured autumn 2006.
Lecturer: Kari Santaoja, senior lecturer
Contents: Application project or laboratory work related to the course Kul-49.144. Can also be an application or a part of other project work in Mechanical Engineering Department courses.
Language: Finnish.

Kul-49.153 Finite Element Method; applications (2 ocr) P

Autumn:
Lecturer: Prof Mauri Määttänen
Contents: Application project related to courses Kul-49.3300/156. Can also be an application or a part of other project work in Mechanical Engineering Department courses.
Language: Finnish.

Kul-49.156 Finite Element Method, advanced course (4 ocr) P

Autumn, alternate years, will be lectured autumn 2006.
Lecturer: Prof Mauri Määttänen
Objectives: To learn the sufficient theoretical background for postgraduate studies and for developing Finite Element Method (FEM).
Contents: To expand the theoretical background and approaches of finite element method and to give base for postgraduate studies.
Requirements: See the homepage of the course.
Literature: Cook, Malkus & Plesha: Concepts and Applications of Finite Element Method. 3rd Edition, J Wiley 1989, and material distributed during the lectures.
Prerequisites: Kul-49.3300 or a corresponding course.
Language: Finnish.

Kul-49.162 Fracture Mechanics (4 ocr) P

Spring, alternate years, will be lectured spring 2007.
Lecturer: Prof Jukka Tuhkuri
Contents: Fracture mechanisms, effect of material properties, linear elastic fracture mechanics, nonlinear fracture mechanics, energy principles, numerical methods, crack growth, experimental methods, project work.
Requirements: Exercises, final examination.
Literature: Janssen, M., Zuideman, J. and Wanhill, R.J.H.: Fracture Mechanics, 2nd edition, Spon Press.
Prerequisites: Kul-49.3200 (obligatory) and Kul-49.3300 (recommended).
Language: Finnish.

Kul-49.170 Dynamics of Structures; lectures and exercises (4 ocr) P

Autumn
Lecturer: Jouni Freund, senior lecturer
Contents: Theory of mechanical vibrations, exact and approximate solutions for continuous systems, modal analysis, experimental determination of eigenmodes and -frequencies, project work.

Requirements: See the requirements to pass the Mechanics of Materials courses. The project work must be finished during the autumn term.

Literature: Inman: Engineering Vibration, 2nd edition, Prentice-Hall.

Prerequisites: Kul-49.1100 (obligatory) and Kul-49.3200 (obligatory).

Language: Finnish.

Kul-49.171 Dynamics of Structures; applications (2 ocr) P

Spring
Lecturer: Jouni Freund, senior lecturer
Contents: Project work related to the course Kul-49.170. Can also be avibration analysis part of other project work in the Department of Mechanical Engineering.
Language: Finnish.

Kul-49.180 Individual Assignments in Mechanics of Materials (2 ocr) P

Autumn & spring
Lecturers: Prof Mauri Määttänen, Prof Jukka Tuhkuri, Kari Santaoja, senior lecturer and Jouni Freund, senior lecturer
Contents: Application project on either theoretical or experimental research in the field of Mechanics of Materials. Can also be an application or a part of other project work in Mechanical Engineering Department courses, or an industry project.
Prerequisites: Courses of Mechanics of Materials relevant to the project.
Note: A student may make only two special assignments. For example, if the project is extensive enough to require both theoretical and experimental work, two reports are prepared and total credits will be 2+2=4 ocr.
Language: Finnish.

Kul-49.210 Ice Mechanics (3 ocr) P

Spring, alternate years, will not be lectured spring 2007.
Lecturer: Prof Mauri Määttänen
Objectives: To learn the physical background for ice mechanical behaviour in order to predict ice loads on structures and ice bearing capacity.
Contents: Physical structure of ice, ice formation, ice and snow mechanical properties, ice bearing capacity, ice loads on offshore structures, river ice jamming, and basic properties of snow.
Requirements: Attending lectures and exercises, and final examination.
Literature: J Kämäräinen: Studies in Ice Mechanics, HUT Laboratory for Mechanics of Materials Report 15, and material distributed during the lectures.
Prerequisites: Kul-49.3100 (obligatory), Kul-49.3200 (obligatory) and Kul-49.144 (recommended) or a corresponding course.
Language: Finnish.

Kul-49.220 Postgraduate Course in Mechanics of Materials (3/5 ocr) P V

Information later.
Lecturer: Prof Mauri Määttänen (responsible)
Contents: Course with varying content.
Requirements: Participation in seminars, own presentation, and examination.
Language: Finnish.

Kul-49.250 Thermomechanics and Material Modelling (3 ocr) P

Autumn, alternate years, will be lectured autumn 2006.
Lecturer: Kari Santaoja, senior lecturer
Contents: Thermomechanics of internal variables is studied in order that the student will be capable of testing material models. The local field equations are derived from the global basic laws of nature. These field equations are the foundation for mechanics of materials and for thermomechanics. The Levenberg-Marquardt method for determination of the values for the material

parameters is derived. The capability of this method is evaluated by examples. At the end of the course the implementation of material models into commercial finite element computer codes is studied by examples. After passing this course the student is familiar with the foundations of mechanics of materials, he/she can implement a material model in the ABAQUS finite element program and he/she can determine the values of the parameters for a material model.

Requirements: Examination and a voluntary assignment.

Literature: Lecture notes in English.

Prerequisites: Good knowledge of material mechanics, mechanics, structural mechanics or thermodynamics. The course material covers all the information needed to pass the course. Therefore a small amount of previous knowledge of the above-mentioned topics is adequate for passing this course with excellent marks.

Language: Finnish or English if needed.

Requirements to pass Mechanics of Materials courses

To obtain the right to take an examination the student has to obtain $1/3$ of the maximum number of the homework points. If the course has several intermediate examinations, the student has to obtain $1/3$ of the maximum number of homework points related to every individual examination. Having a right to take an examination allows the student to try to pass the examination or to obtain a higher mark. To obtain the right to take an intermediate examination the student has to pass his/her homework in the same year. The right to take an examination can be earned several times. To pass the course by intermediate examinations the student has to obtain $1/4$ of the maximum points in every individual intermediate examination. The course brochure given at the beginning of the course may give exceptions to the above rules. The limit to passing the course by an examination or by intermediate examinations varies.

DEPARTMENT OF SURVEYING

Head of department: prof. Kauko Viitanen, tel. 451 3870
 Planning Officer: Päivi Kauppinen, tel. 451 3686
 Department office: Otakaari 1, 02150 Espoo

<http://www.tkk.fi/Yksikot/Maanmittaus>

Chairs:

Maa-6 Geodesy
 Maa-20 Real Estate Studies
 Maa-29 Law
 Maa-57 Photogrammetry and Remote Sensings
 Maa-123 Cartography and Geoinformatics

Please pay attention to the language of the instruction

Courses credited in ECTS

Maa-0.1000 Surveying as a profession and a branch of science (1 cr)

Autumn (period I)
 Autumn (Period I)

Teachers: prof. Arvo Vitikainen and prof. Henrik Haggrén
 Contents: Overall picture of the labour market, duties and a branch of science for those graduating from the Degree Programmes in the Department of Surveying.
 Requirements: Lectures
 Language: Finnish

Courses credited in ocr

Maa-0.110 Studying techniques (1,0 ocr)

Spring

Teacher: Anniina Hukari

Contents: "Studying techniques as professional skills". Improving practical studying skills. Themes eq. Technical writing, Studying mathematics and physics, Reading techniques, Notes, Designing presentations and performing and Preparing for exams.

Requirements: Lectures and learning exercises
 Language: Finnish

Maa-6 GEODESY

Courses credited in ECTS

Prof: Martin Vermeer, tel. 451 3910, room M 309

Maa-6.1213 Introduction to geodesy (3 cr)

Autumn (Period I)

Teacher: prof. Martin Vermeer

Content: History of geodesy, figure of the earth and gravity, ellipsoid, reference systems, co-ordinates, "kkj" and map projections, heights; surveying, measurement units, measurement errors, principles of adjustment; Helmert transformation, datums, principal and inverse problems of geodesy; height systems, height measurement, levels, levelling methods, the geoid; theodolites, angle measurements, tachometers; distance measurement, reflectors, ray propagation in the atmosphere; control surveys,

polygons and their computation; mapping surveys, rectangular, tie-in and free stationing methods; setting-out measurements, engineering surveys, site and route surveys, transfer curves, volume calculation; guidelines and standards.

Requirements: Exam, computing and instrumental exercises as home and laboratory tasks; field exercises.

Literature: Kahmen & Faig, Surveying; material announced in lectures.

Language: Finnish.

Maa-6.1214 Modern geodesy (3 cr)

Spring (period I)

Teacher: prof. Martin Vermeer

Content: Fundamentals of 3-D reference systems; hyperbolic positioning systems and the GPS, GPS satellites, orbits, signals, receivers; pseudorange and carrier phase measurement, measurement geometry, differencing of observations, ambiguities and their resolution; processing GPS observations, relative positioning, differential and real time positioning; principles of the method of least squares, residuals, statistical testing, finding gross errors, reliability, planning of measurement networks; measuring gravity, gravity anomalies, gravimetric geoid; space geodesy, rotation and orbit of the earth, satellite orbits; the role of geodesy in geophysical research.

Requirements: Exam, computing and instrumental exercises as home and laboratory tasks.

Literature: material announced in lectures.

(Modern geodesy corresponds to the course Maa-6.211.)

Language: Finnish.

Maa-6.2227 Geodetic field work (4 cr)

10 days in spring. To be organized by agreement.

Teacher: Prof. Martin Vermeer

Contents: Measurement of local triangular, traverse and levelling networks levelling and/or GPS networks in a realistic setting.

Examination: Passing of the field exercises

Prerequisites: Maa-6.211 or Maa-6.213, Maa-6.222

Language: Finnish.

Maa 6.4279 Satellite positioning (4 cr)

Spring (periods III-IV)

Teacher: Markku Poutanen Ph.D

Content: Fundamentals of GPS position determination, understanding different co-ordinate frames and their effect on GPS measurements. Measurement modes, error sources of measurement, observation and computation.

Literature: Poutanen: GPS-paikanmääritys; furthermore relevant material to be announced during the lectures.

Prerequisites: Maa-6.203, Maa-6.222, Maa-6.227 (recommended)

Language: Finnish.

Courses credited in ocr

Maa-6.133 Surveying in Civil, Environmental and Rock Engineering (3 ocr)

Autumn (periods I-II), the course is organised during the academic year 2006-2007

Teacher: Pertti Heikkilä M.Sc.

Contents: Measurement methods, basics of error theory, tolerances, implementation examples of measuring, calculation and computer-based processing using GIS-software in measurement tasks in civil, environmental and rock engineering.

Examination: Exam and exercises

Literature: Tikka: Käytännön geodesia I; Tikka: Käytännön geodesia II, 1992, ss. 418-442; Tikka: Käytännön geodesia III, 1992, ss. 31-65; Kuparinen: Mittamiehen käsikirja; Salmenperä: Talonrakennuksen mittaukset; Martikainen, Santala: Rakennusmittaus; Vuorimiesyhdistys: Kaivos- ja louhintatekniikan käsikirja s. 727-741; Maanmittauslaitos / Paikkatietokeskus & TKK / maanmittaustekniikan laitos: Paikkatietotekniikan perusteet (<http://www.nls.fi/ptk/perusteet>); Lankinen, Martikainen, Santala: Maastomittauksen laskentakaavoja.

Language: Finnish.

Maa-6.203 Adjustment Calculus (3 ocr)

Autumn (period II)

Teacher: Ulla Kallio M.Sc.

Contents: Least squares adjustment techniques using observation equations, condition equations, combined adjustment, sequential adjustment, adjustment of free networks. General error theory, statistical analyses and tests, deformation analysis and applications.

Examination: Exam and exercise work

Literature: Mikhail: Observation and Least Squares; Cooper: Control Surveys in Civil Engineering or Alfred Leick: GPS Satellite Surveying, second edition; other material announced during the lectures.

Prerequisites: Mat-1.411, Mat-1.412, Mat-1.413, Mat-2.091

Language: Finnish.

Maa-6.222 General Geodesy (2 ocr)

Autumn (period II)

Teacher: Prof. Martin Vermeer

Content: Planning, measurement and computation of plane, vertical and spatial networks. 2D+1D and 3D approach. Building observation equations for least-squares network adjustment. Precision and precision classification of measurements. Statistical testing. Co-ordinate and reference systems, reference ellipsoid, datums and datum transformations. Computation and precision of GPS networks. The combined use and integration of heterogeneous measurements and networks. Calibration.

Examination: Exam and instrumental exercises, partly as home and laboratory work.

Prerequisites: Maa-6.211/214 or Maa-6.1213

Language: Finnish.

Maa-6.230 Geometrical Geodesy (2 ocr)

Autumn (period II)

Teacher: Jaakko Santala, Dr.Tech.

Contents: Spherical trigonometry, geodetic co-ordinate calculus in an ellipsoidal co-ordinate system, geodetic reference systems, transformations between systems and map projections.

Examination: Exam and exercise work

Literature: Hirvonen: Matemaattinen geodesia (partly); Torge: Geodesy, Richardus, Adler: Map projections, other material announced during the lectures

Language: Finnish.

Maa-6.241 Geodetic Instruments and Calibration (2.5 ocr)

Spring (period III)

Teacher: Jaakko Santala, Dr.Tech.

Contents: Modern geodetic instruments and information data acquisition equipment. A study of instruments for angle, distance, height difference measurements, their function, error sources and determination of instrumental errors.

Examination: Exam and exercise work

Literature: Geodesian laboratorion julkaisu 5:1979: Laboratorija kenttäkalibrointimenetelmistä mittaustekniikassa; Deumlich:

Instrumentenkunde der Vermessungstechnik (partly) or analogous translation: Surveying Instruments; Cooper: Modern Theodolites and Levels (partly); Burnside: Electromagnetic Distance Measurement (partly); other material announced during the lectures.

Prerequisites: Maa-6.203

Language: Finnish.

Maa-6.253 Advanced Geodesy A (2.5 ocr) P

Spring (period III)

Teacher: Jaakko Santala, Dr.Tech

Contents: To give further knowledge of plane and height data and reference systems, and to familiarize the students with satellite and inertial positioning, accurate levelling, trigonometric height determination and analysis of accuracy. Other current topics.

Examination: Agreed during the course

Literature: Torge: Geodesy, Leick: GPS Satellite Surveying; Vanicek: Geodesy, the Concepts; other material announced during the course.

Prerequisites: Maa-6.203, Maa-6.230, Maa-6.284

Language: Finnish.

Maa-6.254 Advanced Geodesy B (2.5 ocr) P

Spring (periods III-IV)

Teacher: Prof Martin Vermeer

Content: The objective is to provide a deeper knowledge of the processing of geodetic information, comprising methods for collecting, measuring, computing, analysing and modelling bodies of geodetic information. Additionally, topical issues in geodetic informatics will be treated. The course will be given in seminar format.

Examination: Agreed during the course

Literature: Announced during the course.

Prerequisites: Maa-6.203, Maa-6.230, Maa-6.284

Language: Finnish or English

Maa-6.260 Engineering Geodesy (2 ocr)

Autumn (periods I-II)

Teacher: Jaakko Santala, Dr.Tech.

Contents: Accurate length, angle and height difference measurements methods, mathematical analysis and standardisation of measurements. Setting out, checking and deformation measurements in civil engineering and industrial applications.

Examination: Exam and exercises

Literature: Salmenperä: Muodonmuutosmittaukset; Salmenperä: Talonrakennuksen mittaukset; Martikainen, Santala: Rakennusmittaus; other material announced during the lectures.

Prerequisites: Maa-6.203, Maa-6.241

Language: Finnish.

Maa-6.263 Engineering Geodesy in Building and Industrial Surveying (2 ocr) P

Autumn (periods I-II)

Teacher: Jaakko Santala, Dr. Tech.

Contents: Accurate length, angle and height difference measurement methods and their automation. Setting out, checking and deformation measurements in civil engineering and industrial applications.

Examination: Exam, exercises and report

Literature: Salmenperä: Muodonmuutosmittaukset; Salmenperä: Talonrakennuksen mittaukset; Martikainen, Santala: Rakennusmittaus; other material announced during the lectures.

Prerequisites: Maa-6.133

Language: Finnish.

Maa-6.271 Physical Geodesy (2 ocr)

Spring (periods III-IV)

Teacher: Jaakko Mäkinen, Lic.Phil.

Contents: Gravitational methods in geodesy, the inertial principle and instruments used in conjunction with these.

Examination: Exam and exercises

Literature: Hirvonen: Matemaattinen geodesia (partly); Torge: Geodesy (partly); Heiskanen-Moritz: Physical Geodesy (partly); Torge: Gravimetry (partly); Fargas-Jandl: Einführung in die Inertialvermessung; other material announced during the lectures.

Prerequisites: Maa-6.203

Language: Finnish.

Maa-6.272 Space Geodesy (2 ocr) P

Autumn (periods I-II), every second year, given in autumn 2006

Teacher: Markku Poutanen Ph.D

Content: Use of space geodetic techniques for creation and maintenance of co-ordinate frames. Fundamentals and geodetic applications of GPS, Galileo, satellite lasers, VLBI and satellite altimetry. Use of satellites in determining the Earth's gravity field and in geodynamics research. Application of the latest research results.

Examination: Exam and exercise task, which includes a visit to the Metsähovi research station and an essay on a given subject .

Literature: Text books / publications announced at the lectures. The latest material available on the Internet is to be used, especially in the exercise task.

Prerequisites: Maa-6.230

Language: Finnish.

Maa-6.280 GIS-GPS (2 ocr) P

Autumn (periods I-II)

Teacher: prof. Martin Vermeer

Contents: Use of GPS in conjunction with GIS: GPS in the production of geodata, measurement methods, equipment and application examples.

Examination: Exam and exercises

Literature: Announced during the lectures

Prerequisites: Maa-6.279 (compulsory for students of the option Surveying and Mapping Technology, recommended for others)

Language: Finnish.

Maa-6.282 Advanced Course in Adjustment Calculus (2ocr) P
Spring (periods III-IV), odd years, lectured during the academic year 2006-2007

Teacher: Prof. Martin Vermeer

Contents: Advanced methods and applications of adjustment calculus. Free network, datum, S-transformations and criterion matrices, similarity and affine transformations; determining the shape of an object and deformation analysis; industrial measurements and spatial intersection; adjustment in steps, stacking of normals, Helmert-Wolf; stochastic processes, time series, Kalman filter, least squares collocation, approximation, interpolation, finite elements, kriging; topical issues.

Examination: Exam and exercise work

Literature: Announced during the lectures.

Prerequisites: Maa-6.203

Language: Finnish.

Maa-6.283 Reference Systems (2 ocr) P

Autumn (periods I-II)

Teacher: N.N.

Contents: The course deals with geodetic reference systems: terrestrial coordinate systems, the geoid as height reference surface and different heights, ellipsoidal reference systems, normal gravity field, geodetic reference systems, coordinate systems of space geodetic positioning. Horizontal and vertical datums. Time systems and astronomical coordinate systems.

Examination: Exam and exercises or exercise work.

Literature: Torge: Geodesy; Vanicek: Geodesy, the concepts.

Prerequisites: Maa-6.230, Maa-6.284

Language: Finnish.

Maa-6.284 Map Projections (2 ocr)

Autumn (periods I-II)

Teacher: Jaakko Santala, Dr.Tech

Contents: Introduction. The shape of the Earth and reference surfaces, coordinate- and reference-systems on plane, on sphere and on ellipsoid, Earth ellipsoid and its geometry, general theory of projections, map projections and their classification, the most common projections and the research concerning projections.

Examination: exam and exercises or exercise report

Literature: Pearson: Map Projections. Bugayevskiy, Snyder: Map Projections - A Reference Manual. Material announced during the lectures.

Language: Finnish.

Maa-6.285 Navigation Methods (2 ocr) P

Autumn (periods I-II), odd years, not lectured in the academic year 2006-2007

Teacher: Prof. Martin Vermeer

Content: Fundamentals of navigation. Stochastic processes, Kalman filter, inertial navigation and mechanisation, the real time concept, GPS navigation, on-the-fly ambiguity resolution, use of GPS reference stations, their data communications solutions and standards; navigation and geographic information systems; topical issues.

Examination: Exam and exercises / an exercise task.

Literature: Material distributed during lectures.

Language: Finnish.

Maa-6.290 Geodesy Special Thesis (5 ocr)

Teacher: Prof. Martin Vermeer

Language: Finnish, Swedish or English.

Maa-6.299 Geodesy Postgraduate Seminar (1-4 ocr) P,V

Autumn (periods I-II)

Teacher: Prof. Martin Vermeer

Content: Varying, topical issues within the geodetic discipline.

Pre-graduate students may participate under certain conditions.

Language: Finnish, Swedish or English.

Maa-20 REAL ESTATE STUDIES

Courses credited in ECTS

Prof. Kauko Viitanen, tel. 451 3870, room M 105

Prof. Kari I. Leväinen, tel. 451 3882, room M 325

Prof. Arvo Vitikainen, tel. 451 3872, room M 103

Maa-20.1122 Principles of Cadastral Surveys (3 cr)

Spring (periods II-IV)

Teachers: Prof. Arvo Vitikainen

Contents: Overall picture of the different kinds of cadastral systems. Land subdivision as a transaction, the contents and process. Overall picture of other transactions and the geographical information system for real estates (JAKO). Utilising records in surveying. Exercises: Subdivision of a building site.

Requirements: Examination and exercises. Exercises must be passed before taking the examination.

Literature: Announced at the lectures.

Language: Finnish.

Maa-20.1123 Introduction to Real Estate Valuation (3 cr)

Spring (period II)

Teachers: Prof. Kauko Viitanen

Contents: Overall picture of principles and functions of the real estate valuation. Valuation situations, valuation objects and valuation methods.

Requirements: Examination.

Literature: Announced at the lectures

Language: Finnish.

Maa-20.1124 Introduction to Real Estate Management (3 cr)

Autumn (period I)

Teachers: Prof. Kari I. Leväinen, teaching research scientist Anna-Liisa Lindholm, lecturer N.N

Contents: Principles of real estate management. Economic acquisition, possession, occupancy, management and disposal of real estate. Introduction to property management, facilities management and property investments.

Requirements: Examination

Literature: Material announced during the lectures and on the homepage.

(Additional: Replace the courses Maa-20.124 Introduction to Real Estate Management (2 ocr).)

Language: Finnish

Maa-20.2200 Agriculture and Forestry (2 cr)

Spring (period III)

Teachers: Simo Hannelius, M.For.

Contents: The importance of agriculture and forestry to the national economy. Structure of Finnish agriculture and its development. National objectives set for agriculture, guidance and management. The Finnish forest resources and their utilisation. Objectives and means of the national forest policy. Organisations of the forest branch and their operations. Forest taxation.

Requirements: Examination.

Literature: Statutes and literature announced at the lectures.

(Additional: Replaces the course Maa-20.200 Agriculture and Forestry (2 ocr).)

Language: Finnish.

Maa-20.2315 Advanced Cadastral Surveys (5 cr)

Autumn (periods I-II)

Teacher: Prof. Arvo Vitikainen.

Contents: Land registration and cadastral system. Land division transactions and planning. Tasks of the real estate engineer in a municipality. Utilisation of the geographical information system for real estates (JAKO) in transactions and information service tasks. Exercises: information searches and land subdivision using the JAKO.

Requirements: Examination, exercises, excursion. The exercises must be passed before taking the examination.

Literature: Announced at the lectures.

(Additional: Replaces the course Maa-20.315 Advanced Cadastral Surveys (3 ocr).)

Prerequisites: Maa-20.122.

Language: Finnish

Maa-20.2366 Real Estate Economics and Property Management (5 cr)

Autumn (period II)

Teachers: Mikko Elosuo, Lic.Tech., M.A. and Esko Larkas, MSc

Contents: Advanced studies on Real Estate Economics and Property Management. Real estate economics, property management, asset management, investment management, real estate development, real estate portfolio management and operational real estate management.

Requirements: Examination

Literature: Material announced during the lectures and on the homepage.

(Additional: Replaces the course Maa-20.366 Real Estate Economics and Property Management (3 ocr).)

Prerequisites: Maa-20.124

Language: Finnish

Maa-20.3302 Science of Real Estate Economics (3 cr)

Spring (period III)

Teachers: Prof. Kauko Viitanen

Contents: Price and market theories, land use and location theories, land policy, real estate market basics of real estate investment, concepts in real estate economics.

Requirements: Examination.

Literature: Announced at the lectures.

Prerequisites: Maa-20.121

(Additional: Replaces the course Maa-20.302 Science of Real Estate Economics (2 ocr).)

Language: Finnish.

Maa-20.3312 Land Use Planning and Urban Economics (5 cr)

Spring (period III)

Teacher: Pekka Lahti.

Contents: The role of urban economics in land use planning. Urban economic analysis as a part of compulsory impact assessment procedure required by the current land use and building law (MRL). Other voluntary urban economic impact assessments. National, local and private economies. Focus on municipal and city-region levels especially on general plan level. Economy in relation to other aims of sustainable development (ecological and

social sustainability), to competitiveness and other development activities (including land policy) and qualitative aims (good environment) on municipal level. Urban and regional form and their change. Urban sprawl, its sources and consequences. Low and dense urban form. Knowledge base, methods and tools for analyses.

Requirements: Examination.

Literature: Announced at the lectures.

Prerequisites: Maa-0.1000, Maa-20.1122, A-36.1150 ja Maa-29.321.

Language: Finnish.

Maa-20.3316 Detail Planning (3-5 cr)

Spring (period III)

Teacher: Jouko Riipinen.

Contents: Practical principles of detailed planning. Local detailed plans, planning of municipal centre, traffic and municipal technology, plan documents.

Requirements: Exercise and examination.

Literature: Announced at the lectures.

(Additional: Replaces the course Maa-20.316 Detail Planning (2-3 ocr).)

Prerequisites: A-36.1150 and Maa-29.321

Language: Finnish.

Maa-20.3317 Urban Planning and Development (4 cr) P

Spring (period IV), lectured, if necessary (at least 10 participants)

Teachers: Malgorzata Mierzejewska and Saija Ettanen

Contents: The system of urban development and planning. Interaction between local planning policies and actor's strategies. Economic base theory. Theoretical case study in a role game.

Requirements: Pre-examination and seminar.

Literature: Announced at the lectures.

(Additional: Replaces the course Maa-20.317 Urban Planning and Development (3 ocr).)

Prerequisites: Maa-20.312 and Maa-20.316 or corresponding knowledge.

Language: English.

Maa-20.3330 Calculation Methods of Real Estate Economics (4 cr)

Autumn (period I)

Teachers: teaching research scientist Ari Hiltunen

Contents: Econometric study: theory and requirements set for the observation material. Calculation of multi-variant land price model and its valuation. Land price indexes. Cash-Flow analysis. Profitability calculation. Neural calculation.

Requirements: Exercises and examination.

Literature: Announced at the lectures.

(Additional: Replaces the course Maa-20.330 Calculation Methods of Real Estate Economics (3 ocr).)

Prerequisites: Mat-2.104/Mat-2.2104 and Maa-20.302.

Language: Finnish.

Maa-20.3341 Real Estate Investment Analysis (4-8 cr), P

Autumn (period II)

Teachers: Prof. Kauko Viitanen, lecturers
 Contents: Real estate investment, its aims and contents. Real estate market. Alternative investment forms. Real estates in an investment portfolio. Value chains of real estate investment. Real estate financing. Real estate taxation. Lifecycle of real estates.
 Requirements: Seminar and/or exercises and examination.
 (Additional: Replaces the course Maa-20.341 Real Estate Investment (5 ocr).)
 Language: English

Maa-20.3342 Analysis of Real Estate Assets (4 cr), P
 Spring (period IV), seminar
 Teachers: Prof. Kauko Viitanen, lecturers
 Contents: Real estate investment. Property portfolio appraisal. Valuation of real estate investment companies and funds. Indirect real estate investment vehicles. Portfolio analysis.
 Requirements: Exercises, seminar and examination.
 Literature: Announced at the lectures.
 (Additional: Replaces the course Maa-20.342 Investment Analysis and Appraisal (3 ocr).)
 Prerequisites: Maa-20.3341.
 Language: English.

Maa-20.3365 Corporate Real Estate Management (7-8 cr)
 Spring (period IV)
 Teachers: Prof. Kari I. Leväinen, teaching research scientist Anna-Liisa Lindholm, lecturer N.N.
 Contents: The course introduces real estate management as a strategic support function of an organisation. Main topics are real estate strategy as a part of an organisation wide core strategy, added value of corporate real estate management and corporate real estate management in different kinds of business environments.
 Requirements: Preliminary examination, exercises and examination.
 Literature: Material announced during the lectures and on the homepage.
 (Additional: Replaces the course Corporate Real Estate Management (4 ocr).)
 Prerequisites: Maa-20.124
 Language: English

Maa-20.3367 Facility Management (6 cr) P
 Autumn (periods I-II)
 Teachers: Prof. Brian Atkin, prof. Kari I. Leväinen, teaching research scientist Anna-Liisa Lindholm
 Contents: The aim of the course is to provide a sound grounding in the principles and practice of facility management, and insights into the future creation and operation of built assets. Topics include scope and definitions of FM, FM strategy and the outsourcing decision, managing outsourced and in-house services, specifying services and supplies, selecting services providers, managing performance, and partnerships and long-term projects.
 Requirements: Lectures, on-line sessions, assignment
 Literature: Material announced during the lectures and on the homepage.
 (Additional: Replaces the course Maa-20.367 Facilities Management (4 ocr).)
 Prerequisites: Maa-20.124
 Language: English

Maa-20.3375 International Land Management (6 cr) P
 Autumn (periods I-II), every second year, lectured in 2007
 Teachers: prof. Erik Stubkjaer
 Contents: Basic concepts and regulatory system in Western countries, developing countries and countries in transition. Property division, executory proceedings. The function of real estate registers. The importance of public registers. Legal safeguards. International comparison of systems.

Requirements: Lectures, seminar presentation, examination, mandatory attendance at seminar sessions.
 Literature: Announced at the lectures.
 (Additional: Replaces the course Maa-20.375 International Land Management (3 ocr).)
 Language: English.

Maa-20.3378 Real Estate Management, special topics (4 cr) P, V
 Autumn (periods I-II)
 Teacher: teaching research scientist, PhD Paul Dettwiler
 Contents: Varies. In the academic year 2006-2007 contents are: Topical issues in real estate management. Dynamic of corporate real estate, national and international perspective of real estate management. Global comparisons, knowledge management, business cycles, ownership or leasehold of company spaces.
 Examination: exercises, seminar
 Prerequisites: No
 Language: English

Maa-20.4620 Postgraduate Education in Real Estate and Facilities Management (1-10 cr) P, V
 Teachers: Prof. Kari I. Leväinen, Prof. Kauko Viitanen and Prof. Arvo Vitikainen
 Contents: Postgraduate studies. Main objective is to develop real estate branch postgraduate education together with other universities. Topical issues in real estate branch. Seminars, researcher meetings, presentations.
 (Additional: Replaces the course Maa-20.620 Postgraduate Education in Real Estate and Facilities Management (1-10 ocr).)
 Language: Finnish or English

Maa-20.4630 Real Estate Development (4 cr) P
 Spring (period III)
 Teachers: Malgorzata Mierzejewska
 Contents: Theory of development process. Different methods of developing building land in Europe. The incidence of costs and gains in different types of land development process. Primary services, secondary services, development gain. Traditions of spatial planning in Europe. Instruments to express spatial planning policy: plans and plan implementation tools. Connection between planning and plan implementation. Development control system and property rights.
 Requirements: Lectures, seminar presentation, examination, mandatory attendance at seminar sessions.
 Language: English

Courses credited in ocr

Maa-20.310 Real Estate Studies, Field Studies (1 ocr)
 Spring, not lectured during the academic year 2006-2007
 Teachers: Prof. Kauko Viitanen, Prof. Kari I. Leväinen, Prof. Arvo Vitikainen
 Contents: Field studies in various real estate economic, valuation and planning issues.
 Requirements: Passed participation.
 Language: Finnish.

Maa-20.331 Valuation of Compensation (2 ocr)
 Spring (periods III-IV)
 Teachers: Prof. Kauko Viitanen.
 Contents: Theoretical fundamentals. Principles for compensation enacted by various laws. Compensations in different compensation and expropriation situations.
 Requirements: Exercises and examination.
 Literature: Announced at the lectures.
 Prerequisites: Maa-20.1123
 Language: Finnish.

Maa-20.332 Valuation of Built-up Real Estate (3 ocr)
 Spring (period III)

Teachers: teaching research scientist Ari Hiltunen
 Contents: Principles of the valuation of plots and buildings. Valuation grounds of different plots. Concepts related to valuation of buildings. Built-up real estate as a subject of valuation, from one-family house to a business and industrial building. Valuation for lending purposes, insurance valuation, and property assessment.

Requirements: Exercises and examination.

Literature: Announced at the lectures.

Prerequisites: Maa-20.1123. Rak-43.200 recommended.

Language: Finnish.

Maa-20.333 Special Topics of Real Estate Valuation (5 ocr) P
 Autumn (period II)

Teachers: Prof. Kauko Viitanen.

Contents: Valuation of certain special areas, such as waters, rapids and soil excavation. Valuation of business properties, cash flow and sensitivity analysis in real estate valuation, valuation standards, correction for total value, statement of appraisal, ethics in valuation, real estate valuation and European integration, valuation as an occupation, authorisation and certification, international valuation organisations. Exercise work in the form of case study. Seminar treating valuation problems through foreign literature. Excursions to public establishments and private enterprises.

Requirements: Exercises, seminars, excursions and examination. Mandatory attendance at 75 % of the seminar sessions and two excursions.

Literature: Announced at the lectures.

Prerequisites: Maa-20.1123 and Maa-20.3332.

Language: Finnish.

Maa-20.334 Environmental Impact Assessment (2 ocr)

Spring (period III)

Teachers: Prof. Kauko Viitanen

Contents: Environmental impact assessment of extensive environmental projects, such as areas of soil excavation, motorways, ports, high-voltage power transmission lines. Evaluation processes according to the Act on Environmental Impact Assessment Procedure and Environmental Damage Insurance Act. Environmental impact assessment related to planning. Environmental impact assessment and the social consequences. Evaluation of benefits and affections.

Requirements: Examination and exercises.

Literature: Announced at the lectures.

Language: Finnish.

Maa-20.335 Forest Valuation (3 ocr)

Spring (period IV), every second year, lectures in spring term 2005.

Teacher: Simo Hannelius, M.For.

Contents: Methods of forest valuation. Acquisition of necessary information, its utilisation in the calculations and valuation of the current price.

Requirements: Examination, exercises, demonstration and excursion.

Literature: Announced at the lectures.

Prerequisites: Maa-20.200 or Maa-20.2200.

Language: Finnish.

Maa-20.340 Real Estate Market Analysis (3 ocr)

Autumn (period I)

Teachers: Prof. Kauko Viitanen

Contents: Market and competition status of real estates. Rating. Market analysis. Market analysis in real estate valuation.

Requirements: Exercises and examination.

Literature: Announced at the lectures.

Prerequisites: Maa-20.3302.

Language: Finnish.

Maa-20.368 Real Estate Entrepreneurship (3 ocr)

Spring (period III)

Teacher: teaching research scientist, PhD Paul Dettwiler

Contents: Introduces to entrepreneurship. The contents will vary each year. In the academic year 2006-2007 contents are: Growth firms, incubators and global development, internal and external influences, relation to location; single sites and multiple sites.

Requirements: Preliminary examination, exercises, seminar, learning diary.

Literature: Material announced during the lectures and on the homepage.

Prerequisites: Maa-20.124

Language: English.

Maa-20.369 Seminar on Real Estate Management (3 ocr)

Spring (periods III-IV)

Teacher: Prof. Kari I. Leväinen

Contents: Issues in real estate and facilities management are treated at the seminar based on foreign and Finnish literature and particular cases. Mandatory attendance in 80 % of the seminar sessions.

Requirements: Seminar presentation, acting as an opponent and participation.

Prerequisites: Maa-20.124 pr Maa-20.1124

Language: Finnish.

Maa-20.371 Real Estate Planning and Land Consolidation (2 ocr) P

Autumn (periods I-II), every second year, will be lecture during the academic year 2006-2007

Teachers: Prof. Arvo Vitikainen, N.N., lecturer

Contents: Measures that improve the division of real property and contribute to the realisation of land use plans: land consolidations and the required reports, urban land consolidation, inventories, planning of real estate network, exploration of the impacts on society and the community, private and environmental impacts, planning methods, utilisation of geographical information systems in project planning and realisation, corresponding activities in foreign countries.

Requirements: Lectures, exercises and examination.

Literature: Announced at the lectures.

Prerequisites: Maa-20.315 or maa-20.2315.

Language: Finnish.

Maa-20.374 Practical Training in Cadastral Surveying (1 ocr)

Autumn & spring

Teacher: Prof. Arvo Vitikainen

Contents: The aim of this study module is to familiarise the student with the practice of real estate surveys. Attendance (25 h) at official real estate surveys and sessions of the Land Court.

Requirements: The student shall present a certificate under-signed by a supervisory engineer, a real estate engineer or a Land Court judge that he/she has attended the required number of meetings and sessions (25 h), and write up a report on the most important matters treated. The required 25 h shall include at least 3 h of Land Court sessions, at least 3 h of plot divisions and divisions of public areas, and 10 h of other surveys. In addition to plots and public areas, the real estate surveys shall include at least three other types of surveys. Surveys in towns shall include surveys of public areas.

Language: Finnish.

Maa-20.376 Cadastral Surveys and Land Management (4 ocr)

Spring (periods III-IV)

Teacher: Prof. Arvo Vitikainen

Contents: Exacting real estate surveys involving judicial and real property duties. Utilisation of the JAKO geographical information system for real estates at proceedings and registration. Exercise works: demarcation and land division.

Requirements: Examination, exercise work, excursion. The exercises must be passed before taking the examination.

Literature: Announced at the lectures.

Prerequisites: Maa-20.315 or Maa-20.2315.

Language: Finnish.

Maa-20.377 Expropriation and Road Surveys (5 ocr)

Autumn + spring

Teacher: Prof. Arvo Vitikainen

Contents: Road surveys according to the legislation. Various expropriation proceedings and real estate surveys according to special statutes. The related judicial and real property duties. The special issues related to real estate surveys and the land registration and cadastral system will be treated at the seminars. Exercises: private road survey, public road survey and expropriation proceedings.

Requirements: Examination, seminar, exercise work and excursion. The seminar and the exercises must be passed before taking the examination. Mandatory attendance in $\frac{3}{4}$ of the seminar sessions. Announced at the lectures.

Prerequisites: Maa-20.315 or Maa-20.2315.

Language: Finnish

Maa-20.400 Real Estate Studies, Special Assignment (5 ocr) V

Autumn (II) + spring (IV)

Teachers: Prof. Kauko Viitanen, Prof. Kari I. Leväinen, Prof. Arvo Vitikainen

Contents: An essay individually agreed upon with the professor and seminar.

Language: Finnish.

Maa-20.500 Postgraduate Seminar on Real Estate Studies (1-4 ocr) P, V

Autumn + spring

Teachers: Prof. Kauko Viitanen

Contents: Real estate investment and value determination. Real estate market and real estate equity in the national economy. Real estate branch and the equity market. Prospects of the real estate branch.

Language: Finnish.

Maa-20.511 Postgraduate Seminar on Real Estate Management (1-10 ocr) P, V

Autumn + spring

Teacher: Prof. Kari I. Leväinen

Contents: Topical issues in real estate management.

Language: Finnish.

Maa-29 LAW

Courses credited in ECTS

Prof. Ari Ekroos, tel. 451 3860, room M132

Maa-29.1301 Elementary Law (2 cr)

Autumn (periods I-II)

Lecturer: Pekka Kolppanen, specialist teacher

Contents: A basic overview of legal thinking and judicial regulation, basis for other law courses.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Language: Finnish.

Maa-29.1311 Real Estate Law (3-6 cr)

Spring (period IV)

Lecturer: Erja Werdi, lecturer

Contents: Introduction to the legal basis of real estate management, purchase of a real estate and other legal relationships concerning real estates.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.1301 (recommended)

Maa-29.1321 Planning and Building Law (3-6 cr) P

Autumn (period I)

Lecturer: Prof. Ari Ekroos

Contents: Basics in planning and building law. Regulations, basic information on planning, land policy, restrictions in land use, permission system and conservation of the build environment etc. Voluntary exercises.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.311 (recommended)

Language: Finnish.

Maa-29.1330 Introduction to Environmental Law (2-3 cr)

Spring (period IV)

Lecturer: Prof. Ari Ekroos or Erja Werdi, lecturer

Contents: Giving a general view of the structure, main concepts, principles, goals and legislation in environmental law. Environmental aspects in land use planning, nature conservation, use of natural resources and legislation concerning environmental protection.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Language: Finnish (lectures) and English.

Maa-29.2312 Law of Surveying and Conveyance (3-6 cr)

Spring (periods III-IV)

Lecturer: Jari Salila, specialist teacher

Contents: Legal conditions of real estate proceedings concerning e.g. the status of a party, land register system and community planning.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.311 (compulsory)

Language: Finnish.

Maa-29.2323 Law of Construction and Real Estate Contracts (3-6 cr)

Spring

Lecturer: Prof. Ari Ekroos, several specialist teachers

Contents: Special contractual and other legal problems related to facility management, selling and renting real estate, real estate investment and contracts on building and land use.

Requirements: Examination

Literature: Announced on the homepage and bulletin board.

Language: Finnish.

Maa-29.2351 Principles of Law on Contracts and Obligations (3-6 cr)

Autumn (period I)

Lecturer: Antti Palmujoki, specialist teacher

Contents: Legal basis of contracts, obligations, companies, marketing and consumer protection etc.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.301 (recommended)

Language: Finnish.

Maa-29.2373 Public Law (3-6 cr)

Spring (period IV)

Lecturer: Erja Werdi, lecturer

Contents: General view of state and community administration, tasks of different sections, individuals' legal protection and civil servants' liability.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.301 (recommended)

Language: Finnish.

Maa-29.3313 Seminar on Real Estate, Land Use Planning and Environmental Law (5 cr)

Spring (periods III-IV)

Lecturer: Prof. Ari Ekroos

Contents: Special topics in real estate, planning, environmental and nature conservation law. Course includes topics like land acquisition, real estate proceedings, planning, environmental impacts, redemption, indemnification, use of natural resources and other rights of use related to real estates.

Requirements: Seminar presentation, acting as an opponent and participation in the seminar.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.311 or Maa-29.331 (recommended)

Language: Finnish.

Maa-29.3322 Land Use Planning and Environmental Law, practical course (3 cr)

Spring (period III)

Lecturer: Prof Ari Ekroos or Matti Laihonen, lecturer

Contents: To get acquainted with legal practice and its adaption in land use and environmental protection. Different interests of the students will be taken into account when choosing topics for the exercise.

Requirements: Writing an exercise and active participation in the exercises.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.321, Maa-29.331 and Maa-29.322 (recommended)

Language: Finnish.

Maa-29.3332 Environmental Protection Law (3-6 cr), P

Autumn (period II)

Lecturer: Prof Ari Ekroos or Mika Seppälä, lecturer

Contents: Environmental legislation. Air and water protection, waste treatment, noise protection, environmental hygiene and chemicals, environmental permissions and indemnification system for environmental damage. Voluntary exercises.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.331 (recommended)

Language: Finnish.

Maa-29.3333 Nature Conservation Law (3-6 cr P)

Autumn (period I)

Lecturer: Erja Werdi, lecturer

Contents: Legal basis of protecting nature, landscape and cultural environment. Getting acquainted with legislation concerning nature conservation, land extraction, building conservation and outdoor activities and recreation, forestry and fishing.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.311 (recommended)

Language: Finnish.

Maa-29.3334 Water Resources Law (3-6 cr)

Spring (period IV)

Lecturer: Prof Ari Ekroos, Tuire Taina, lecturer

Contents: Basic legalisation concerning water, the ownership of water areas, use of water and water resources engineering for students from different departments.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.331 (recommended)

Language: Finnish.

Maa-29.3335 Environmental Liabilities of Companies (3-6 cr)

Spring (period IV)

Lecturer: Sanna Suvanto, specialist teacher

Contents: Environmental liabilities of companies such as the responsibility for environmental damage, environmental

offences and restoration of soil and voluntary activities concerning environmental protection.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.331 and Maa-29.332 (recommended)

Language: Finnish.

Maa-29.3336 Environmental Economic Law (3-6 cr)

Spring (period III)

Lecturer: Prof Ari Ekroos

Contents: Literature examination, possible lectures are announced later. To get acquainted with environmental economic law, which includes e.g. environmental taxes and subsidies and the trade in emission permits.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.332 and Maa-29.335 (recommended)

Language: Finnish (lectures) and English.

Maa-29.3338 Environmental Law, special topics (2-6 cr) V

Spring (periods III-IV)

Lecturer: Prof Ari Ekroos

Contents: Current topics in environmental law. Lectures are held if needed. More information on the home page and bulletin board.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Language: Finnish.

Maa-29.3341 International Environmental Law (3-6 cr) P

Spring (periods III-IV)

Lecturer: Prof Ari Ekroos or Erja werdi, lecturer

Contents: To get acquainted with the main sources, principles and parts of international environmental law.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.331 (recommended)

Language: Finnish (lectures) and English.

Maa-29.3342 EU Environmental Law (3-6 cr) P

Spring (period III)

Lecturer: Prof Ari Ekroos or Erja Werdi, lecturer

Contents: To get acquainted with the legislation and principles of EU environmental law.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.343 (recommended)

Language: Finnish (lectures) and English.

Maa-29.3345 Introduction to the EU Law (3-6 cr)

Autumn (period I)

Lecturer: Jaana Junnila, lecturer

Contents: EU organs, main principles of action, jurisdiction, decision types and procedures, relations between EU and national legislation. Special topics in one sector of EU legislation (changes every year).

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.301 (recommended)

Language: Finnish (lectures) and English.

Maa-29.3352 Law on Contracts (3-6 cr) P

Autumn (periods I-II)

Lecturer: N.N., specialist teacher

Contents: Literature examination, possible lectures announced later. To get acquainted with the law of contracts.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.351 (recommended)

Language: Finnish (lectures) and English.

Maa-29.3353 Law on International Contracts (3-6 cr) P

Autumn (periods I-II)

Lecturer: Patrick Lindgren, specialist teacher

Contents: Special problems with international contract law, such as the territory of application of national law, competent courts, execution problems, settlement of conflicts and different contract types.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.301 and Maa-29.351 (recommended)

Language: Finnish.

Maa-29.3355 General Damage Compensation Law (3-6 cr)

Autumn and spring

Lecturer: N.N., specialist teacher

Contents: Literature examination, possible lectures announced later. To get acquainted with the law of damage compensation.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.301 (recommended)

Language: Finnish.

Maa-29.3356 Competition Law (3-6 cr)

Spring (period III)

Lecturer: Antti Palmujoki, specialist teacher

Contents: Competition legislation and case law in Finland and EU. Restrictions of vertical and horizontal competition, abuse of dominant market position, the effect on contracts between organisations.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.301 (recommended)

Language: Finnish.

Maa-29.3360 Patent Law, Copyright Law and Trade Mark Law (2-4 cr) P

Autumn/Spring

Lecturer: N.N. specialist teacher

Contents: The course deals with the basics of patent law, copyright law and trade mark law and other IPR (intellectual property rights) law.

Requirements: Examination.

(Additional: Replace the courses Maa-29.361 Internet Law (2 ocr), Maa-29.362 Electricity and Telecommunications Law (2 ocr) and Maa-29.365 Copyright and Trade Mark (2 ocr).)

Language: Finnish.

Maa-29.3364 Legislations on Patents (3 cr)

Autumn (periods I-II)

Lecturer: Heli Pihlajamaa, specialist teacher

Contents: Patent and other incorporeal rights.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.301 (recommended)

Language: Finnish.

Maa-29.3366 Intellectual Property Law, special topics (2-6 cr) V

Autumn /spring

Lecturer: N.N., specialist teacher

Contents: Current topics in intellectual property law. Lectures are held if needed. More information on the home page and bulletin board.

Requirements: Examination

Language: Finnish.

Maa-29.3372 Labour Law (3 cr)

Spring (period IV)

Lecturer: Antti Palmujoki, specialist teacher

Contents: Acts on contracts of employment and collective labour contracts, other labour related laws and work safety regulations. International labour law.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Prerequisites: Maa-29.301 (recommended)

Language: Finnish.

Maa-29.3376 Economic Law, special topics (2-6 cr) V

Spring (periods III-IV)

Lecturer: N.N., lecturer

Contents: Current topics in economic law. Lectures are held if needed. More information on the home page and bulletin board.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Language: Finnish.

Maa-29.3381 Jurisprudence (3-12 cr) P, V

Spring (periods III-IV)

Lecturer: Prof Ari Ekroos

Contents: To get acquainted with a sector of law more specifically. Contents depend on the agreed literature.

Requirements: Examination.

Literature: Announced on the homepage and bulletin board.

Language: Finnish, English.

Maa-29.3382 Law, special assignment (5-12 cr) P

Lecturer: Prof Ari Ekroos

Contents: Written assignment on a legal issue, topic agreed with the professor. About 10-40 pages, depending on topic.

Requirements: Written assignment.

Language: Finnish, English.

Maa-29.3383 Seminar on Economic and Environmental Law, advanced studies (2-5 cr)

Autumn/spring

Lecturer: Prof Ari Ekroos

Contents: Basic skills for legal research and writing as well as doctrine of legal sources. Intended for students who write their special assignment or Master's thesis.

Requirements: Seminar presentation and participation in the seminar

Language: Finnish, English.

Maa-29.4391 Postgraduate Seminar on Law (2-12 cr) P, V

Lecturer: Prof Ari Ekroos

Contents: To get acquainted with special topics in real estate law, planning and building law or environmental and water resources law.

Language: Finnish, English.

Maa-57 PHOTOGRAMMETRY AND REMOTE SENSING**Courses credited in ECTS**

Prof. Henrik Haggrén , tel. 451 3900, room M223

Maa-57.1010 Fundamentals of Photography, Photogrammetry and Remote Sensing (4 cr) P

Spring (period III)

Lecturer: Prof. Henrik Haggrén and Anita Laiho-Heikinen, M.Sc

Contents: Satellite imaging, aerial and close-range photography. Image formation theory (analogue and digital). Production of digital images. Image geometry (central projection, orthophoto, scanners). Stereo photography and mensuration (photobase, accuracy aspects, anaglyph etc.) Sensor construction principles and properties. Visual interpretation of images and remote sensing data. Photo orienteering.

Requirements: Obligatory exercises and examination
 Literature: G. Konecny: Geoinformation - Remote Sensing, Photogrammetry and Geographic Information Systems, Taylor&Francis, London 2003. Other literature shall be announced during the lectures and on the home page of the course.
 Language: Finnish

Maa-57.1020 (Fundamentals of Remote Sensing) (3 cr)

Autumn (period I)
 Lecturer: Juho Lumme, M.Sc. (Tech.)
 Contents: The Remote Sensing Process, electromagnetic radiation and its properties, interaction of electromagnetic radiation with the Earth's surface and atmosphere, active and passive remote sensing instruments and their operational principles.
 Requirements: Obligatory exercises and examination.
 Literature: Lillesand, T.M. & Kiefer, R.W.: Remote Sensing and Image Interpretation, 3rd edition, John Wiley & Sons, Inc., 1994.
 (Additional: Replaces the course Maa-57.235 Fundamentals of Microwave Remote Sensing (2 ocr).)
 Language: Finnish

Maa-57.1030 Fundamentals of Photogrammetry (3 cr)

Spring (period III)
 Lecturer: prof. Henrik Haggrén and Petri Rönholm Lic. Sc. (Tech.)
 Contents: In the course the geometric principles of photogrammetry are handled. We go also through the useful and fundamental terminology of photogrammetry. After completing the course you should be able to acquire essential images for various map-making applications. You become capable in applying photogrammetric systems in producing three-dimensional models of varying objects. The course makes you also acquainted with the basics of photogrammetric mapping processes. After the course you will understand the relations between images and how the environment will appear in them.
 Requirements: Obligatory exercises, examination
 Literature: K. Kraus: Photogrammetry, Volume 1, Fundamentals and standard processes, Dümmler, Bonn 1993; H. Salmenperä: Fotogrammetria, TTKK, Tampere 1999. Other literature shall be announced during the lectures and on the home page of the course.
 (Additional: Replaces the course Maa-57.300 Fundamentals of Photogrammetry (2 ocr).)
 Prerequisites: Maa-57.1010
 Language: Finnish

Courses credited in ocr

Maa-57.220 Photogrammetric Mapping (2.5 ocr) P

Autumn (period I)
 Lecturer: prof. Henrik Haggrén and Eija Honkavaara, Lic.Sc. (Tech.)
 Contents: Mapping processes. Digitizing of aerial photography. Block triangulation. Digital workstation. Data acquisition for digital terrain models. Production of 3D environmental models. Airborne laser scanning.
 Requirements: Obligatory exercises, examination
 Literature: Proceedings of the OEEPE - WORKSHOP on Application of Digital Photogrammetric Workstations OEEPE, Official Publications No 33, Institut für Angewandte Geodäsie, Frankfurt am Main 1996, 453 p.; Salmenperä: Fotogrammetrisen pistetihennyksen menetelmät ja sovellutukset, TTKK, Tampere 1989; Fritsch/Spiller (Eds.): photogrammetric Week '99, H. Wichmann Verlag, Heidelberg, 1999.
 Prerequisites: Maa-57.301
 Language: Finnish

Maa-57.231 Digital Image Processing (2.5 ocr) P

Spring (period III), lectured for the last time during the academic year 2006-2007
 Lecturer: Keijo Inkilä, Lic.Sc. (Tech.)
 Contents: Image transforms, sampling, enhancement, restoration, compression and geometric transformations and multiresolution theory.
 Requirements: Obligatory exercises, examination
 Literature: Rosenfeld - Kak: Digital Picture Processing 1, 2. edition, 1982. Gonzales - Woods: Digital Image Processing, 1992 and other material to be announced during lectures.
 Language: Finnish

Maa-57.241 Analytical Photogrammetry (2.5 ocr) P

Autumn (period I)
 Lecturer: Keijo Inkilä Lic.Sc. (Tech.)
 Contents: Determination of the shape, size and position of an object by using images and mathematical methods. Sensor models, parameter estimation and statistical quality evaluation.
 Requirements: Obligatory exercises, examination. Alternative: separately agreed literature.
 Literature: To be announced
 Language: Finnish

Maa-57.251 Remote Sensing I (4 ocr) P

Spring (periods III-IV), every second year, lectured during the academic year 2006-2007
 Lecturer: Markus Törmä Lic.Sc. (Tech.)
 Contents: Fundamentals of statistical pattern recognition: Bayes decision theory, nearest neighbor decision rule, discriminant functions, feature selection and extraction, clustering analysis, classification error estimation.
 Requirements: Obligatory exercises, examination. Alternative: separately agreed literature and exercises.
 Literature: To be announced
 Prerequisites: Mat-2.091
 Language: Finnish (English if needed)

Maa-57.252 Remote Sensing II (6 ocr) P

Autumn + spring, every second year, not lectured during academic year 2006-2007
 Lecturer: Markus Törmä Lic.Sc. (Tech.)
 Contents: The process of classification in real life situations. Supervised, unsupervised and rule-based interpretation.
 Requirements: Obligatory exercises. Alternative: separately agreed literature and exercises.
 Literature: To be announced
 Prerequisites: Maa-57.251
 Language: Finnish (English if needed)

Maa-57.260 Close-Range Photogrammetry (2 ocr) P

Spring (period III), every second year, not lectured in the academic year 2006-2007
 Lecturer: prof. Henrik Haggrén and Petteri Pöntinen, Lic.Sc. (Tech.)
 Contents: Photogrammetry applied to science, arts and industry. On-line and off-line applications; planning, simulation and realization. Measurements for quality control, motion control and deformation. 3D content production. Reconstruction of 3D indoor and product models.
 Requirements: Obligatory exercises, examination. Alternative: separately agreed literature.
 Literature: Karara, H.M. (ed.): Non-Topographic Photogrammetry, 2nd Edition, ASPRS 1989; Atkinson, K.B. (ed.): Close-Range Photogrammetry and Machine Vision, Whittles Publishing, 1996.
 Language: Finnish

Maa-57.270 Seminar on Photogrammetry, Photo-interpretation and Remote Sensing (1.5 ocr) P, V

Spring (periods III-IV)

Lecturer: Prof Henrik Haggrén
 Contents: The students will lecture on an actual topic of interest within the field of photogrammetry and remote sensing. The lectures are each opposed by a student opponent and they are open for scientific discussion. The final manuscripts are prepared according to specifications for publication.
 Language: Finnish

Maa-57.290 Special Assignment in Photogrammetry, Photo-interpretation and Remote Sensing (5 ocr) P, V
 Teacher: prof Henrik Haggrén
 Language: Finnish (English if needed)

Maa-57.295 Postgraduate Seminar on Photogrammetry, Photo-interpretation and Remote Sensing (1-4 ocr) P, V
 Lecturer: prof Henrik Haggrén
 Contents: Lectures and presentations on actual topics for increasing professional insight. Actual topics will be decided during the seminar.
 Language: English

Maa-57.301 General Photogrammetry (2 ocr)
 Autumn (period I), lectured for the last time during the academic year 2006-2007
 Lecturer: prof. Henrik Haggrén and Petri Rönnholm, M.Sc. (Tech.)
 Contents: Alternative photogrammetric measuring principles. General analytical model of photogrammetry, image coordinate observations, transformation to 3D coordinate systems, orientation and georeference of images. Analytical stereo measurements. Single image photogrammetry.
 Requirements: Obligatory exercises, examination
 Literature: Karl Kraus: Photogrammetry, Volume 1, Fundamentals and standard processes, Dümmler, Bonn 1993; Petteri Pöntinen: Kolmiulotteinen videodigitointi, TKK, Fotogrammetrian ja kaukokartoituksen laboratorio, Reports 2/1994.
 Prerequisites: Maa-57.300
 Language: Finnish

Maa-57.305 Digital Photogrammetry I (2.5 ocr)
 Autumn (period II)
 Lecturer: Keijo Inkilä Lic.Sc. (Tech.)
 Contents: Automatic extraction of geometrical and physical information from digital images. Feature extraction, segmentation, image matching and object reconstruction.
 Requirements: Obligatory exercises, examination. Alternative: separately agreed literature.
 Literature: To be announced
 Language: Finnish

Maa-57.306 Digital Photogrammetry II (2 ocr)
 Spring (period IV), every second year, will be lectured during the academic year 2006-2007
 Lecturer: Keijo Inkilä Lic.Sc. (Tech.)
 Contents: Shape from shading, optical flow, object tracking, shape matching, automation of photogrammetric problems, digital instruments and their calibration.
 Requirements: Obligatory exercises, examination. Alternative: separately agreed literature.
 Literature: To be announced
 Prerequisites: Maa-57.305
 Language: Finnish

Maa-57.351 General Remote Sensing (2 ocr)
 Spring (periods III-IV), lectured for the last time during the academic year 2006-2007
 Lecturer: Markus Törmä, Lic.Sc. (Tech.)
 Contents: The acquisition, processing and interpretation of remote sensing data and their applications. Satellite images, image preprocessing, feature extraction, interpretation, applications.

Requirements: Obligatory exercises, examination
 Literature: to be announced
 Language: Finnish (English if needed)

Maa-57.355 Exercise in Imaging Technology (5 ocr) P, V
 Lecturer: prof Henrik Haggrén
 Content: Problem solving within imaging technology and its realization.
 Language: Finnish, (English if needed)

Maa-57.370 Radar Remote Sensing (2 ocr) P
 Spring (periods III-IV), every second year, will be lectured during academic year 2006-2007
 Lecturer: N. N.
 Contents: Preprocessing of radar images, interpretation and applications. Effects of image parameters (frequency, incidence angle etc.) on image formation. Mostly focused on SAR-images.
 Requirements: obligatory exercises, examination
 Literature: to be announced
 Language: Finnish

Maa-57.400 Research seminar on Photogrammetry, Photo-interpretation and Remote Sensing (2 ocr) P, V
 Autumn (periods I-II)
 Instructor: prof Henrik Haggrén
 Contents: Demonstration of research works within photogrammetry, photo-interpretation and remote sensing.
 Language: English

Maa-123 CARTOGRAPHY AND GEOINFORMATICS

Courses credited in ECTS

Prof. Kirsi Virrantaus, M202, 451 3912
 Prof. Ari Jolma, M213, 451 3886

Maa-123.1110 Introduction to Cartography and Geoinformatics (3 cr)
 Spring (period IV)
 Lecturer: Paula Ahonen-Rainio, lecturer
 Contents: The course introduces the concept of a map and its principle elements, and gives an overview of mapping process and different types of maps. It also introduces modelling of spatial features, some basic algorithms and components of geographic information systems (GIS), and gives an overview of application fields of GIS. Exercises consist of working with maps and a GIS.
 Examination: Exercises and exam.
 Literature: Heywood, I. et. al., An Introduction to geographical Information Systems; Kraak, M.J., Ormeling, F., Cartography: Visualization of Geospatial Data (partly); material announced on lectures.
 Language: English

Maa-123.1120 Introduction to Geoinformatics in Civil and Environmental Engineering (4 cr)
 Spring (period IV)
 Lecturer: Professor Ari Jolma and lecturer Paula Ahonen-Rainio, lecturer.
 Contents: The course introduces the concept of a map and its principal elements, and gives an overview of mapping process and different types of maps. It also introduces modelling of spatial features, some basic algorithms and components of geographic information systems (GIS), and gives an overview of applications of GIS in civil and environmental engineering. The exercises introduce to common geographic datasets and processing of them, and to fundamental methods in geoinformatics and visualisation of geospatial data.
 Examination: Exercises and exam.

Literature: Heywood, I. et al., *An Introduction to Geographical Information Systems*; Kraak, M.J., Ormeling, F., *Cartography: Visualization of Geospatial Data* (partly); material announced on lectures.

Prerequisites: T-106.1206, Yhd-0.1100

Language: English

Maa-123.1310 Theories and Techniques of Geoinformatics (7 cr)

Spring (period III, exercises period IV)

Lecturer: Paula Ahonen-Rainio, lecturer

Contents: Principles of spatial modelling and spatial analysis. Specification of geographic datasets, uncertainty and quality models of geographic data; quality evaluation. Introduction to geographic data management. Visualisation of geographic data on maps. Management of a geographic information system. Concepts of spatial data infrastructures; geospatial metadata; issues of data policy. Exercises comprise of working with different GIS software products.

Examination: Exercises and exam.

Literature: Longley, P. et al., *Geographic Information Systems and Science*; material announced on lectures.

Prerequisites: Maa-123.110 or Maa-123.1110 or Maa-123.1120, T-106.253 or T-106.1223.

Language: English

Maa-123.1320 Geoinformatics for Real Estate Economics (5 cr)

Spring (period III, exercises period IV)

Lecturer: Paula Ahonen-Rainio, lecturer

Contents: Principles of spatial modelling and spatial analysis. Specification of geographic datasets, uncertainty and quality models of geographic data; quality evaluation. Introduction to geographic data management. Visualisation of geographic data on maps. Management of a geographic information system. Concepts of spatial data infrastructures; geospatial metadata; issues of data policy. Exercises comprise of working with different GIS software products on real estate economy applications.

Examination: Exercises and exam.

Literature: Longley, P. et al., *Geographic Information Systems and Science*; material announced on lectures.

Prerequisites: Maa-123.110 or Maa-123.1110 or Maa-123.1120.

Language: English

Maa-123.3410 Fuzzy Modeling of Geographic Information (4 cr) P

Autumn (period II)

Lecturer: Docent Vesa Niskanen

Contents: The course introduces the student to fuzzy logic and fuzzy modelling in theory and also in practice by exercises made in Matlab Fuzzy Toolbox environment. The special emphasis is on fuzzy modelling of imprecise geographic information and vague spatial objects like soil map polygons and phenomena like elevation and land use. The course consists of lectures and exercises as well as an individual project work.

Examination: Laboratory exercises, exam and project work.

Literature: Niskanen, V., *Soft Computing in Human Sciences*, lecture material.

Prerequisites: Maa-123.310 or Maa-123.1310.

Language: English

Maa-123.3570 Geosimulation (4 cr) P

Spring (period IV)

Lecturer: Professor Ari Jolma

Contents: This course considers geospatial modeling and simulation. Topics include introductions to cellular automata and its extensions, geosimulation with map algebra and its extensions, dynamic models and GIS, agent-based geospatial models, and software for geosimulation. Exercises in computer classrooms.

Examination: Examination and exercises.

Literature: Beneson, Torres, *Geosimulation: automata-based modeling of urban phenomena*; material announced on lectures.

Prerequisites: Maa-123.490 or Maa-123.420.

Language: English

Courses credited in ocr

Maa-123.320 GIS Architectures (2 ocr)

Autumn (period II)

Lecturer: Professor Ari Jolma

Contents: Components, platforms, and architectures of a GIS, introduction to computer, computer networks, computer graphics, input and output devices, and mobile devices. Introduction to storage of geodata file formats. Organizational issues of GIS requirements and specifications. Students prepare and present a small study on a selected GIS component.

Examination: Exercise project, exam.

Literature: Announced on lectures.

Prerequisites: Maa-123.310 or Maa-123.1310, Maa-123.330.

Language: English

Maa-123.330 GIS Design (1,5 ocr)

Autumn (period I)

Lecturer: Professor Ari Jolma

Contents: Introduction to GIS in organizations, analysing and solving problems, description of data contents and functionalities, and introduction to software development methods in general. Introduction to UML. Working and collaboration in a virtual environment. Students conduct a small feasibility study during the course and document it into a collaborative environment. GIS Design is a virtual course.

Examination: Exercise project, exam.

Literature: Announced in the virtual learning environment.

Prerequisites: Maa-123.310 or Maa-123.1310.

Language: English

Maa-123.340 Spatial Data Algorithms (3 ocr)

Spring (period III, programming exercise in period IV)

Lecturer: Professor Kirsi Virrantaus

Contents: Voronoi-diagram with variations, TIN, map overlay, plane sweep and rotational sweep based algorithms, polygon map traversal, graph problems, raster base route optimisation, visibility graph, spatial indexing, DCEL, quad tree, winged edge, quad edge. Programming exercise.

Examination: Studio sessions, programming exercise and exam.

Literature: Material distributed during the lectures: lecture overheads, articles.

Prerequisites: Maa-123.310 or Maa-123.1310, T-106.253

Language: English

Maa-123.350 Computational Cartography (2 ocr)

Spring (period III, programming exercise in period IV), lectured last time in Spring 2007

Lecturer: Professor Kirsi Virrantaus

Contents: Voronoi-diagram with variations, TIN, some spatial data structures used in cartographic algorithms, vector and raster based cartographic generalization, decision tree based generalization, name placement problem, DEM-based algorithms, cartographic transformations

Examination: Studio sessions, exercise and exam; or exam and exercises.

Literature: Material distributed during the lectures: lecture overheads, articles.

Prerequisites: Maa-123.310 or Maa-123.1310, T-106.253

Language: English

Maa-123.410 Geographic Data Management (3 ocr) P

Autumn (period III)

Lecturer: Docent Tuija Kuusisto

Contents: The course deals with the theory and practical implementation of geographic data management: relational data base management, conceptual modelling, object data bases, spatial data base functions, long transactions, spatial indexing, versioning, spatial data models, multiple resolution data bases, UML. Project work.

Examination: Exam and exercises.

Literature: Lecture overheads. Other material announced on lectures.

Prerequisites: Maa-123.310 or Maa-123.1310, Maa-123.330, Maa-123.340

Language: English

Maa-123.420 GIS Analysis (2 ocr) P

Autumn (period I)

Lecturer: Professor Kirsi Virrantaus

Contents: Analysis of point patterns, areas, and polygon maps by using spatio-statistical methods; statistics on fields, introduction to geostatistics: analysis of lines and graphs; analysis of multivariate spatial data; uncertainty issues of analyses; examples of GIS analysis in hydrology; spatial data in decision making.

Examination: Exercises and exam.

Literature: Unwin, D., O'Sullivan, D., Geographic Information Analysis; material announced on lectures; Lecture overheads and additional material.

Prerequisites: Maa-123.340 or Maa-123.350

Language: English

Maa-123.430 Visualisation of Geographic Information (3 ocr) P

Spring (periods I-II)

Lecturer: Paula Ahonen-Rainio, lecturer

Contents: Theories of visual perception, cartographic visualization and cartographic communication. Map design for paper, screen and mobile displays. Design exercises and written reports.

Examination: Portfolio of design exercises and written reports.

Literature: Material announced during the lectures and on the home page of the course.

Prerequisites: Maa-123.210 or Maa-123.1110

Language: English

Maa-123.440 Webtop GIS (2 ocr) P

Spring (period IV), lectured the last time in Spring 2007

Lecturer: Lassi Lehto, L.Sc.(Tech.)

Contents: Implementation of a GIS application to Internet. Standards, usability, XML-technologies; programming exercise.

Examination: Exercises and exam.

Literature: Kraak, M.J., Brown, A. (eds), Web cartography: developments and prospects, Taylor & Francis 2001; material announced on lectures.

Language: English

Maa-123.450 Grid Analysis (2 ocr)

Spring (period III)

Lecturer: Jukka Krisp, Lic.Sc

Contents: Project work on GIS analysis using GIS-software for raster analysis and geostatistics.

Examination: Project work

Prerequisites: Maa-123.420

Language: English

Maa-123.460 Topographic Maps (3 ocr) P

Spring (period IV)

Lecturer: Paula Ahonen-Rainio, lecturer

Contents: History of topographic maps, modern topographic maps and map databases, generalization and multi-scale representations of maps, introduction to geomorphology and presentation of elevation, place names in maps and foreign topographic maps.

Examination: Exam and exercises

Literature: Imhof, E., Cartographic relief presentation; lecture overheads; material announced on lectures; material announced during the lectures and on the home page of the course.

Prerequisites: Maa-123.210 or Maa-123.1110

Language: English

Maa-123.470 GIS Software Engineering (5 ocr) P

Autumn and spring (periods I-IV)

Lecturer: Professor Kirsi Virrantaus

Contents: Design and implementation of a GIS application. Project work.

Examination: Project work.

Prerequisites: Maa-123.410, Maa-123.340, T-106.253, T-106.216, programming ability.

Language: English

Maa-123.480 Development of a Cartographic Information System (3 ocr) P

Autumn and spring (periods I-IV)

Lecturer: Professor Kirsi Virrantaus

Contents: Design and implementation of a cartographic GIS application. Project work.

Examination: Project work

Prerequisites: Maa-123.410, Maa-123.350, programming ability

Language: English

Maa-123.490 Programming in GIS (2 ocr) P

Autumn (period II), lectured the last time in autumn 2006

Lecturer: Professor Ari Jolma, Teemu Kokkonen, D.Sc

Contents: Object-oriented programming, software libraries, programmable environments, accessing geodata in various formats and systems, software development. Exercises in Java, Perl, Python, and/or Net. Suitable also for non-geoinformatics students who need to use geoinformatics in their research.

Examination: Programming exercises and exam.

Literature: Announced on lectures.

Prerequisites: Maa-123.310 or Maa-123.1310, Maa-123.320, programming ability

Language: English

Maa-123.491 Geoinformatics in Civil and Environmental Engineering (2 ocr) P

Spring (period III)

Lecturer: Professor Ari Jolma

Contents: The course deals with exploitation of spatial data in civil and environmental engineering projects and problem solving in three phases: data acquisition, selection of methods and application of tools. The course consists of a set of typical civil engineering tasks, cases, which have a spatial dimension. Project work assignments are built on these cases and the student works on them in different roles, enabling him/her to broaden and/or deepen his/her knowledge and skills in geoinformatics and civil engineering.

Examination: Project work assignment and exam.

Literature: Announced on lectures.

Prerequisites: Candidate studies in civil and environmental engineering, Maa-123.310 or Maa-123.1310 or comparable knowledge and skills.

Language: English

Maa-123.510 Current Topics on Cartography and Geoinformatics (2 ocr) P, V

Spring (period II)

Lecturer: Professor Kirsi Virrantaus

Contents: In the academic year 2006–2007 the topic is uncertainty in geographic information.

Examination: Studio sessions and a documented exercise.

Language: English

Maa-123.520 Special Assignment in Geoinformation Technique (5 ocr)

Lecturer: Professor Kirsi Virrantaus, professor Ari Jolma
Contents: Student writes a research paper or other study on a specific topic in geoinformation technique.
Language: English

Maa-123.530 Special Assignment in Cartography (5 ocr) P, V

Lecturer: Professor Kirsi Virrantaus, Paula Ahonen-Rainio, lecturer
Contents: Student writes a research paper or other study on a specific topic in Cartography.
Language: English

Maa-123.540 Principles of Geostatistics (2 ocr) P

Period IV
Lecturer: doc. Eevaliisa Laine
Contents: Introduction to geostatistics, kriging, indicator kriging.
Examination: Learning diary
Prerequisites: Maa-123.310 or Maa-123.1310 or Maa-123.420
Language: English

Maa-123.550 Hydrography (1,5 ocr) P

Period II
Lecturer: Maarit Mikkelsen, M.Sc.
Contents: Nautical charts, hydrographic mapping methods, GIS in hydrography and nautical chart production, ENC.
Examination: Exam
Prerequisites: Maa-123.210 or Maa-123.460
Language: English

Maa-123.610 Postgraduate Course on Geoinformatics (1-4 ocr) P, V

Lecturer: Professor Kirsi Virrantaus, professor Ari Jolma
Contents: Varying topics. Lectured by visiting lecturers.
Language: English

Maa-123.620 Postgraduate Seminar on Geoinformatics (1-4 ocr) P, V

Lecturer: Professor Kirsi Virrantaus
Contents: Seminar on postgraduate research topics.
Language: English

SEPARATE COURSES IN GENERAL STUDIES

COURSES IN COMMUNICATION AND LANGUAGES

Language Centre (KIE)

Head of Department, tel. 451 4298
Department secretary, tel. 451 4281
Study Counsellor: tel. 451 4282
<http://language.tkk.fi/>

The Language Centre is a separate institution set up under the Council of Helsinki University of Technology. It provides instruction in ten languages. The emphasis is on teaching practical language skills as well as cultural awareness. One of the main aims is also to develop materials and methods for teaching languages and communication.

The Centre has an extensive self-study library which offers books, audio and video cassettes as well as computer programs for individual use. Some of the books can be borrowed for two weeks.

The Language Centre is located on the fourth and fifth floors of the Main Building. The self-study library is located in room U414a in the Main Building. Room has been reserved for group-work as well as for watching videos and reading magazines and newspapers. Dictionaries and handbooks are also available and there is a multimedia language laboratory, where the computers can be used, e.g. for listening and recording.

Please notice that the participation to the language or communication courses may require the command of Finnish language. Please contact the teacher in question for more information.

COURSES

Courses credited in ECTS

Chinese

Ako-98.9410 Chinese 1 (4 cr)

See Open University (<http://www.avoin.hut.fi>). Please note: There is a registration fee.

Teacher: Hai Guo

Contents: A suggestopedic course of practical Chinese.

Literature: Hai Guo: Matka Kiinan kieleen ja kulttuuriin

Prerequisites: The course is meant for beginners.

Ako-98.9411 Chinese 2 (4 cr)

See Open University (<http://www.avoin.hut.fi>). Please note: There is a registration fee.

Teacher: Hai Guo

Contents: A suggestopedic course of practical Chinese.

Literature: Hai Guo: Matka Kiinan kieleen ja kulttuuriin

Prerequisites: Ako-/Kie-98.410 or equivalent knowledge of Chinese.

Ako-98.9412 Chinese 3 (2 cr)

See Open University (<http://www.avoin.hut.fi>). Please note: There is a registration fee.

Teacher: Hai Guo

Contents: A suggestopedic course of practical Chinese.

Literature: Hai Guo: Matka Kiinan kieleen ja kulttuuriin

Prerequisites: Kie-/Ako-98.411, Ako-98.9411 or equivalent knowledge.

Ako-98.9413 Chinese Conversation (2 cr)

See Open University (<http://www.avoin.hut.fi>). Please note: There is a registration fee.

Teacher: Hai Guo

Contents: The goal is to maintain the level of the knowledge of Chinese reached. Note: The contents of the course vary, i.e. it is possible for a student to take the course several times.

Literature: To be announced at the beginning of the course.

Prerequisites: Ako-/Kie-98.412, Ako-98.9412 or equivalent knowledge.

Communication

Vie-98.1220 Speech Communication (2 cr)

24+28 I, II, III, IV

Teachers: Eeva-Leena Aittoniemi and Tarja Tuomikoski

Contents: The course develops and reinforces individual and group communication skills, as well as prepares students for communicative situations in work life. The course includes recognising one's own communicative capabilities, building and visualization of a spoken presentation, and meetings and negotiating skills.

Grade: Pass/Fail

Additional: This course replaces Vie-98.220. Groups are also offered in Swedish and English.

Vie-98.1221 Public Speaking (2 cr)

24+28 III

Teacher: Eeva-Leena Aittoniemi

Contents: The course aims to increase students' confidence in giving presentations and strengthen their own personal style. The course includes practice in giving presentations of different lengths and styles, video exercises, and feedback sessions.

Grade: Pass/Fail

Additional: This course replaces Vie-98.234

Vie-98.1222 Cultures and Communication (2 cr)

24+28 III-IV

Teacher: Tarja Tuomikoski

Contents: This course explores the meaning of internationalization, familiarises students with different cultures, raises awareness of cultural differences and the underlying reasons, interaction in different cultures, meaning and expression. Lecturers from different cultures.

Grade: Pass/Fail

Additional: This course replaces Vie-98.249

Vie-98.1223 Meeting Skills (2 cr)

24+28 I, IV

Teacher: Tarja Tuomikoski

Contents: This course explores the meaning, structure, procedural rules and stages in meetings. During the course, students chair, participate and perform different tasks in meetings, including housing association meetings, as well as attend and report on a city council meeting.

Grade: Pass/Fail

Additional: This course replaces Vie-98.237

Vie-98.1224 Negotiating Skills (2 cr)

24+28 I, III

Teacher: Eeva-Leena Aittoniemi

Contents: The course guides students in developing personal capabilities and skills as a negotiator, as well as an awareness of the goals and meaning of different negotiation situations.

Grade: Pass/Fail

Additional: This course replaces Vie-98.236

Vie-98.1225 Team Work (2 cr)

24+28 I-II

Teacher: Tarja Tuomikoski

Contents: The course provides basic information on the approaches used in team work, as well as guides students in analysing their own and others' behaviour in small groups and in recognising the interactive processes of the group. The course also examines the meaning, reasons and concepts, focusing on recognition, analysis and control.

Grade: Pass/Fail

Additional: This course replaces Vie-98.221

Vie-98.1226 Debating Skills (2 cr)

24+28 II, III

Teacher: Eeva-Leena Aittoniemi

Contents: The course develops students' confidence and ability to persuade others. The course includes summarising and focusing the message; improving reaction time; developing listening skills; proper argumentation; recognising the importance of a solid, persuasive presentation; and giving and receiving feedback.

Grade: Pass/Fail

Additional: This course replaces Vie-98.233

Vie-98.1227 Environmental Issues (3 cr)

24+28 I-II

Teacher: Eeva-Leena Aittoniemi

Contents: The course focuses on the reporting of environmental issues to company stakeholders, the channels and techniques that can be used, the legal requirements and strategic significance of environmental reporting, as well as communication methods used in special situations. Lecturers from various universities and companies.

Grade: Pass/Fail

Additional: This course replaces Vie-98.800

Vie-98.1228 Informative Presentations (1 cr)

II

Teacher: Eeva-Leena Aittoniemi

Contents: This course guides students in planning, practicing and giving effective informative presentations on a topic related to their own field of study. During the course, each student will give a Powerpoint presentation. In addition, the students will evaluate and discuss each others presentations.

Grade: Pass/Fail

Vie-98.1229 Job Search (1 cr)

III

Teacher: Tarja Tuomikoski

Contents: The course guides students through the process of constructing documents used in job search. In addition, student will practice job interviews.

Grade: Pass/Fail

Vie-98.1230 Introduction to Effective Communication (1 cr)

I

Teacher: Tarja Tuomikoski

Contents: In this course, students practise the spoken skills necessary to communicate effectively in meetings and negotiations.

Grade: Pass/Fail

Vie-98.1331 Speaking Argumentation and Persuasion (1 cr)

IV

Teacher: Eeva-Leena Aittoniemi

Contents: The course aims to develop students' argumentation skills. The students will learn about effective rhetorical strategies and practice persuasive speaking.

Grade: Pass/Fail

English

Kie-98.1300 Introduction to Public Speaking (3 cr)

36 + 42 I-II, III-IV

Teacher: English teachers

Contents: The aim is to increase confidence in giving a talk. Students practice giving short talks, both planned and unplanned. They also participate in giving and receiving feedback on each other's talks in a supportive environment.

Grade: Pass/Fail

Additional info: This course fulfills the compulsory foreign language studies.

CEF Starting Level: B2

Kie-98.1302 Informative Presentations (3 cr)

20 + 58 I, II, III, IV

Teacher: English teachers

Contents: This course guides students in planning, practicing and giving effective "informative" presentations on a topic related to their own field of study. The course consists of two phases. In the first two weeks, students attend three 2-hour workshops, during which they plan and organize their presentation. During weeks 3 - 6, students meet for two hours per week in small groups to practice and record revised versions of their talk.

Course materials: <http://sana.hut.fi/en/981302>

Additional info: Please note that this course must be completed before you can be admitted to Kie-98.1303 Persuasive Presentations. This course fulfills the compulsory foreign language studies. In the old degree program, this course replaces part of Kie-98.103, 104, and 105.

CEF level: C1

Kie-98.1302 Informative Presentations (2 cr)

2 + 50 (independent study) I, II, III, IV

Teacher: English teachers

Contents: This self-study version allows students to complete the informative presentations course without attending lectures and small-group rehearsals. To successfully complete the course, students must submit the following tasks for approval by the teacher before they can give their presentation:

- Outline (containing purpose and thesis statement)
- PowerPoint slides

For more current information about the content, requirements and tasks, see <http://sana.hut.fi/en/981302/selfstudy/>

Additional info: This course fulfills part (2:3 cr) of the compulsory foreign language studies. In the old degree program, this course replaces part of Kie-98.103, 104 and 105.

CEF Starting Level: C1

Kie-98.1303 Persuasive Presentations (3 cr)

20 + 58 II, IV

Teacher: English teachers

Contents: This course aims to prepare students in planning, practicing and giving a "persuasive" presentation on a topic related to their own field of study. The course consists of two phases. In the first two weeks, students attend three 2-hour workshops during which they plan and organize their presentation. During weeks 3 - 6, students meet for two hours per week in small groups to practice and record revised versions of their talk.

Course materials: <http://sana.hut.fi/en/981303>

Prerequisites: Kie-98.1302 Informative Presentations

Additional info: This course fulfills the compulsory foreign language studies. In the old degree program, this course replaces part of Kie-98.103, 104, and 105.

CEF Starting Level: C1

Kie-98.1303 Persuasive Presentations (2 cr)

2 + 50 (independent study) II, IV

Teacher: English teachers

Contents: This self-study version allows students to complete the persuasive presentations course without attending lectures and small-group rehearsals. To successfully complete the course, students must submit the following tasks for approval by the teacher before they can give their presentation:

- Outline (defining the audience, purpose, thesis statement, and organizational pattern)
- PowerPoint slides

For more current information about the content, requirements and tasks, see <http://sana.hut.fi/en/981303/selfstudy/>

Additional info: This course fulfills part (2:3) of the compulsory foreign language studies. In the old degree program, this course replaces part of Kie-98.103, 104 and 105.

CEF Starting Level: C1

Kie-98.1304 Debating Issues (3 cr)

36 + 42 II, III, IV

Teacher: English teachers

Contents: The aim of this course is to develop argumentation skills that enable students to discuss controversial topics in a diplomatic way. Students gather, evaluate, and synthesize data on contentious issues to form arguments in support of their position. Debate topics cover issues related to science and technology.

Additional info: This course fulfills the compulsory foreign language studies. In the old degree program, this course replaces part of Kie-98-103.

CEF Starting Level: B2 or higher

Kie-98.1305 Presenting a Technical Paper (2 cr)

20 + 32 IV + summer

Teacher: English teachers

Contents: This course provides students with the opportunity to practice and record different versions of a conference paper (or presentation of thesis projects) in small groups, while giving and receiving feedback on their visuals, contents, and language use.

Grade: Pass / Fail

Additional info: Course homepage: <http://sana.hut.fi/en/981305>. This course fulfills part (1:3 cr) of the compulsory foreign language studies. In the old degree program, there is no equivalent for this course.

CEF Starting Level: B2

Kie-98.1308 Meetings and Negotiations (1-2 cr)

26 + 0 (1 cr); 52 + 0 (2 cr) I, II, III, IV

Teacher: English teachers

Contents: In this course, students practice the spoken skills necessary to communicate effectively in meetings and negotiations. In addition, they practice language features that help persuade and motivate others. This course also aims to raise awareness of culture in communication.

Grade: Pass/fail

Additional info: Course homepage: <http://sana.hut.fi/en/981308>. This course fulfills part (1-2:3 cr) of the compulsory foreign language studies. In the old degree program, this course replaces part of Kie-98.313.

CEF Starting Level: B2

Kie-98.1309 Targeting Pronunciation A (1-2 cr)

12 + 14 (1 cr); 16 + 36 (2 cr) I-II, III-IV

Teacher: English teachers

Contents: This one credit course aims to improve clarity of speech by practicing rhythm and stress, where the individual sounds of English are dealt with as needed. The course targets words from the field of science and technology. For an additional credit, students can continue to work on their individual challenge areas established during the first six weeks of the course. Since improving pronunciation requires regular practice, the participants should be highly motivated.

Grade: Pass/fail

Additional info: This oral skills course fulfills part (1-2:3 cr) of the compulsory foreign language studies. In the old degree program, this course replaces Kie-98.319.

Kie-98.1201 Mechanics of Writing I (1 cr)

0 + 26 (independent study) I, II, III, IV

Teacher: English teachers

Contents: In this self-study course, students work through web-based materials and take a final exam. The course aims to familiarize students with the basic mechanics of writing, including rules of punctuation and grammar specific to formal writing. Final examinations are offered twice each period.

Grade: Pass/fail

Additional info: Please note that this course and Kie-98.1202 Mechanics of Writing II must be completed before you can be admitted to other writing courses. Course homepage: <http://sana.hut.fi/en/981201>. This course fulfills part (1:3 cr) of the compulsory foreign language studies. In the old degree program, there is no equivalent for this course.

CEF Starting Level: B2 or higher

Kie-98.1202 Mechanics of Writing II (1 cr)

0 + 26 (independent study) I, II, III, IV

Teacher: English teachers

Contents: In this self-study course, students work through web-based materials and take a final exam. This course is a continuation of Kie-98.1201 Mechanics of Writing I. Students are introduced to stylistic features of formal writing and the principles of ordering information at the sentence level. Final examinations are offered twice each period.

Grade: Pass/ Fail

Prerequisites: Kie-98.1201 Mechanics of Writing I.

Additional info: Please note that this course must be completed before you can be admitted to other writing courses. Course homepage: <http://sana.hut.fi/en/981202/>. This course fulfills part (1:3 cr) of the compulsory foreign language studies. In the old degree program, there is no equivalent for this course.

CEF Starting Level: B2 or higher

Kie-98.1205 Mechanics of Writing III (1 cr)

12 + 14 II, III, IV

Teacher: English teachers

Contents: This course is a continuation of Kie-98.1202 Mechanics of Writing 2. During the course, students are introduced to different organizational patterns and features of a well-structured paragraph, as well as practice and receive feedback on their writing.

Grade: Pass/ Fail

Prerequisites: Kie-98.1201 Mechanics of Writing I and Kie-98.1202 Mechanics of Writing II.

Additional info: This course fulfills part (1:3 cr) of the compulsory foreign language studies. In the old degree program, there is no equivalent for this course.

CEF Starting Level: B2 or higher

Kie-98.1206 Academic Writing (2 cr)

24 + 28 I, II, III, IV

Teacher: English teachers

Contents: This course focuses on the formal language of journal articles, conference papers, and theses. During the course, students are introduced to important features of academic writing, including audience, purpose, organization, and style. Students also collect sample research articles from their own fields for analysis and report on their findings.

Grade: Pass/fail

Prerequisites: Kie-98.1201 Mechanics of Writing I and Kie-98.1202 Mechanics of Writing II.

Additional info: This course fulfills part (2:3 cr) of the compulsory foreign language studies. In the old degree program, this course replaces Kie-98.006.

CEF Starting Level: B2 or higher

Kie-98.1207 Technical Writing: Writing instructions (1 cr)

12 + 14 I, IV

Teacher: English teachers

Contents: This course aims to provide students with practice in planning and writing of users instructions.

Grade: Pass/Fail

Prerequisites: Kie-98.1201 Mechanics of Writing I and Kie-98.1202 Mechanics of Writing II

Additional info: This course fulfills part (1:3 cr) of the compulsory foreign language studies. In the old degree program, there is no equivalent for this course.

CEF Starting Level: B2 or higher

Kie-98.1208 Writing Clinic (1 cr)

0 + 26 (independent study) I, II, III, IV

Teacher: English teachers

Contents: This online clinic offers students the opportunity to obtain feedback on samples of their writing, such as seminar papers, project proposals, conference papers, M.A. theses, thesis abstracts, technical reports, and other professional writing tasks. Students submit and receive feedback on their work online. All feedback includes links to explanations, examples and interactive exercises on grammar and other writing features.

Grade: Pass/Fail

Additional info: Course homepage: <http://sana.hut.fi/en/981208/>. This course fulfills part (1:3 cr) of the compulsory foreign language studies. In the old degree program, there is no equivalent for this course.

CEF Starting Level: B2 or higher

Kie-98.1401 Job Search (1 cr)

2 + 24 (independent study) III, IV

Teacher: English teachers

Contents: The course guides students through the process of constructing a resume/CV and a covering letter. Students work autonomously, meeting weekly deadlines.

Grade: Pass/fail

Prerequisites: Recommended Kie-98.1201

Additional info: Course homepage: <http://sana.hut.fi/en/981401/>. This course fulfills part (1:3 cr) of the compulsory foreign language studies. In the old degree program, this course replaces part of Kie-98.507.

CEF Starting Level: B2 or higher

Kie-98.1402 Business Correspondence (2 cr)

12 + 40 I, III

Teacher: English teachers

Contents: This course aims to familiarize students with strategies to compose effective and clear business messages, such as letters of request, claims, bad-news messages, and sales correspondence.

Grade: Pass/fail

Prerequisites: Kie-98.1201 Mechanics of Writing I and Kie-98.1202 Mechanics of Writing II

Additional info: This course fulfills part (2:3 cr) of the compulsory foreign language studies. In the old degree program, there is no equivalent for this course.

CEF Starting Level: B2 or higher

Kie-98.1106 Activation of English (4 cr)

48 + 56 I-II, III-IV

Teacher: English teachers

Contents: The course provides students an opportunity to activate their reading, speaking and writing skills. In addition, the course is meant for students who wish to revise English grammar. The course consists of lectures and workshops. Students work individually, in pairs, and in groups, meeting weekly deadlines. Registration takes place through WebTopi.

Grade: Pass/fail

Additional info: This course fulfills the compulsory foreign language studies.

CEF Starting Level: B2.1

Kie-98.1107 Effective Reading Strategies (3 cr)

24 + 54 I, II, III, IV

Teacher: English teachers

Contents: The aim is to prepare students to read scientific and technical texts. This course guides students through the reading process, practicing reading strategies, and analyzing texts as well as expanding vocabulary. Students attend workshops and work autonomously, meeting weekly deadlines.

Grade: Pass/fail

Additional info: This course fulfills the compulsory foreign language studies. In the old degree program, this course replaces Kie-98.102.

CEF Starting Level: B2 or higher

Kie-98.1108 Pop Science (3 cr)

36 + 42 I, II, III, IV

Teacher: English teachers

Contents: This course aims to increase the general scientific vocabulary through the reading, writing and discussion of articles from science and technology. Students gain confidence in summarizing ideas in English and presenting them to others.

Grade: Pass/fail

Additional info: This course fulfills the compulsory foreign language studies. In the old degree program, this course replaces Kie-98.104.

CEF Starting Level: B2 or higher

Kie-98.1501 Student Tutoring in English (1 cr)

1 + 25 (independent study) I, II, III, IV

Teacher: English teachers

Contents: Students can receive one credit of foreign language study for tutoring international students. This option requires that the tutor submits a written report in English concerning the tutoring process. Students may also need to come to an interview.

Grade: Pass/fail

Additional info: <http://language.tkk.fi/information/tutoring.htm>

CEF Starting Level: B2

Kie-98.1600 English Reading/Writing Test (1 cr)

I, II, III, IV

Teacher: English teachers

Contents: The reading/writing test is arranged every period. The aim of this test is to demonstrate proficiency in reading comprehension at level C1 or higher on the CEF scale. A pass from this test fulfills part (1:3cr) of the compulsory foreign language studies. Students can register for this test only one time.

Grade: Pass/Fail

Additional: See <http://language.tkk.fi/courses/english/courses.htm#kie981600>. Partly replaces both Kie-98.100 and Kie-98.1100.

CEF Starting Level: C1 or higher

Kie-98.1601 English Oral Skills Test (2 cr)

I, II, III, IV

Teacher: English teachers

Contents: The oral skills test is arranged every period. A pass from this test fulfills part (2:3 cr) of the compulsory foreign language studies. Students can register for this test only one time. The aim of this test is to demonstrate proficiency in English oral skills at level C1 or higher on the CEF scale. Before coming to this test, you will need to do some preparatory tasks.

Grade: Pass/Fail

Additional: See <http://language.tkk.fi/courses/english/courses.htm#kie981601>. Partly replaces both Kie-98.100 and Kie-98.1100.

CEF Starting Level: C1 or higher

Finnish

Kie-98.7011 Finnish 1A (2 cr)

24+28 I, III

Teacher: Seija Koski

Contents: This course introduces students to the vocabulary and basic grammar of Finnish needed in everyday life. Practice is provided through course readings, exercises, and pair work. Because the course is quite intensive and includes much homework, students are expected to attend lessons regularly. The languages of instruction are English and Finnish. Written final exam.

Literature: In-house materials "Suomi 1", Chapters 1 - 5.

Prerequisites: This course is intended for complete beginners.

Additional: This course together with Kie-98.7012 replaces Kie-98.199.

CEF Target Level: A1

Kie-98.7012 Finnish 1B (2 cr)

24+28 II, IV

Teacher: Seija Koski

Contents: This course provides students with further vocabulary and basic grammar needed in everyday life. Practice is provided through course readings, exercises, and pair work. Because the course is quite intensive and includes much homework, students are expected to attend lessons regularly. The languages of instruction are English and Finnish. Written final exam.

Literature: In-house materials "Suomi 1", Chapters 6 - 9.

Prerequisites: Kie-98.7011

Additional: This course together with Kie-98.7011 replaces Kie-98.199.

CEF Target Level: A1

Kie-98.7021 Finnish 2A (2 cr)

24+28 I, III

Teacher: Seija Koski

Contents: This course aims to improve students' discussion skills, further expand their vocabulary and knowledge of basic grammar through readings and exercises, as well as develop writing skills through short essays given as homework. Written final exam.

Literature: In-house materials "Suomi 2", Chapters 1 - 5.

Prerequisites: Kie-98.7012

Additional: This course together with Kie-98.7022 replaces Kie-98.200.

CEF Target Level: A2

Kie-98.7022 Finnish 2B (2 cr)

24+28 II, IV

Teacher: Seija Koski

Contents: This course aims to improve students' discussion skills, further expand their vocabulary and knowledge of basic grammar through readings and exercises, as well as develop writing skills through short essays given as homework. Written final exam.

Literature: In-house materials "Suomi 2", Chapters 6 - 12.

Prerequisites: Kie-98.7021

Additional: This course together with Kie-98.7021 replaces Kie-98.200.

CEF Target Level: A2

Kie-98.7031 Finnish 3A (2 cr)

24+28 I, III

Teacher: Seija Koski

Contents: This course focuses on grammar, exercises, texts and discussion in pairs and groups. Writing skills are practised by writing short essays as homework. Written final exam.

Literature: In-house materials "Suomi 3", Chapters 1 - 4.

Prerequisites: Kie-98.7022

Additional: This course together with Kie-98.7032 replaces Kie-98.201.

CEF Target Level: A2

Kie-98.7032 Finnish 3B (2 cr)

24+28 II, IV

Teacher: Seija Koski

Contents: This course focuses on grammar, exercises, texts and discussion in pairs and groups. Writing skills are practised by writing short essays as homework. Written final exam.

Literature: In-house materials "Suomi 3", Chapters 5 - 10.

Prerequisites: Kie-98.7031

Additional: This course together with Kie-98.7031 replaces Kie-98.201.

CEF Target Level: A2

Kie-98.7041 Finnish 4A (2 cr)

24+28 I, III

Teacher: Seija Koski

Contents: This course aims to expand students' vocabulary and knowledge of grammar through exercises and course readings. Students are expected to participate actively in class discussions and to write essays as homework. Written final exam.

Literature: In-house materials "Suomi 4", Chapters 1 - 6.

Prerequisites: Kie-98.7032

Additional: This course together with Kie-98.7042 replaces Kie-98.202.

CEF Target Level: B1

Kie-98.7042 Finnish 4B (2 cr)

24+28 II, IV

Teacher: Seija Koski

Contents: This course aims to expand students' vocabulary and knowledge of grammar through exercises and course readings. Students are expected to participate actively in class discussions, give a short presentation, and write essays as homework. Written final exam.

Literature: In-house materials "Suomi 4", Chapters 7 - 15.

Prerequisites: Kie-98.7041

Additional: This course together with Kie-98.7041 replaces Kie-98.202.

CEF Target Level: B1

Kie-98.7051 Finnish 5A (2 cr)

2+50 (independent study) I, II, III, IV

Teacher: Seija Koski

Contents: This course is based on independent work. The course aims to expand students' vocabulary and knowledge of grammar through exercises and course readings. Written final exam.

Literature: In-house materials, supplemented by materials collected from the Internet by students.

Prerequisites: Kie-98.7042

Additional: <http://language.hut.fi/courses/finnish/courses.htm>

CEF Starting Level: B1

Kie-98.7071 Finnish for Swedish-speaking Finns (2 cr)

24+28 (lectures when necessary)

Teacher: Seija Koski

Contents: Grammar, texts and discussion. Written homework tasks. Written final exam and active participation in class discussions. Successful completion of the course fulfils the National Language Requirement (Finnish).

Literature: In-house materials.

Prerequisites: Secondary school level Finnish courses (B1 language).

Additional: This course replaces Kie-98.203.

CEF Target Level: B1

Kie-98.7001 National Language Requirement (Finnish), Writing Test (1 cr)**Kie-98.7002 National Language Requirement (Finnish), Oral test (1 cr)**

Teacher: Seija Koski

Contents: Demonstrating proficiency in Finnish is required of all Swedish-speaking students studying according to the Degree Regulations of 1979 (Statutes §14 and §15).

There are four alternative ways to fulfil the National Language Requirement:

1. Passing both the writing and oral tests for the National Language Requirement (Finnish) offered at HUT.
 2. Completing the course Kie-98.7071 Finnish for Swedish-speaking Finns.
 3. Completing an equivalent test for the National Language Requirement (Finnish) held at another Finnish tertiary-level institution.
 4. A certificate of Finnish language proficiency awarded by State Board of Language Examinations (See <http://www.oph.fi/english/SubPage.asp?path=447,490,5373>) supplemented by an oral proficiency test given at the Helsinki University of Technology. The oral proficiency test consists of an interview, in which the student demonstrates command of the vocabulary from their own technical field. Further information: http://kielikeskus.tkk.fi/yleistietoa/toinen_kotimainen_suomi.htm.
- Additional: This course replaces Kie-98.004.
CEF Start Level: B1

French**Kie-98.4011 French 1A (2 cr)**

24+28 I

Teacher: Nina Korimo-Girod

Contents: This is a basic course for beginners in French, which familiarises students with everyday expressions used in French. The course aims to give students confidence in speaking French even with a limited vocabulary.

Literature: Mérieux – Loiseau : Connexions 1 (Didier), section 1 or Eevi Nivanka - Soili Sutinen: Chez Marianne 1 (Finn Lectura), chapters 1-3.

Prerequisites: This course is designed for beginners.

Additional: Together with Kie-98.4012 the course replaces Kie-98.150

Kie-98.4012 French 1B (2 cr)

24+28 II

Teacher: Nina Korimo-Girod

Contents: This is a basic course for beginners in French, which familiarises students with everyday expressions used in French. The course aims to give students confidence in speaking French even with a limited vocabulary.

Literature: Mérieux – Loiseau : Connexions 1 (Didier), section 2 or Eevi Nivanka - Soili Sutinen: Chez Marianne 1 (Finn Lectura), chapters 4-6.

Prerequisites: Kie-98.4011.

Additional: Together with Kie-98.4011 the course replaces Kie-98.150.

CEF Target Level: A1.1

Kie-98.4021 French 2A (2 cr)

24+28 III

Teacher: Nina Korimo-Girod

Contents: Same as 1B. In addition to listening comprehension, this course offers a wide range of dictation and transformation drills, as well as short compositions and translation exercises.

Literature: Mérieux – Loiseau : Connexions 1 (Didier), section 3 or Eevi Nivanka - Soili Sutinen: Chez Marianne 1 (Finn Lectura), chapters 7-9.

Prerequisites: Kie-98.4012.

Additional: Together with Kie-98.4022 the course replaces Kie-98.151

Kie-98.4022 French 2B (2 cr)

24+28 IV

Teacher: Nina Korimo-Girod

Contents: Same as 1B. In addition to listening comprehension, this course offers a wide range of dictation and transformation drills, as well as short compositions and translation exercises.

Literature: Mérieux – Loiseau : Connexions 1 (Didier), section 4 or Eevi Nivanka - Soili Sutinen: Chez Marianne 1 (Finn Lectura), chapters 10-12.

Prerequisites: Kie-98.4021.

Additional: Together with Kie-98.4021 the course replaces Kie-98.151

CEF Target Level: A1.2

Kie-98.4031 French 3A (2 cr)

24+28 I

Teacher: Nina Korimo-Girod

Contents: In addition to practicing a variety of practical communicative situations and central grammar, students work through simple articles.

Literature: Girardet - Gridling: Panorama 1 (CLE International), section 5 or Soili Sutinen - Luciane Hakulinen: Chez Marianne 2 (Finn Lectura), chapters 1-3.

Prerequisites: Kie-98.4022.

Additional: Together with Kie-98.4032 the course replaces Kie-98.152

Kie-98.4032 French 3B (2 cr)

24+28 II

Teacher: Nina Korimo-Girod

Contents: In addition to practicing a variety of practical communicative situations and key grammar, students work through simple newspaper and magazine articles.

Literature: Girardet - Gridling: Panorama 1 (CLE International), section 6 or Soili Sutinen - Luciane Hakulinen: Chez Marianne 2 (Finn Lectura), chapters 4-6.

Additional: Together with Kie-98.4031 the course replaces Kie-98.152

CEF Target Level: A2.1

Kie-98.4041 French 4A (2 cr)

24+28 III

Teacher: Nina Korimo-Girod

Contents: During this course, students work through role-play simulations, write short compositions, and produce verbal summaries based on listening comprehension exercises. In addition, students practise basic grammar.

Literature: Girardet - Gridling: Panorama 2 (CLE International), section 1 or Soili Sutinen - Luciane Hakulinen: Chez Marianne 2 (Finn Lectura), chapters 7-9.

Prerequisites: Kie-98.4032.

Additional: Together with Kie-98.4042 the course replaces Kie-98.153

Kie-98.4042 French 4B (2 cr)

24+28 IV

Teacher: Nina Korimo-Girod

Contents: During this course, students work through role-play simulations, write short compositions, and produce verbal summaries based on listening comprehension exercises. In addition, students practise basic grammar.

Literature: Girardet - Gridling: Panorama 2 (CLE International), section 2 or Soili Sutinen - Luciane Hakulinen: Chez Marianne 2 (Finn Lectura), chapters 10-12.

Prerequisites: Kie-98.4032.

Additional: Together with Kie-98.4041 the course replaces Kie-98.153

CEF Target Level: A2.2

Kie-98.4051 French 5A (2 cr)

24+28 I

Teacher: Alain Thibault

Contents: This course revises some of the basic structures in French, provides a wide range of oral exercises and familiarises students with more difficult texts.

Literature: Girardet - Gridling: Panorama 2, section 3.

Prerequisites: Kie-98.4042 or five years of French at secondary level.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4052 the course replaces Kie-98.154

Kie-98.4052 French 5B (2 cr)

24+28 II

Teacher: Alain Thibault

Contents: This course revises some of the basic structures in French, provides a wide range of oral exercises and familiarises students with more difficult texts.

Literature: Girardet - Gridling: Panorama 2, section 4.

Prerequisites: Kie-98.4051 or five years of French at secondary level

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4051 the course replaces Kie-98.154

CEF Target Level: B1.1

Kie-98.4061 French 6A (2 cr)

24+28 III

Teacher: Nina Korimo-Girod

Contents: During the course, students work through a variety of communicative situations, become familiar with the French classics and practise giving short presentations.

Literature: Girardet - Gridling: Panorama 2, section 5.

Prerequisites: Kie-98.4052 or equivalent knowledge.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4062 the course replaces Kie-98.1545.

Kie-98.4062 French 6B (2 cr)

24+28 IV

Teacher: Nina Korimo-Girod

Contents: During the course, students work through a variety of communicative situations, become familiar with the French classics and practise giving short presentations.

Literature: Girardet - Gridling: Panorama 2, section 6.

Prerequisites: Kie-98.4061 or equivalent knowledge.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4061 the course replaces Kie-98.155.

CEF Target Level: B1.2

Kie-98.4071 French 7A (2 cr)

24+28 I

Teacher: Alain Thibault

Contents: This is an advanced-intermediate course in French. During the course, students practice spoken communicative situations, and create video productions.

Literature: Girardet - Frérot: Panorama 3 (CLE International).

Prerequisites: Kie-98.4062 or ten years of French at secondary level.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4072 the course replaces Kie-98.294.

Kie-98.4072 French 7B (2 cr)

24+28 II

Teacher: Alain Thibault

Contents: This is an advanced-intermediate course in French. During the course, students practice spoken communicative situations, and create video productions.

Literature: Girardet - Frérot: Panorama 3.

Prerequisites: Kie-98.4071 or ten years of French at secondary level.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4071 the course replaces Kie-98.294.

CEF Target Level: B2.1

Kie-98.4081 French 8A (2 cr)

24+28 III

Teacher: Alain Thibault

Contents: This is an advanced course in French. During the course, students practice spoken communicative situations, create video productions and become familiar with newspaper and magazine articles. In addition, they analyze these articles and write short compositions.

Literature: Panorama 3.

Prerequisites: Kie-98.4072 or ten years of French at secondary level.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4082 the course replaces Kie-98.295.

Kie-98.4082 French 8B (2 cr)

24+28 IV

Teacher: Alain Thibault

Contents: This is an advanced course in French. During the course, students practice spoken communicative situations, create video productions and become familiar with newspaper and magazine articles. In addition, they analyze these articles and write short compositions.

Literature: Panorama 3.

Prerequisites: Kie-98.4081 or ten years of French at secondary level.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4081 the course replaces Kie-98.295.

CEF Target Level: B2.2

Kie-98.4101 French for Business 1 (2 cr)

12+40 I

Teacher: Alain Thibault

Contents: This course focuses on business communications in the French-speaking world. Students practise communicating within business and professional settings and expand their business vocabulary.

Literature: Claude Le Goff: Le nouveau French for Business - le Français des Affaires (Hatier International).

Prerequisites: Kie-98.4071

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4102 the course replaces Kie-98.288

Kie-98.4102 French for Business 2 (2 cr)

12+40 II

Teacher: Alain Thibault

Contents: This course focuses on business communications in the French-speaking world. Students practise communicating within business and professional settings and expand their business vocabulary.

Literature: Claude Le Goff: Le nouveau French for Business - le Français des Affaires (Hatier International).

Prerequisites: Kie-98.4101.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4101 the course replaces Kie-98.288.

Kie-98.4103 French for Business 3 (2 cr)

12+40 III

Teacher: Alain Thibault

Contents: This course focuses on business communications in the French-speaking world. Students practise communicating within business and professional settings and expand their business vocabulary. In addition, students practise giving short group presentations.

Literature: Claude Le Goff: *Le nouveau French for Business - le Français des Affaires* (Hatier International).

Prerequisites: Kie-98.4102.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies.

Kie-98.4104 French for Business 4 (2 cr)

12+40 IV

Teacher: Alain Thibault

Contents: This course focuses on business communications in the French-speaking world. Students practise communicating within business and professional settings and expand their business vocabulary. In addition, students practise giving short group presentations.

Literature: Claude Le Goff: *Le nouveau French for Business - le Français des Affaires* (Hatier International).

Prerequisites: Kie-98.4103.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4103 the course replaces Kie-98.289.

CEF Target Level: C1.1

Kie-98.4111 French for Science and Technology 1 (2 cr)

12+40 I

Teacher: Nina Korimo-Girod

Contents: During the course, students become familiar with basic technical vocabulary through the reading of technical articles. Successful completion of the course requires giving an oral presentation and giving peer evaluation. If time permits, the schedule can include guest speakers.

Literature: In-house materials.

Prerequisites: Kie-98.4071 or higher.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4112 the course replaces Kie-98.286.

Kie-98.4112 French for Science and Technology 2 (2 cr)

12+40 II

Teacher: Nina Korimo-Girod

Contents: During the course, students become familiar with basic technical vocabulary through the reading of technical articles. Successful completion of the course requires giving an oral presentation and giving peer evaluation. If time permits, the schedule can include guest speakers.

Literature: In-house materials.

Prerequisites: Kie-98.4111.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4111 the course replaces Kie-98.286.

Kie-98.4113 French for Science and Technology 3 (2 cr)

12+40 III

Teacher: Nina Korimo-Girod

Contents: This course guides students in the independent study of general technical texts. Successful completion of the course requires completing a written assignment from the student's own technical field and presenting it to the class.

Literature: In-house materials.

Prerequisites: Kie-98.4112.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4114 the course replaces Kie-98.287.

Kie-98.4114 French for Science and Technology 4 (2 cr)

12+40 IV

Teacher: Nina Korimo-Girod

Contents: This course guides students in the independent study of general technical texts. Successful completion of the course requires completing a written assignment from the student's own technical field and presenting it to the class.

Literature: In-house materials.

Prerequisites: Kie-98.4113.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4113 the course replaces Kie-98.287.

CEF Target Level: C1.1

Kie-98.4121 French Civilisation 1 (1 cr)

12+14 I

Teacher: Alain Thibault

Contents: This course provides an introduction to the French cultural history, geography and current conditions in France through lectures, films, discussions and short introductory presentations by students.

Literature: To be announced.

Prerequisites: Kie-98.4061 or equivalent knowledge.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4122 the course replaces Kie-98.156.

Kie-98.4122 French Civilisation 2 (1 cr)

12+14 II

Teacher: Alain Thibault

Contents: This course provides an introduction to the French cultural history, geography and current conditions in France through lectures, films, discussions and short introductory presentations by students.

Literature: To be announced.

Prerequisites: Kie-98.4121.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4121 the course replaces Kie-98.156.

Kie-98.4123 French Civilisation 3 (1 cr)

12+14 III

Teacher: Alain Thibault

Contents: This course provides an introduction to the French cultural history, geography and current conditions in France through lectures, films, discussions and short introductory presentations by students.

Literature: To be announced.

Prerequisites: Kie-98.4122.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4124 the course replaces Kie-98.157.

Kie-98.4124 French Civilisation 4 (1 cr)

12+14 IV

Teacher: Alain Thibault

Contents: This course provides an introduction to the French cultural history, geography and current conditions in France through lectures, films, discussions and short introductory presentations by students.

Literature: To be announced.

Prerequisites: Kie-98.4123.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4123 the course replaces Kie-98.157.

CEF Target Level: C1.1

Kie-98.4131 French for Trainees 1 (1 cr)

12+14 I

Teacher: Nina Korimo-Girod

Contents: This course develops students' practical language skills through discussions based on TV news and articles dealing with current affairs. The aim of the course is to prepare students for student exchange and traineeships abroad. Students are also

encouraged to enrol in either Kie-98.4510 or Kie-98.4520, as these courses complement each other.

Literature: Distributed during the course.

Prerequisites: Kie-98.4061 or equivalent knowledge.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4132 the course replaces Kie-98.290.

Kie-98.4132 French for Trainees 2 (1 cr)

12+14 II

Teacher: Nina Korimo-Girod

Contents: This course develops students' practical language skills through discussions based on TV news and articles dealing with current affairs. The aim of the course is to prepare students for student exchange and traineeships abroad. Students are also encouraged to enrol in either Kie-98.4510 or Kie-98.4520, as these courses complement each other.

Literature: Distributed during the course.

Prerequisites: Kie-98.4131 or equivalent knowledge.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4131 the course replaces Kie-98.290.

Kie-98.4133 French for Trainees 3 (1 cr)

12+14 III

Teacher: Nina Korimo-Girod

Contents: This course develops students' practical language skills through discussions based on TV news and articles dealing with current affairs. The aim of the course is to prepare students for student exchange and traineeships abroad. Students are also encouraged to enrol in either Kie-98.4510 or Kie-98.4520, as these courses complement each other.

Literature: Distributed during the course.

Prerequisites: Kie-98.4132

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4134 the course replaces Kie-98.291.

Kie-98.4134 French for Trainees 4 (1 cr)

12+14 IV

Teacher: Nina Korimo-Girod

Contents: This course develops students' practical language skills through discussions based on TV news and articles dealing with current affairs. The aim of the course is to prepare students for student exchange and traineeships abroad. Students are also encouraged to enrol in either Kie-98.4510 or Kie-98.4520, as these courses complement each other.

Literature: Distributed during the course.

Prerequisites: Kie-98.4133

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. Together with Kie-98.4133 the course replaces Kie-98.291.
CEF Target Level: C1.1

Kie-98.4210 Self-access Course in French 1 (1 cr)

2+24 (Independent study) I, II, III, IV

Teacher: Nina Korimo-Girod

Contents: This course gives students an opportunity to design their own course which should be approved in advance by the teacher.

Prerequisites: Kie-98.4061 or ten years of French at secondary level.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies.
CEF Starting Level: C1.1

Kie-98.4220 Self-access Course in French 2 (2 cr)

4+48 (Independent study) I, II, III, IV

Teacher: Nina Korimo-Girod

Contents: This course gives students an opportunity to design their own course which should be approved in advance by the teacher.

Prerequisites: Kie-98.4061 or ten years of French at secondary level.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Starting Level: C1.1

Kie-98.4310 French Grammar 1 (2 cr)

4+48 (Independent study) I, II, III, IV

Teacher: Nina Korimo-Girod

Contents: This course revises basic grammar with a focus on nouns, adjectives and pronouns.

Literature: Nivanka - Sutinen: Ranskan kielioppi ja käsikirja (Finn Lectura) and the exercise book. The teacher gives guidance via email.

Prerequisites: Kie-98.4042 or equivalent knowledge.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. The course replaces Kie-98.158.

CEF Starting Level: C1.1

Kie-98.4320 French Grammar 2 (2 cr)

4+48 (Independent study) I, II, III, IV

Teacher: Nina Korimo-Girod

Contents: This course revises and deepens students' knowledge of basic grammar. The course focuses on the use of verbs.

Literature: Nivanka - Sutinen: Ranskan kielioppi ja käsikirja (Finn Lectura) and the exercise book. The teacher gives guidance via email.

Prerequisites: Kie-98.4310.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies. The course replaces Kie-98.159.

CEF Starting Level: C1.1

Kie-98.4410 French Literature 1 (2 cr)

4+48 (Independent study) I, II, III, IV

Teacher: Nina Korimo-Girod

Contents: This course gives students an opportunity to study the French classics. Successful completion of the course requires passing an oral examination at the end of the course.

Literature: To be announced.

Grade: Pass/fail.

Prerequisites: Kie-98.4082 or ten years of French at secondary level.

Additional: This course meets the university regulations for foreign language studies.

CEF Starting Level: C1.2

Kie-98.4420 French Literature 2 (2 cr)

4+48 (Independent study) I, II, III, IV

Teacher: Nina Korimo-Girod

Contents: This course gives students an opportunity to study the French classics. Successful completion of the course requires passing an oral examination at the end of the course.

Literature: To be announced.

Grade: Pass/fail.

Prerequisites: Kie-98.4410.

Additional: This course meets the university regulations for foreign language studies.

CEF Starting Level: C1.2

Kie-98.4510 Writing in French 1 (1 cr)

2+24 (Independent study) I, II, III, IV

Teacher: Nina Korimo-Girod

Contents: This course aims to familiarize students with various forms of written communication, including business correspondence, email messages and crafting summaries.

Grade: Pass/fail.

Literature: In-house materials.

Prerequisites: Kie-98.4042 or equivalent knowledge.

Additional: This course meets the university regulations for foreign language studies.

CEF Starting Level: C1.1

Kie-98.4520 Writing in French 2 (2 cr)

4+48 (Independent Study) I, II, III, IV

Teacher: Nina Korimo-Girod

Contents: This course aims to familiarize students with various forms of written communication, including business correspondence, email messages and crafting summaries, as well as CVs.

Grade: Pass / fail.

Literature: In-house materials.

Prerequisites: Kie-98.4042 or equivalent knowledge.

Additional: This course meets the university regulations for foreign language studies. The course replaces Kie-98.370.

CEF Starting Level: C1.2

Kie-98.4610 French Pronunciation 1 (2 cr)

4+48 (Independent Study) I, II, III, IV

Teacher: Nina Korimo-Girod.

Contents: In addition to offering an opportunity to check and practice their pronunciation, this course also guides students in distinguishing French sounds and producing flawless French.

Grade: pass/fail.

Literature: Léon: Exercices systématiques de prononciation française and webmaterial.

Prerequisites: Kie-98.4042 or five years of French at secondary level.

Additional: This course meets the university regulations for foreign language studies. The course replaces Kie-98.292.

CEF Starting Level: B1.1

Kie-98.4620 French Pronunciation 2 (2 cr)

4+48 (Independent Study) I, II, III, IV

Teacher: Nina Korimo-Girod.

Contents: In addition to offering an opportunity to check and practice their pronunciation, this course also guides students in using the correct intonation when speaking French.

Grade: pass/fail.

Literature: Léon: Exercices systématiques de prononciation française and webmaterial.

Prerequisites: Kie-98.4610

Additional: This course meets the university regulations for foreign language studies. The course replaces Kie-98.293.

CEF Starting Level: B1.1

Kie-98.4710 French-speaking countries 1 (1 cr)

2+24 (Independent Study) I, II, III, IV

Teacher: Nina Korimo-Girod.

Contents: This course familiarizes students with the history, economic life, or the culture of a French-speaking country. The student completes a written report and orally presents it to the teacher.

Prerequisites: Kie-98.4052.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Starting level: C1.1

Kie-98.4720 French-speaking countries 2 (1 cr)

2+26 (Independent Study) I, II, III, IV

Teacher: Nina Korimo-Girod.

Contents: This course familiarizes students with the history, economic life, or the culture of a French-speaking country. The student completes a written report and orally presents it to the teacher.

Prerequisites: Kie-98.4710

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Starting level: C1.1

Kie-98.4800 - Kie-98.4860 Specialized courses in specific technical areas

4+48 (Independent Study) I, II, III, IV

Teacher: Nina Korimo-Girod.

Contents: This course familiarizes students with the basic technical vocabulary of their own field.

Prerequisites: Kie-98.4072 or Kie-98.4114 or ten years of French at secondary level.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Starting Level: C1.1

Kie-98.4800 Architecture (2 cr)

Kie-98.4810 Chimie technique (2 cr)

Kie-98.4820 Génie électrique (2 cr)

Kie-98.4830 Génie mécanique (2 cr)

Kie-98.4840 Génie informatique (2 cr)

Kie-98.4850 Physique et mathématiques (2 cr)

Kie-98.4860 Transformation du bois (2 cr)

Kie-98.4900 Student tutoring in French/Italian (1 cr)

1+25 (Independent Study) I, II, III, IV

Teacher: Nina Korimo-Girod.

Contents: This course offers students an opportunity to earn one foreign language credit for tutoring international students. This option requires that the tutor submits a written report in French concerning the tutoring process. Students interested should contact the French instructor for further details.

Grade: pass/fail.

Prerequisites: Kie-98.4042.

CEF Starting Level: B1

Additional: See: <http://language.tkk.fi/information/tutoring.htm>

The course replaces Kie-98.011.

German

Kie-98.6011 German 1A (2 cr)

24+28 I, III

Teachers: Pauli Kudel and Kristina Manner

Contents: This course provides an introduction to the basics of German grammar and life in German-speaking countries.

Literature: Kudel - Kyyhkynen: Einverstanden 1 (Otava).

Prerequisites: This course is intended for beginners.

Additional: Together with Kie-98.6012 this course replaces Kie-98.118.

CEF Target Level: A1

Kie-98.6012 German 1B (2 cr)

24+28 II, IV

Teachers: Pauli Kudel and Kristina Manner

Contents: This course presents more basic German structures and provides students with a deeper understanding of life in German-speaking countries.

Literature: Kudel - Kyyhkynen: Einverstanden 1 (Otava).

Prerequisites: Kie-98.6011 or equivalent knowledge.

Additional: Together with Kie-98.6011 this course replaces Kie-98.118.

CEF Target Level: A1

Kie-98.6021 German 2A (2 cr)

24+28 I, III

Teachers: Pauli Kudel and Kristina Manner

Contents: This course provides practice in everyday speaking situations and in understanding short texts. The course also familiarises students with the lifestyle and cultures of German-speaking countries.

Literature: Kudel - Kyyhkynen: Einverstanden 2 (Otava).
Prerequisites: Kie-98.6012 or equivalent knowledge.
Additional: Together with Kie-98.6022 this course replaces Kie-98.119.
CEF Target Level: A1-A2

Kie-98.6022 German 2B (2 cr)

24+28 II, IV
Teachers: Pauli Kudel and Kristina Manner
Contents: This course provides further practice in everyday speaking situations and in reading short texts. The course also familiarises students with the lifestyle and cultures of German-speaking countries.
Literature: Kudel - Kyyhkynen: Einverstanden 2 (Otava).
Prerequisites: Kie-98.6021 or equivalent knowledge.
Additional: Together with Kie-98.6021 this course replaces Kie-98.119.
CEF Target Level: A1-A2

Kie-98.6031 German 3A (2 cr)

24+28 I, III
Teachers: Eeva Elomaa and Caren Schröder.
Contents: This course revises the basics of German grammar presented in earlier courses, and enlarges students' vocabulary. Students also practice conversational situations related to work and leisure-time activities.
Literature: Kauppi - Simon: Fahrplan 2 (Tammi).
Prerequisites: Kie-98.6022 or equivalent knowledge.
Additional: Together with Kie-98.6032 this course replaces Kie-98.450.
CEF Target Level: A2

Kie-98.6032 German 3B (2 cr)

24+28 II, IV
Teachers: Eeva Elomaa and Caren Schröder.
Contents: This course continues revising the basics of German grammar and expanding students' vocabulary. Students also practice more conversational situations related to work and leisure-time activities.
Literature: Kauppi - Simon: Fahrplan 2 (Tammi).
Prerequisites: Kie-98.6022 or equivalent knowledge.
Additional: Together with Kie-98.6031 this course replaces Kie-98.450.
CEF Target Level: A2

Kie-98.6041 German 4A (2 cr)

24+28 I, III
Teachers: Pauli Kudel and Kristina Manner
Contents: This course consolidates key grammar, while developing listening and reading comprehension, as well as providing practice in oral expression.
Literature: Elomaa - Manner - Schröder: Fremde in der Nacht (WSOY) tai Kudel: Land unde Leute (Otava).
Prerequisites: Kie-98.6032 or equivalent knowledge.
Additional: Together with Kie-98.6042 this course replaces Kie-98.451.
CEF Target Level: B1

Kie-98.6042 German 4B (2 cr)

24+28 II, IV
Teachers: Pauli Kudel and Kristina Manner
Contents: This course consolidates key grammar, while developing listening and reading comprehension, as well as providing practice in oral expression.
Literature: Elomaa - Manner - Schröder: Fremde in der Nacht (WSOY) tai Kudel: Land unde Leute (Otava).
Prerequisites: Kie-98.6041 or equivalent knowledge.
Additional: Together with Kie-98.6041 this course replaces Kie-98.451.
CEF Target Level: B1

Kie-98.6051 German 5A (2 cr)

24+28 I, III
Teachers: Eeva Elomaa and Kristina Manner
Contents: This course aims to develop students' oral skills and expand their vocabulary.
Literature: em neu Hauptkurs Deutsch als Fremdsprache (Hueber).
Prerequisites: Kie-98.6042 or equivalent knowledge.
Additional: Together with Kie-98.6052 this course replaces Kie-98.452.
CEF Target Level: B2

Kie-98.6052 German 5B (2 cr)

24+28 II, IV
Teachers: Eeva Elomaa and Kristina Manner
Contents: This course aims to develop students' oral skills and expand their vocabulary.
Literature: em neu Hauptkurs Deutsch als Fremdsprache (Hueber).
Prerequisites: Kie-98.6051 or equivalent knowledge.
Additional: Together with Kie-98.6051 this course replaces Kie-98.452. With a minimum grade of 3, this course meets the university regulations for foreign language studies.
CEF Target Level: B2

Kie-98.6061 German 6A (2 cr)

24+28 I, III
Teachers: Dorothea Simojoki and Caren Schröder
Contents: This course aims to develop students' conversational skills in everyday situations.
Literature: In-house material.
Prerequisites: Kie-98.6052 or equivalent knowledge.
Additional: Together with Kie-98.6062 this course replaces Kie-98.125. With a minimum grade of 3, this course meets the university regulations for foreign language studies.
CEF Target Level: C1

Kie-98.6062 German 6B (2 cr)

24+28 II, IV
Teachers: Dorothea Simojoki and Caren Schröder
Contents: This course aims to develop conversational and argumentative skills, as well as expand students' vocabulary.
Literature: In-house material.
Prerequisites: Kie-98.6061 or equivalent knowledge.
Additional: Together with Kie-98.6061 this course replaces Kie-98.125. With a minimum grade of 3, this course meets the university regulations for foreign language studies.
CEF Target Level: C1

Kie-98.6400 German for Trainees (1 cr)

1+25 (Independent study) I, II, III, IV
Teacher: Pauli Kudel
Contents: This course focuses on developing the practical language skills needed by students for traineeships or study abroad in a German-speaking environment.
Literature: Kontakt Deutsch: Deutsch für berufliche Situationen. (Kievarissa cd.rom).
Grade: Pass/fail.
Prerequisites: Kie-98.6041 or equivalent knowledge.
Additional: This course replaces Kie-98.124.
CEF Starting Level: B1

Kie-98.6440 German Grammar 1 (2 cr)

2+50 (Independent study) I, III
Teacher: Eeva Elomaa
Contents: This course revises the basic structures taught in courses 1A - 3B.
Literature: In-house material and/or a grammar course on the Net.
Grade: Pass/fail.

Prerequisites: Kie-98.6021- Kie-98.6032 or equivalent knowledge.

Additional: This course replaces Kie-98.328.
CEF Starting Level: A2

Kie-98.6450 German Grammar 2 (2 cr)

2+50 (Independent study) I, III

Teacher: Dorothea Simojoki

Contents: This course revises the basic structures taught in courses 4A - 6B.

Literature: grammar course on the Net.

Grade: pass/fail.

Prerequisites: Kie-98.6042 or equivalent knowledge.

Additional: This course replaces Kie-98.329. This course meets the university regulations for foreign language studies

CEF Starting Level: B1

Kie-98.6459 German Listening Comprehension (1 cr)

12+14 I

Teacher: Kristina Manner

Contents: This course aims to develop students' listening skills through a variety of different exercises.

Literature: oral exercises.

Grade: Pass/fail.

Prerequisites: Kie-98.6041 or equivalent knowledge.

CEF Target Level: A2-B1

Kie-98.6569 German in the Media (2 cr)

24+28

Teachers: Eeva Elomaa and Pauli Kudel.

Contents: This course aims to familiarise students with the German language and its differences in different mass media.

Literature: In-house material.

Grade: Pass/fail.

Prerequisites: Kie-98.6052 or equivalent knowledge.

Additional: This course fulfills the foreign language degree requirements.

CEF Target Level: B2

Kie-98.6579 German Conversation (1 cr)

12+14 III

Teacher: Pauli Kudel

Contents: This course aims to maintain and develop students' oral skills through the discussion of current topics based on articles and short presentations.

Grade: Pass/fail.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: This course replaces Kie-98.457. This course fulfills the foreign language degree requirements.

CEF Target Level: B2

Kie-98.6609 German Writing Skills (2 cr)

38+14 (Partially independent study) III

Teacher: Caren Schröder

Contents: This course aims to develop students' writing skills in German and familiarise them with various forms of written communication.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Target Level: B2-C1

Kie-98.6619 Introduction to German Culture 1 (1 cr)

12+14 III

Teacher: Pauli Kudel

Contents: This course provides an introduction to the past and present situation of the German-speaking countries.

Grade: Pass/fail.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: This course replaces Kie-98.128. This course fulfills the foreign language degree requirements.

CEF Target Level: B1

Kie-98.6620 Introduction to German Culture 2 (1 cr)

12+14 I

Teacher: Pauli Kudel

Contents: This course provides a more in-depth view of the cultures, history and current situation of German-speaking countries through reading assignments and student presentations.

Grade: Pass/fail.

Prerequisites: Kie-98.6619

Additional: This course fulfills the foreign language degree requirements.

CEF Target Level: B2

Kie-98.6629 German Literature 1 (2 cr)

1+51 (Independent study)

Teacher: Pauli Kudel

Contents: In this course, students read German-language fiction and are then tested orally in German on the content of their readings.

Literature: Negotiated with teacher.

Grade: Pass/fail.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: This course replaces Kie-98.132. This course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.6630 German Literature 2 (2 cr)

1+51 (Independent study)

Teacher: Pauli Kudel

Contents: In this course, students read German-language fiction and are then tested orally in German on the content of their readings.

Literature: Negotiated with teacher.

Prerequisites: Kie-98.6629

Additional: This course fulfills the foreign language degree requirements.

CEF Starting Level: C1

Kie-98.6649 German for Business A (2 cr)

24+28 III

Teacher: Dorothea Simojoki

Contents: This course provides practice in communicating within business and professional settings.

Prerequisites: Kie-986051 or equivalent knowledge.

Additional: Together with the course Kie.66.51 B this course replaces Kie-98.453. This course fulfills the foreign language degree requirements.

CEF Target Level: B2

Kie-98.6651 German for Business B (2 cr)

24+28 IV

Teacher: Dorothea Simojoki

Contents: This course provides practice in communicating within business and professional settings.

Prerequisites: Kie-986051 or equivalent knowledge.

Additional: Together with the course Kie.98.6649 this course replaces Kie-98.453. This course fulfills the foreign language degree requirements.

CEF Target Level: C1

Kie-98.6650 German for Export (2 cr)

24+28 (Independent study) I, II, III, IV

Teacher: Dorothea Simojoki

Contents: This course focuses on exercises simulating key situations in export and trade.

Grade: Pass/fail.

Prerequisites: Kie-986051 or equivalent knowledge.

Additional: This course replaces Kie-98.331. This course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.6669 Oral Communication (2 cr)

24+28

Teachers: Caren Schröder and Pauli Kudel

Contents: This course familiarises students with German customs and related forms of oral communication.

Grade: Pass/fail

Prerequisites: Kie-98.6650, Kie-98.6062 or equivalent knowledge.

Additional: This course replaces Kie-98.455. This course fulfills the foreign language degree requirements.

CEF Target Level: B2-C1

Kie-98.6700 Self-access Course in German 1 (1 cr)

2+24 (Independent study) I, II, III, IV

Teacher: Pauli Kudel

Contents: This course allows students to design a course suitable to their own needs. The course can include both independent study as well as group activities.

Grade: Pass/fail

Prerequisites: Kie-98.6052 or equivalent knowledge.

Additional: This course replaces Kie-98.337. This course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.6710 Self-access Course in German 2 (2 cr)

1+52 (Independent study) I, II, III, IV

Teacher: Pauli Kudel

Contents: This course offers an expanded version of Kie-98.6700, which allows students to design a course that can include both independent study and group activities.

Grade: Pass/fail

Prerequisites: Kie-98.6700, Kie-98.6061 or equivalent knowledge.

Additional: This course replaces Kie-98.334. This course fulfills the foreign language degree requirements.

CEF Starting Level: C1

Kie-98.6729 Technical German Reading Comprehension (2-3 cr)

12+40 or 12+66 (Partially independent study) I, III

Teacher: Pauli Kudel

Contents: This course aims to familiarise students with general technical texts, and to improve their ability to read professional literature in German with sufficient speed.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: This course replaces Kie-98.123. This course fulfills the foreign language degree requirements.

CEF Target Level: B2-C1

Kie-98.6739 German for Science and Technology 1 (2 cr)

24+28

Teacher: Caren Schröder

Contents: This course aims to familiarise students with technical German through oral and written exercises.

Literature: Aus moderner Technik und Naturwissenschaft (Hueber). Units 1-4.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: Together with Kie-98.6749 this course replaces Kie-98.123. This course fulfills the foreign language degree requirements.

CEF Target Level: B2

Kie-98.6749 German for Science and Technology 2 (2 cr)

24+28 II, IV

Teacher: Caren Schröder

Contents: This course aims to familiarise students with technical German through oral and written exercises, including oral presentations on topics related to the students' own fields of study.

Literature: Aus moderner Technik und Naturwissenschaft (Hueber). Units 5-7.

Grade: Pass/fail.

Prerequisites: Kie-98.6739 or equivalent knowledge.

Additional: Together with Kie-98.6739 this course replaces Kie-98.123. This course fulfills the foreign language degree requirements.

CEF Target Level: C1

Kie-98.6810 German for Architects (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Pauli Kudel

Contents: This course aims to improve students' command of basic vocabulary in the field of architecture through a variety of exercises.

Grade: Pass/fail.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: This course replaces Kie-98.326. This course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.6820 German for Electronics (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Kristina Manner

Contents: This course aims to improve students' command of basic vocabulary in the field of electronics through a variety of exercises.

Grade: Pass/fail.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: This course replaces Kie-98.325. This course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.6830 German for Energy Technology (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Eeva Elomaa

Contents: This course aims to improve students' command of basic vocabulary in the field of energy technology through a variety of exercises.

Grade: Pass/fail.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: This course replaces Kie-98.320. This course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.6840 German for Chemists (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Caren Schröder

Contents: This course aims to improve students' command of basic vocabulary in the field of chemistry through a variety of exercises.

Grade: Pass/fail.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: This course replaces Kie-98.323. This course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.6850 German for Mechanical Engineering (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Eeva Elomaa

Contents: This course aims to improve students' command of basic vocabulary in the field of mechanical engineering through a variety of exercises.

Grade: Pass/fail.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: This course replaces Kie-98.333. This course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.6860 German for Forest Products Technology (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Caren Schröder

Contents: This course aims to improve students' command of basic vocabulary in the field of forest products technology through a variety of exercises.

Grade: Pass/fail.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: This course replaces Kie-98.321. This course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.6870 German for Construction Design (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Kristina Manner

Contents: This course aims to improve students' command of basic vocabulary in the field of construction design through a variety of exercises.

Grade: Pass/fail.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: This course replaces Kie-98.322. This course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.6880 German for Electrical Engineering (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Dorothea Simojoki

Contents: This course aims to improve students' command of basic vocabulary in the field of electrical engineering through a variety of exercises.

Grade: Pass/fail.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: This course replaces Kie-98.324. This course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.6890 Environmental German (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Pauli Kudel

Contents: This course aims to improve students' command of basic vocabulary in the field of environmental sciences through a variety of exercises.

Grade: Pass/fail.

Prerequisites: Kie-98.6051 or equivalent knowledge.

Additional: This course replaces Kie-98.456. This course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.6900 Student Tutoring in German (1 cr)

1+25 (Independent study) I, II, III, IV

Teacher: Pauli Kudel

Contents: Students can receive one credit of foreign language study for tutoring international students. This option requires that the tutor submits a written report in German concerning the tutoring process. Students wishing to take this option should contact the German teacher for further details.

Grade: Pass/Fail

Additional: See <http://language.tkk.fi/information/tutoring.htm>

CEF Starting Level: B2

Japanese

Kie-98.3015 Japanese 1 (4 cr)

48+60 I-II

Teacher: Junichiro Okura

Contents: This is a basic course for beginners in Japanese. The course teaches students basic vocabulary and grammar as well as introduces them to the Kana characters. Students work in pairs and learn Japanese through texts, exercises, and discussions. Homework consists of character and grammar exercises. There is a final exam at the end of the course.

Literature: Handout "Iki iki Nihongo" Units 1-5.

Prerequisites: The course is designed for beginners.

Additional: This course replaces Kie-98.241 or both Kie-98.3011 and Kie-98.3012.

CEF Target Level: A 1

Kie-98.3026 Japanese 2 (4 cr)

48+60 III-IV

Teacher: Junichiro Okura

Contents: This is a basic course for beginners in Japanese. The course teaches students basic vocabulary and grammar. Students work in pairs and learn Japanese through texts, exercises, and discussions. Homework consists of character and grammar exercises. There is a final exam at the end of the course.

Literature: Handout "Iki iki Nihongo" Units 6-10.

Prerequisites: Kie-98.3015.

Additional: This course replaces Kie-98.242 or both Kie-98.3023 and Kie-98.3024.

CEF Target Level: A 2

Kie-98.3035 Japanese 3 (4 cr)

48+60 I-II

Teacher: Junichiro Okura

Contents: This is an intermediate basic course in Japanese. The course offers students an opportunity to further develop their vocabulary and grammar, as well as introduces them to the kanji characters. Students work in pairs and learn Japanese through texts, exercises, and discussions. During this course, the students will also begin writing simple compositions in Japanese. Homework consists of character and grammar exercises. There is a final exam at the end of the course.

Literature: Handout "Iki iki Nihongo" Unit11-14. Basic Kanji Book Units 11-15.

Prerequisites: Kie-98.3026.

Additional: This course replaces Kie-98.243 or both Kie-98.3031 and Kie-98.3032.

CEF Target Level: A 2

Kie-98.3046 Japanese 4 (4 cr)

48+60 III-IV

Teacher: Junichiro Okura

Contents: This is an intermediate basic course in Japanese. The course offers students an opportunity to further develop their vocabulary and grammar and to deepen their knowledge of the kanji characters. In this course, students work in pairs and learn Japanese through texts, exercises, and discussions. The homework for the course consists of character and grammar exercises. There is a final exam at the end of the course.

Literature: Handout "Iki iki Nihongo" Unit15-18. Basic Kanji Book Units 16-20.

Prerequisites: Kie-98.3035.

Additional: This course replaces Kie-98.244 or both Kie-98.3043 and Kie-98.3044.

CEF Target Level: B 1

Kie-98.3055 Japanese 5 (4 cr)

48+60 I-II

Teacher: Junichiro Okura

Contents: This is an advanced basic course in Japanese. The course offers students an opportunity to further develop their vocabulary and grammar, as well as to deepen their knowledge of the kanji characters. In this course, students work in pairs and learn Japanese through texts, exercises, and discussions. The homework for the course consists of character and grammar exercises. There is a final exam at the end of the course.

Literature: Handout "Iki iki Nihongo" Unit 19-22. Basic Kanji Book Units 21-25.

Prerequisites: Kie-98.3046.

Additional: This course replaces Kie-98.245 or both Kie-98.3051 and Kie-98.3052. To meet the university regulations for foreign language studies, a student must complete Kie-98.3055 with a minimum grade of 3.

CEF Target Level: B 1

Kie-98.3066 Japanese 6 (4 cr)

48+60 III-IV

Teacher: Junichiro Okura

Contents: This is an advanced basic course in Japanese. The course offers students an opportunity to further develop their vocabulary and grammar and to deepen their knowledge of the kanji characters. In this course, students work in pairs and learn Japanese through texts, exercises, and discussions. The homework for the course consists of character and grammar exercises and written assignments. There is a final exam at the end of the course.

Literature: Handout "Iki iki Nihongo" Unit 23-25. Basic Kanji Book Units 26-30.

Prerequisites: Kie-98.3055.

Additional: This course replaces Kie-98.246 or both Kie-98.3063 and Kie-98.3064. To meet the university regulations for foreign language studies, a student must complete Kie-98.3066 with a minimum grade of 3.

CEF Target Level: B 2

Kie-98.3795 Japanese Seminar in Technology 1 (2 cr)

24+30 I-II

Teacher: Junichiro Okura

Contents: This is an advanced level course in Japanese that reviews the content of earlier courses (Japanese 1-6). During the course, students read articles on science and technology, and give short presentations in Japanese based on these articles. This course teaches the students to present their ideas in Japanese and to understand spoken Japanese. In addition, the students are expected to complete a written assignment in Japanese and participate actively in classes.

Literature: To be announced. Articles come from a variety of sources including the Internet.

Prerequisites: Kie-98.3066.

Additional: This course replaces Kie-98.249 or both Kie-98.3791 and Kie-98.3792. To meet the university regulations for foreign language studies, a student must complete Kie-98.3795.

CEF Target Level: C 1

Kie-98.3896 Japanese Seminar in Technology 2 (2 cr)

24+30 III-IV

Teacher: Junichiro Okura

Contents: This is an advanced level course in Japanese. The central aim of the course is to acquaint students with basic scientific vocabulary in Japanese through the reading of articles on science and technology. In addition, students are expected to complete a written assignment in Japanese based on a topic from their own field and participate actively in classes.

Literature: To be announced. The articles come from a variety of sources including the Internet.

Prerequisites: Kie-98.3795.

Additional: This course replaces Kie-98.252 or both Kie-98.3893 and Kie-98.3894. To meet the university regulations for foreign language studies, a student must complete Kie-98.3896.

CEF Target Level: C 1

Kie-98.3229 Introduction to Kanji System (2 cr)

24+30 III-IV

Teacher: Junichiro Okura

Contents: This is a supplementary course for students who have studied Japanese for about 50 hours. In addition, the course serves as an introduction to the independent study of Chinese characters, the Kanji signs. The course familiarizes students with the basic idea, logic and system entirety, special features, and the evolutionary history of the Kanji system. There is a final exam at the end of the course.

Literature: Basic Kanji Book (Bonjinsha). Units 1-10.

Prerequisites: Kie-98.3015.

Additional: The course replaces Kie-98.247.

CEF Target Level: Unclassified

Kie-98.3249 Japanese for Everyday Use (2 cr)

24+30 III-IV

Teacher: Junichiro Okura

Contents: This is a supplementary course for those who have studied Japanese for about 150 hours. As the central aim is to improve students' fluency in everyday Japanese, this course focuses on oral communication and uses audio-visual material as a teaching aid.

Literature: In-house material "Nihongo de ikou!"

Prerequisites: Kie-98.3035.

Grade: pass/fail

Additional: The course replaces Kie-98.253.

CEF Target Level: B 1

Kie-98.3410 Japanese Culture (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Junichiro Okura

Contents: In this course, students gain knowledge of Japanese customs, arts and philosophy. In addition, they read technical literature and summarize a text in Japanese. Successful completion of the course requires submitting a written assignment and passing an oral interview in Japanese.

Literature: To be announced.

Prerequisites: Kie-98.3066.

Grade: pass/fail

Additional: The course meets the university regulations for foreign language studies.

CEF Target Level: C 1

Kie-98.3420 Japanese Society (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Junichiro Okura

Contents: In this course, students gain a deep appreciation and an understanding of special features of the Japanese society. In addition, they read technical literature and summarize a text in Japanese. Successful completion of the course requires submitting a written assignment and passing an oral interview in Japanese.

Literature: To be announced.

Prerequisites: Kie-98.3066.

Grade: pass/fail

Additional: This course meets the university regulations for foreign language studies.

CEF Target Level: C 1

Kie-98.3430 Professional Literature in Japanese (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Junichiro Okura

Contents: In this course, students read technical literature in Japanese. Successful completion of the course requires submitting a written assignment and passing an oral interview in Japanese.

Literature: To be announced.

Prerequisites: Kie-98.3066.

Grade: pass/fail

Additional: This course meets the university regulations for foreign language studies.

CEF Target Level: C 1

Kie-98.3440 Japanese Literature (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Junichiro Okura

Contents: In this course, students read Japanese fiction. Successful completion of the course requires submitting a written assignment and passing an oral interview in Japanese.

Literature: To be announced.

Prerequisites: Kie-98.3066.

Grade: pass/fail

Additional: This course meets the university regulations for foreign language studies.

CEF Target Level: C 1

Kie-98.3450 Writing in Japanese (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Junichiro Okura

Contents: In this course, students are introduced to different genres and writing conventions in Japanese. The course offers students an opportunity to practice writing letters, reports and summaries in Japanese. Successful completion of the course requires passing an oral interview in Japanese.

Literature: To be announced.

Prerequisites: Kie-98.3066.

Grade: pass/fail

Additional: This course meets the university regulations for foreign language studies.

CEF Target Level: C 1

Kie-98.3460 Japanese in the Media (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Junichiro Okura

Contents: This course is designed to familiarise students with the language of the media (newspapers, magazines, and TV news). In addition, they summarize a text in Japanese. Successful completion of the course requires submitting a written assignment and passing an oral interview in Japanese.

Literature: To be announced.

Prerequisites: Kie-98.3066.

Grade: pass/fail

Additional: This course meets the university regulations for foreign language studies.

CEF Target Level: C 1

Kie-98.3470 Japanese for Business (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Junichiro Okura

Contents: In this course, students learn the key terms, concepts, and expressions used in the Japanese business world. They are also introduced to the Japanese cultural etiquette. In addition, they read technical literature and summarize a text in Japanese. Successful completion of the course requires submitting a written assignment and passing an oral interview in Japanese.

Literature: To be announced.

Prerequisites: Kie-98.3066.

Grade: pass/fail

Additional: This course meets the university regulations for foreign language studies.

CEF Target Level: C 1

Kie-98.3480 Technical Vocabulary in Japanese (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Junichiro Okura

Contents: This course aims to improve students' technical vocabulary in Japanese. During the course, students create specialized trilingual glossaries of technical terms in their chosen field. All terms are in Japanese, Finnish and English. Successful completion of the course requires submitting a written assignment and passing an oral interview in Japanese.

Literature: To be announced.

Prerequisites: Kie-98.3066.

Grade: pass/fail

Additional: This course meets the university regulations for foreign language studies.

CEF Target Level: C 1

Kie-98.3490 Japanese Reading Comprehension for Technical Sciences (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Junichiro Okura

Contents: The aim of this course is to guide students through reading scientific and technical texts and producing well-structured written summaries. Successful completion of the course requires submitting a written assignment and passing an oral interview in Japanese.

Literature: To be announced.

Prerequisites: Kie-98.3066.

Grade: pass/fail

Additional: This course meets the university regulations for foreign language studies.

CEF Target Level: C 1

Kie-98.3520 Japanese for Export (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Junichiro Okura

Contents: In this course, students learn the key terms, concepts, and expressions used in the world of Japanese export. They are also introduced to the Japanese cultural etiquette. In addition, students read technical literature and summarize a text in Japanese. Successful completion of the course requires submitting a written assignment and passing an oral interview in Japanese.

Literature: To be announced.

Prerequisites: Kie-98.3066.

Grade: pass/fail

Additional: This course meets the university regulations for foreign language studies.

CEF Target Level: C 1

Kie-98.3530 Environmental Japanese (2 cr)

2+50 (Independent study) I, II, III, IV

Teacher: Junichiro Okura

Contents: This course focuses on environmental issues. Students read technical literature and summarize a text in Japanese. Successful completion of the course requires submitting a written assignment and passing an oral examination, an interview in Japanese.

Literature: To be announced.

Prerequisites: Kie-98.3066.

Grade: pass/fail

Additional: This course meets the university regulations for foreign language studies.

CEF Target Level: C 1

Kie-98.3900 Student Tutoring in Japanese (1 cr)

1+25 (Independent study) I, II, III, IV

Teacher: Junichiro Okura

Contents: This course offers students an opportunity to earn one foreign language credit for tutoring international students. This option requires that the tutor submits a written report in Japanese concerning the tutoring process. Students interested should contact the Japanese instructor for further details.

Grade: pass/fail

Additional: See: <http://language.tkk.fi/information/tutoring.htm>

CEF Target Level: B 1

Portuguese**Ako-98.9390 Portuguese 1 (4 cr)**

Open University (<http://www.avoin.hut.fi>). Please note: There is a registration fee for the course.

Teacher: Dorothea Simojoki

Contents: A self-study course of basic Portuguese. Basic vocabulary and grammar, and practising the use of the language in everyday situations.

Literature: To be chosen with the teacher.

Replaces course Kie-98.390.

Ako-98.9391 Portuguese 2 (4 cr)

See Open University (<http://www.avoin.hut.fi>). Please note: There is a registration fee for the course.

Teacher: Dorothea Simojoki

Contents: Enhancing both oral and written skills by increasing the amount of vocabulary and structures.

Literature: To be chosen with the teacher.

Prerequisites: Kie-98.390 or Ako-98.9390.

Replaces course Kie-98.391.

Russian

Kie-98.8001 A Foretaste of Russian (1 cr)

12 + 14 I

Teacher: Maria Nikiforow

Contents: This course provides a brief introduction to the Russian alphabet, pronunciation, numbers, and common phrases.

Literature: Materials provided by teacher

Prerequisites: This is a course for beginners.

Additional: This course replaces Kie-98.137.

Kie-98.8011 Russian 1A (2 cr)

24 + 28 I

Teacher: Maria Nikiforow

Contents: This course provides an introduction to the Russian alphabet, pronunciation, basic structures and grammar.

Literature: M. Nikiforow, R. Keränen, V. Alikov: Saljut 1 (Units 1-3)

Prerequisites: This is a course for beginners.

Additional: This course together with Kie-98.8012 replaces Kie-98.135.

CEF Target Level: A1.1

Kie-98.8012 Russian 1B (2 cr)

24+28 II

Teacher: Maria Nikiforow

Contents: This course provides more Russian structures and expands students' vocabulary at the beginning level.

Literature: M. Nikiforow, R. Keränen, V. Alikov: Saljut 1 (Units 4-6)

Prerequisites: Kie-98.8011

Additional: This course together with Kie-98.8011 replaces Kie-98.135.

CEF Target Level: A1.1

Kie-98.8021 Russian 2A (2 cr)

24+28 III

Teacher: Maria Nikiforow

Contents: This course continues by deepening students' understanding of basic grammar and vocabulary.

Literature: M. Nikiforow, R. Keränen, V. Alikov: Saljut 1 (Units 7-9)

Prerequisites: Kie-98.8012

Additional: This course together with Kie-98.8022 replaces Kie-98.136.

CEF Target Level: A1.2

Kie-98.8022 Russian 2B (2 cr)

24+28 IV

Teacher: Maria Nikiforow

Contents: This course provides further structures, grammar and vocabulary at the beginning level. Students practise speaking Russian in simple language situations and write short essays.

Literature: M. Nikiforow, R. Keränen, V. Alikov: Saljut 1 (Units 10-12)

Prerequisites: Kie-98.8021

Additional: This course together with Kie-98.8021 replaces Kie-98.136.

CEF Target Level: A1.2

Kie-98.8031 Russian 3A (2 cr)

24+28 I

Teacher: Maria Nikiforow

Contents: This course revises the language presented in earlier courses, deepens students' command of structures and grammar, and enlarges their vocabulary. During the course, students practise talking in Russian about topics of interest in their lives.

Literature: M. Nikiforow, R. Keränen, N. Patrikainen: Saljut 2 (Units 1-2)

Prerequisites: Kie-98.8022

Additional: This course together with Kie-98.8032 replaces Kie-98.138.

CEF Target Level: A1.2

Kie-98.8032 Russian 3B (2 cr)

24+28 II

Teacher: Maria Nikiforow

Contents: This course continues deepening students' command of sentence structures and enlarging their vocabulary. Topics include health and well-being, outdoor activities, and gardening.

Literature: M. Nikiforow, R. Keränen, N. Patrikainen: Saljut 2 (Units 3-4)

Prerequisites: Kie-98.8031

Additional: This course together with Kie-98.8031 replaces Kie-98.138.

CEF Target Level: A2.1

Kie-98.8041 Russian 4A (2 cr)

24+28 III

Teacher: Lena Hillebrandt

Contents: This course consolidates and expands on structures learned in earlier courses, with a focus on using Russian to communicate in different situations when visiting Russian cities.

Literature: M. Nikiforow, R. Keränen, N. Patrikainen: Saljut 2 (Units 5-6)

Prerequisites: Kie-98.8032

Additional: This course together with Kie-98.8042 replaces Kie-98.139.

CEF Target Level: A2.1

Kie-98.8042 Russian 4B (2 cr)

24+28 IV

Teacher: Lena Hillebrandt

Contents: This course widens students' command of language structures and vocabulary. Topics include studying, hobbies, shopping, and celebrations.

Literature: M. Nikiforow, R. Keränen, N. Patrikainen: Saljut 2 (Units 7-8)

Prerequisites: Kie-98.8041

Additional: This course together with Kie-98.8041 replaces Kie-98.139.

CEF Target Level: A2.1

Kie-98.8051 Russian 5A (2 cr)

24+28 I

Teacher: Lena Hillebrandt

Contents: This course revises the basic structures of the Russian language and expands students' vocabulary, with a focus on using Russian to exchange opinions. Discussion topics include train travel, nature conservation, and TV programmes.

Literature: M. Nikiforow, R. Keränen, N. Patrikainen: Saljut 2 (Units 9-10)

Prerequisites: Kie-98.8042

Additional: This course together with Kie-98.8052 replaces Kie-98.141.

CEF Target Level: A2.2

Kie-98.8052 Russian 5B (2 cr)

24+28 II

Teacher: Lena Hillebrandt

Contents: This course introduces the use of participles, gerunds and passive forms of expression. During the course, students write essays. Topics include Russian customs, Orthodox traditions, and literature.

Literature: M. Nikiforow, R. Keränen, N. Patrikainen: Saljut 2 (Units 11-12)

Prerequisites: Kie-98.8051

Additional: This course together with Kie-98.8051 replaces Kie-98.141.

CEF Target Level: A2.2

Kie-98.8061 Russian 6A (2 cr)

24+28 III

Teacher: Maria Nikiforow

Contents: This course focuses on developing students' spoken skills in a variety of everyday situations.

Literature: Materials provided by teacher.

Prerequisites: Kie-98.8052

Additional: This course together with Kie-98.8062 replaces Kie-98.142.

CEF Target Level: B1.1

Kie-98.8062 Russian 6B (2 cr)

24+28 IV

Teacher: Maria Nikiforow

Contents: This course focuses on developing students' listening, reading, and writing skills.

Literature: Materials provided by teacher.

Prerequisites: Kie-98.8061

Additional: This course together with Kie-98.8061 replaces Kie-98.142. The course can fulfill the foreign language degree requirements, if a final grade of 3 or above is obtained.

CEF Target Level: B1.1

Kie-98.8069 Russian for Everyday Use (3 cr)

36+42 (intensive course, lectured on demand)

Teacher: Maria Nikiforow

Contents: This course provides students with practice in speaking Russian in everyday situations.

Literature: Materials provided by teacher.

Prerequisites: Kie-98.8052

Additional: This course replaces Kie-98.140.

CEF Target Level: B1.1

Kie-98.8071 Russian for Business 1 (2 cr)

24+28 I

Teacher: Maria Nikiforow

Contents: This course provides students with practice in telephoning.

Literature: S-L. Ojanen, E. Laurila-Hellman, I. Prokkola: Sekret uspeha 1 / Yrityksen viestintää (Units 1-4)

Prerequisites: Kie-98.8062

Additional: This course together with Kie-98.8072 replaces Kie-98.144. The course can fulfill the foreign language degree requirements, if a final grade of 3 or above is obtained.

CEF Target Level: B1.2

Kie-98.8072 Russian for Business 2 (2 cr)

24+28 II

Teacher: Maria Nikiforow

Contents: This course aims to familiarise students with the language used in business correspondence, as well as the phrases and expressions associated with visiting Russian businesses.

Literature: S-L. Ojanen, E. Laurila-Hellman, I. Prokkola: Sekret uspeha 1 / Yrityksen viestintää (Units 5-7)

Prerequisites: Kie-98.8071

Additional: This course together with Kie-98.8071 replaces Kie-98.144. The course can fulfill the foreign language degree requirements, if a final grade of 3 or above is obtained.

CEF Target Level: B1.2

Kie-98.8075 Russian for Business 3 (1 cr)

64+22 (independent study) IV

Teacher: Maria Nikiforow

Contents: This course aims to develop students' spoken skills, with a focus on product and company presentations.

Prerequisites: Kie-98.8081

Additional: This course replaces Kie-98.363. The course can fulfill the foreign language degree requirements, if a final grade of 3 or above is obtained.

CEF Starting Level: B1.2

Kie-98.8081 Industrial Russian 1 (2 cr)

24+28 III

Teacher: Lena Hillebrandt

Contents: The vocabulary of industry and commerce.

Literature: S-L. Ojanen, E. Laurila-Hellman, I. Prokkola: Sekret uspeha 1 / Yrityksen viestintää (Units 8-10) and supplementary material.

Prerequisites: Kie-98.8062

Additional: This course together with Kie-98.8082 replaces Kie-98.145. The course can fulfill the foreign language degree requirements, if a final grade of 3 or above is obtained.

CEF Target Level: B1.2

Kie-98.8082 Industrial Russian 2 (2 cr)

24+28 IV

Teacher: Lena Hillebrandt

Contents: This course focuses on texts concerning Finnish economic and business life.

Literature: Materials provided by teacher.

Prerequisites: Kie-98.8081

Additional: This course together with Kie-98.8081 replaces Kie-98.145. The course can fulfill the foreign language degree requirements, if a final grade of 3 or above is obtained.

CEF Target Level: B2

Kie-98.8090 Russian in the Media 1 (2 cr)

6+46 (independent study) I

Teacher: Maria Nikiforow

Contents: This course aims to familiarise students with the vocabulary and language structures common to newspaper articles. During the course, students learn to cope with even the most difficult newspaper articles.

Literature: Materials provided by teacher.

Prerequisites: Kie-98.8062

Additional: This course together with Kie-98.8095 replaces Kie-98.146. The course can fulfill the foreign language degree requirements, if a final grade of 3 or above is obtained.

CEF Target Level: B2

Kie-98.8095 Russian in the Media 2 (1 cr)

4+22 (independent study) II

Teacher: Maria Nikiforow

Contents: This course guides students in following TV news reports in Russian.

Literature: Materials provided by teacher.

Prerequisites: Kie-98.8062

Additional: This course together with Kie-98.8090 replaces Kie-98.146. The course can fulfill the foreign language degree requirements, if a final grade of 3 or above is obtained.

CEF Target Level: B2

Kie-98.8100 Russian Reading Comprehension for Science and Technology 1 (2 cr)

6+46 (independent study) III

Teacher: Maria Nikiforow

Contents: This course aims to familiarise students with the sentence structures commonly found in scientific texts through the reading of popularised science articles.

Literature: Materials provided by teacher.

Prerequisites: Kie-98.8062

Additional: This course together with Kie-98.8105 replaces Kie-98.147. The course can fulfill the foreign language degree requirements, if a final grade of 3 or above is obtained.

CEF Target Level: C1

Kie-98.8105 Russian Reading Comprehension for Science and Technology 2 (1 cr)

4+22 (independent study) IV

Teacher: Maria Nikiforow

Contents: In this course, students select a longer popular science article, write a summary on the article, and then give an oral presentation in Russian based on the article.

Grade: Pass/Fail

Prerequisites: Kie-98.8100

Additional: This course together with Kie-98.8100 replaces Kie-98.147. The course fulfills the foreign language degree requirements.

CEF Starting Level: C1

Kie-98.8110 Russian for Science and Technology 1 (2 cr)

2+50 (independent study) I, II, III, IV

Teacher: Maria Nikiforow

Contents: In this course, students read literature in their field of study, select and become familiar with several areas in that field, write a summary of the areas read, and compile vocabularies based on their readings.

Literature: Negotiated with Teacher.

Grade: Pass/Fail

Prerequisites: Kie-98.8100

Additional: This course replaces Kie-98.360. The course fulfills the foreign language degree requirements.

CEF Target Level: C1

Kie-98.8115 Russian for Science and Technology 2 (1 cr)

2+24 (independent study) III, IV

Teacher: Maria Nikiforow

Contents: In this course, students choose an extended article from a technical field of interest, write a summary of the article, and give an oral presentation in Russian based on the article.

Literature: Negotiated with Teacher.

Grade: Pass/Fail

Prerequisites: Kie-98.8100

Additional: The course fulfills the foreign language degree requirements.

CEF Starting Level: C1

Kie-98.8120 Russian Literature 1 (1 cr)

2+24 (independent study) I, II, III, IV

Teacher: Maria Nikiforow

Contents: In this course, students read Russian fiction and novels, and are then tested orally on the content of their readings.

Literature: Negotiated with Teacher.

Grade: Pass/Fail

Prerequisites: Kie-98.8061

Additional: This course together with Kie-98.8130 replaces Kie-98.149. The course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.8130 Russian Literature 2 (2 cr)

4+48 (independent study) I, II, III, IV

Teacher: Maria Nikiforow

Contents: In this course, students read Russian fiction and novels, and are then tested orally on the content of their readings.

Literature: Negotiated with Teacher.

Grade: Pass/Fail

Prerequisites: Kie-98.8061

Additional: This course together with Kie-98.8120 replaces Kie-98.149. The course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.8210 Russian Grammar 1 (2 cr)

6+46 (independent study) I, II

Teacher: Maria Nikiforow

Contents: This course focuses on the grammar of nouns, pronouns and adjectives, and provides practice of the most difficult areas.

Literature: Materials provided by teacher.

Prerequisites: Kie-98.8042

Additional: This course replaces Kie-98.143.

CEF Starting Level: B1

Kie-98.8220 Russian Grammar 2 (2 cr)

6+46 (independent study) III, IV

Teacher: Maria Nikiforow

Contents: This course focuses on the grammar of the 'verb', particularly the verbs of motion, verbal aspect, participles, verbal adverbs, and formation of the passive, and provides practice of the most difficult areas.

Literature: Materials provided by teacher.

Prerequisites: Kie-98.8052

Additional: This course replaces Kie-98.365

CEF Starting Level: B1

Kie-98.8310 Russian Conversation 1 (1 cr)

4+22 (independent study) I, II, III, IV

Teacher: Maria Nikiforow

Contents: This course aims to develop practical language skills by practising introducing oneself and becoming personally acquainted with others in small groups.

Literature: Negotiated with Teacher.

Grade: Pass/Fail

Prerequisites: Kie-98.8032

Additional: This course replaces Kie-98.361.

CEF Starting Level: A2

Kie-98.8320 Russian Conversation 2 (1 cr)

4+22 (independent study) I, II, III, IV

Teacher: Maria Nikiforow

Contents: In this course, students discuss in small groups about Finnish and Russian customs, as well as gain practise in presenting information about Finland to foreigners.

Literature: Negotiated with Teacher.

Grade: Pass/Fail

Prerequisites: Kie-98.8052

Additional: This course replaces 362

CEF Starting Level: B1

Kie-98.8330 Introduction to Russian Culture 1 (1 cr)

4+22 (independent study) I, II

Teacher: Maria Nikiforow

Contents: In this course, students give presentations and discuss Russian history, culture and geography.

Literature: Negotiated with Teacher.

Grade: Pass/Fail

Prerequisites: Kie-98.8062

Additional: This course together with Kie-98.8340 replaces Kie-98.364. The course fulfills the foreign language degree requirements.

CEF Starting Level: B2

Kie-98.8340 Introduction to Russian Culture 2 (1 cr)

4+22 (independent study) I, II, III, IV

Teacher: Maria Nikiforow

Contents: In this course, students form small groups to discuss Russian current affairs derived from the Russian media. Discussions are introduced by a brief synopsis of the topic given by a group member.

Literature: Negotiated with Teacher.

Prerequisites: Kie-98.8092

Grade: Pass/Fail

Additional: This course together with Kie-98.8330 replaces Kie-98.364. The course fulfills the foreign language degree requirements.

CEF Starting Level: C1

Kie-98.8410 Self-Access Course in Russian 1 (1 cr)

2+24 (independent study) I, II, III, IV

Teacher: Maria Nikiforow

Contents: This course offers students the opportunity to independently study particular aspects of Russian pronunciation, grammar and vocabulary.

Literature: Negotiated with Teacher.

Grade: Pass/Fail

Prerequisites: Kie-98.8021

Kie-98.8420 Self-Access Course in Russian 2 (1 cr)

2+24 (independent study) I, II, III, IV

Teacher: Maria Nikiforov

Contents: This course offers students the opportunity to independently create vocabulary or grammar materials.

Literature: Negotiated with Teacher.

Grade: Pass/Fail

Prerequisites: Kie-98.8061

Additional: The course fulfills the foreign language degree requirements.

Kie-98.8900 Student Tutoring in Russian (1 cr)

1+25 (independent study) I, II, III, IV

Teacher: Maria Nikiforov

Contents: Students can receive one credit of foreign language study for tutoring international students. This option requires that the tutor submits a written report in Russian concerning the tutoring process. Students wishing to take this option should contact the Russian Teacher for further details.

Grade: Pass/Fail

Additional: See <http://language.tkk.fi/information/tutoring.htm>

CEF Starting Level: B1

Spanish

Kie-98.2011 Spanish 1A (2 cr)

24+28 I

Teachers: Carmen Rodellas

Contents: This is a basic course for beginners in Spanish, which offers students an opportunity to practice their everyday Spanish both orally and in writing. During the course, students work through a wide range of authentic audio and video material.

Literature: Kautto-Laine-Lehmussaari, Entre Amigos.

Prerequisites: The course is designed for beginners.

Additional: Together with Kie-98.2012, this course replaces Kie-98.175.

Kie-98.2012 Spanish 1B (2 cr)

24+28 II

Teachers: Carmen Rodellas

Contents: This course offers students an opportunity to further practice their everyday Spanish both orally and in writing. During the course, students work through a wide range of authentic audio and video material.

Literature: Kautto-Laine-Lehmussaari, Entre Amigos.

Prerequisites: Kie-98.2011.

Additional: Together with Kie-98.2011, this course replaces Kie-98.175.

CEF Target Level: A1

Kie-98.2021 Spanish 2A (2 cr)

24+28 III

Teachers: Carmen Rodellas

Contents: This course offers students an opportunity to improve their oral and written skills while expanding their vocabulary and grammar. During the course, students work through a wide range of authentic audio and video material.

Literature: Kautto-Laine-Lehmussaari, Entre Amigos.

Prerequisites: 98.2012, Kie-98.2150, or Kie-98.175.

Additional: Together with Kie-98.2022, this course replaces Kie-98.176.

Kie-98.2022 Spanish 2B (2 cr)

24+28 IV

Teachers: Carmen Rodellas

Contents: This course offers students an opportunity to improve their oral and written skills while expanding their vocabulary and grammar. During the course, students work through a wide range of authentic audio and video material.

Literature: Kautto-Laine-Lehmussaari, Entre Amigos.

Prerequisites: Kie-98.2021.

Additional: Together with Kie-98.2021, this course replaces Kie-98.176.

CEF Target Level: A2

Kie-98.2031 Spanish 3A (2 cr)

24+28 I

Teachers: Carmen Rodellas

Contents: This course offers students an opportunity to practice their language skills in simple everyday situations. In addition, the course aims to expand students' basic grammar and vocabulary.

Literature: Kautto-Laine-Lehmussaari, Entre Amigos.

Prerequisites: Kie-98.2022 or Kie-98.176.

Additional: Together with Kie-98.2032, this course replaces Kie-98.177.

Kie-98.2032 Spanish 3B (2 cr)

24+28 II

Teachers: Carmen Rodellas

Contents: This course continues to develop students' language skills in everyday situations. In addition, the course aims to expand students' basic grammar and vocabulary.

Literature: Kautto-Laine-Lehmussaari, Entre Amigos.

Prerequisites: Kie-98.2031.

Additional: Together with Kie-98.2031, this course replaces Kie-98.177.

CEF Target Level: B1

Kie-98.2041 Spanish 4A (2 cr)

24+28 III

Teachers: Carmen Rodellas and Tanya Tynjälä

Contents: This course aims to deepen students' command of essential grammar and vocabulary.

Literature: Kautto-Laine-Lehmussaari, Entre Amigos.

Prerequisites: Kie-98.2032 or Kie-98.177.

Additional: Together with Kie-98.2042, this course replaces Kie-98.178.

Kie-98.2042 Spanish 4B (2 cr)

24+28 IV

Teachers: Carmen Rodellas and Tanya Tynjälä

Contents: This course aims to deepen students' command of essential grammar and vocabulary. After finishing the course a hardworking student should have gained enough confidence to cope in Spanish while touring in a Spanish-speaking country.

Literature: Kautto-Laine-Lehmussaari, Entre Amigos.

Prerequisites: Kie-98.2041.

Additional: Together with Kie-98.2041, this course replaces Kie-98.178.

CEF Target Level: B1.2

Kie-98.2051 Spanish 5A (2 cr)

24+28 I

Teachers: Carmen Rodellas and Tanya Tynjälä

Contents: This course offers students an opportunity to improve their speaking, reading and writing skills. In addition, the course revises the central grammar presented in previous courses.

Literature: Moreno-Moreno-Zurita: Avance (Nivel intermedio-avanzado, 2004)

Prerequisites: Kie-98.2042 or Kie-98.178.

Additional: Together with Kie-98.2052, this course replaces Kie-98.179. With a minimum grade of 3, this course meets the university regulations for foreign language studies.

Kie-98.2052 Spanish 5B (2 cr)

24+28 II

Teachers: Carmen Rodellas and Tanya Tynjälä

Contents: This course offers students an opportunity to improve their speaking, reading and writing skills. In addition, the course reviews the central grammar presented in previous courses.

Literature: Moreno-Moreno-Zurita: Avance (Nivel intermedio-avanzado, 2004)

Prerequisites: Kie-98.2051.

Additional: Together with Kie-98.2051, this course replaces Kie-98.179. With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Target Level: B2

Kie-98.2061 Spanish 6A (2 cr)

24+28 III

Teachers: Carmen Rodellas and Tanya Tynjälä

Contents: This course offers students an opportunity to improve their speaking, reading and writing skills. In addition, the course reviews the central grammar presented in previous courses.

Literature: Moreno-Moreno-Zurita: Avance (Nivel intermedio-avanzado, 2004)

Prerequisites: Kie-98.2052 or Kie-98.179.

Additional: Together with Kie-98.2062, this course replaces Kie-98.180. With a minimum grade of 3, this course meets the university regulations for foreign language studies.

Kie-98.2062 Spanish 6B (2 cr)

24+28 IV

Teachers: Carmen Rodellas and Tanya Tynjälä

Contents: This course offers students an opportunity to further improve their speaking, reading and writing skills. In addition, the course reviews the central grammar presented in previous courses.

Literature: Moreno-Moreno-Zurita: Avance (Nivel intermedio-avanzado, 2004)

Prerequisites: Kie-98.2061.

Additional: Together with Kie-98.2061, this course replaces Kie-98.180. With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Target Level: C1

Kie-98.2071 Latin American Cultures and Civilisation 1 (1 cr)

12+14 I

Teacher: Tanya Tynjälä

Contents: During this course, students are introduced to the cultural diversity of Latin America.

Literature: In-house materials

Prerequisites: Kie-98.2062 or Kie-98.180, or equivalent knowledge.

Additional: Together with Kie-98.2072, this course replaces Kie-98.181. With a minimum grade of 3, this course meets the university regulations for foreign language studies.

Kie-98.2072 Latin American Cultures and Civilisation 2 (1 cr)

12+14 II

Teacher: Tanya Tynjälä

Contents: During this course, students are introduced to the cultural diversity of Latin America.

Literature: In-house materials

Prerequisites: Kie-98.2071 or equivalent knowledge.

Additional: Together with Kie-98.2071, this course replaces Kie-98.181. With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Target Level: C1.2

Kie-98.2081 Spanish Conversation 1 (1 cr)

12+14 III

Teacher: Tanya Tynjälä

Contents: In this course, students discuss articles dealing with current issues.

Literature: In-house materials

Prerequisites: Kie-98.2062 or Kie-98.180, or equivalent knowledge.

Additional: Together with Kie-98.2082, this course replaces Kie-98.182. With a minimum grade of 3, this course meets the university regulations for foreign language studies.

Kie-98.2082 Spanish Conversation 2 (1 cr)

12+14 IV

Teacher: Tanya Tynjälä

Contents: In this course, students discuss articles dealing with current issues.

Literature: In-house materials

Prerequisites: Kie-98.2081 or equivalent knowledge.

Additional: Together with Kie-98.2081, this course replaces Kie-98.182. With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Target Level: C1.2

Kie-98.2093 Spanish for Science and Technology (4 cr)

48+56 I-II or III-IV

Teacher: Carmen Rodellas

Contents: This course aims to familiarize students with general technical texts.

Literature: In-house material.

Prerequisites: Kie-98.2081, Kie-98.180 or equivalent knowledge.

Additional: Replaces Kie-98.184. With a minimum grade of three, this course meets university regulations for foreign language studies.

CEF Target Level: C1.1

Kie-98.2010 Speak Spanish (2 cr)

5+47 (Independent study) I, II, III, IV

Teacher: Carmen Rodellas

Contents: The aim of this course is to teach students survival Spanish for tourists. During the course, students work through a wide range of authentic audio and video material.

Literature: Longo Sánchez, Puhu espanjaa

Prerequisites: This course is designed for beginners.

Additional: This course replaces Kie-98.275.

Kie-98.2150 Este País 1 (3 cr)

8+70 (Independent study) I, II, III, IV

Teacher: Carmen Rodellas

Contents: During this course, students become familiar with Spain and the Spanish language by following the life of doña Felisa's large family. Additional material for the course includes a video tape and an audio cassette.

Literature: Sjögren, Serrano, Muro, Torikka, Este País 1.

Prerequisites: This course is designed for beginners.

Additional: This course replaces Kie-98.175.

Kie-98.2020 Spanish for Trainees (2 cr)

5+47 (Independent study) I, II, III, IV

Teacher: Tanya Tynjälä

Contents: This course offers an insight into the cultural, historical, and geographical aspects of the Spanish-speaking world.

Literature: Uriz-Harling, En España

Prerequisites: Kie-98.2022 or Kie-98.176.

Additional: This course replaces Kie-98.274.

CEF Starting Level: B1

Kie-98.2030 Spanish for Business (2 cr)

5+47 (Independent study) I, II, III, IV

Teacher: Carmen Rodellas

Contents: This course familiarizes students with business life in the Spanish-speaking world.

Literature: Lingren-Savinainen-Seppä, Claves del éxito.

Prerequisites: Kie-98.2032, Kie-98.177, or equivalent knowledge.

Additional: This course replaces Kie-98.272.

CEF Starting Level: B.1

Kie-98.2040 Spanish Grammar (2 cr)

5+47 (Independent study) I, II, III, IV

Teacher: Tanya Tynjälä

Contents: This course aims to provide an overview of Spanish grammar and enables students to practice the most difficult grammar points in Spanish.

Literature: Mäkinen-Torvinen, Claro! (exercise book).

Prerequisites: Kie-98.2042 or Kie-98.178

Additional: This course replaces Kie-98.273.

CEF Starting Level: B1.2

Kie-98.2050 Self-access Course in Spanish 1 (1 cr)

2+24 (Independent study) I, II, III, IV

Teacher: Carmen Rodellas

Contents: This course gives students an opportunity to design their own course that can consist of both self-study and group work.

Prerequisites: Kie-98.2042, Kie-98.178, or equivalent knowledge.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Starting Level: B1.2

Kie-98.2060 Self-access Course in Spanish 2 (2 cr)

8+44 (Independent study) I, II, III, IV

Teacher: Carmen Rodellas

Contents: This course gives students an opportunity to design their own course that can consist of both self-study and group work.

Prerequisites: Kie-98.2052, Kie-98.179, or equivalent knowledge.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Starting Level: B2.2

Kie-98.2070 Spanish and Latin American Literature 1 (1 cr)

2+24 (Independent study) I, II, III, IV

Teacher: Tanya Tynjälä

Contents: The aim of this course is to familiarise students with the literature of the Spanish-speaking world. This is a self-study course during which students read assigned books independently and come to an oral examination at the end of the course.

Literature: Two books from the required list.

Prerequisites: Kie-98.2061, Kie-98.180, or equivalent knowledge.

Additional: With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Starting Level: C1

Kie-98.2080 Spanish and Latin American Literature 2 (2 cr)

8+44 (Independent study) I, II, III, IV

Teacher: Tanya Tynjälä

Contents: The aim of this course is to familiarise students with the literature of the Spanish-speaking world. This is a self-study course during which students read assigned books independently and come to an oral examination at the end of the course.

Literature: Four books from the required list.

Prerequisites: Kie-98.2061, Kie-98.180, or equivalent knowledge.

Additional: This course replaces Kie-98.183. With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Starting Level: C1

Kie-98.2090 Spanish and Latin American Film 1 (2 cr)

4+48 (Independent study) I, II, III, IV

Teacher: Tanya Tynjälä

Contents: In this course, students complete oral and written exercises based on Spanish and Latin American films. The course includes meetings with the teacher.

Literature: Santos Gargallo, Isabel & Santos Gargallo, Alfonso, De cine (exercise book and video tape).

Prerequisites: Kie-98.2061, Kie-98.180, or equivalent knowledge.

Additional: Together with Kie-98.2100 this course replaces Kie-98.277. With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Starting Level: C1

Kie-98.2100 Spanish and Latin American Film 2 (2 cr)

4+48 (Independent study) I, II, III, IV

Teacher: Tanya Tynjälä

Contents: In this course, students complete oral and written exercises based on Spanish and Latin American films. The course includes meetings with the teacher.

Literature: Santos Gargallo, Isabel & Santos Gargallo, Alfonso, De cine (exercise book and video tape)

Prerequisites: Kie-98.2090 or equivalent knowledge.

Additional: Together with Kie-98.2090 this course replaces Kie-98.277. With a minimum grade of 3, this course meets the university regulations for foreign language studies.

CEF Starting Level: C1

Kie-98.2500 Internet course: Caminando por mundos hispanos (4 cr)

0 + 104 I-II or III-IV

Teacher: Anna Mattsson, Carmen Rodellas or Tanya Tynjälä.

Contents: This Internet course gives students the opportunity to improve their grammar skills and expand their vocabulary in Spanish, while providing them with information about the Spanish-speaking world from diverse perspectives.

Literature: Online materials.

Prerequisites: Kie-98.2042, Kie-98.178 or equivalent knowledge.

Additional: With a minimum grade of three, this course meets university regulations for foreign language studies.

CEF Starting Level: B1.2

Kie-98.2900 Student Tutoring in Spanish (1 cr)

1+25 (Independent study) I, II, III, IV

Teacher: Tanya Tynjälä

Contents: This course offers students an opportunity to earn one foreign language credit for tutoring international students. This option requires that the tutor submits a written report in Spanish concerning the tutoring process. Students interested should contact the Spanish instructor for further details.

Grade: Pass/fail

Prerequisites: Kie-98.2042 or Kie-98.178.

Additional: This course replaces Kie-98.011. See:

<http://language.tkk.fi/information/tutoring.htm>

CEF Starting Level: B1

Swedish

Swedish courses taken at TKK (with the exception of certain special or theme-based courses) can fulfill the university requirement for proficiency in the second national language, and are thus equivalent to the test for the National Language Requirement (Swedish), Kie-98.5001 and Kie-98.5002. For a list of course options and alternatives for fulfilling the National Language Requirement, see http://kielikeskus.tkk.fi/yleistieto/toinen_kotimainen_ruotsi.htm. Swedish web site: <http://kielikeskus.tkk.fi/opetus/ruotsi/index.htm>.

Kie-98.5005 Revision Course in Swedish (3 cr)

24+52 I, II, III, IV

Teachers: Swedish teachers.

Contents: This course revises basic vocabulary and key points of Swedish grammar. It also provides students with opportunities to practise these skills in small groups. During the course students write an essay and a summary. Final exam.

Literature: To be announced later.

Prerequisites: The course is recommended for those with either weak Swedish language skills or who have studied Swedish less than 6 years.

Additional info: This course partly replaces Kie-98.340 and Kie-98.5340.

CEF Starting Level: A2

Kie-98.5009 Practising Spoken Swedish (1 cr)

16+10 I, II, III, IV

Teachers: Swedish teachers

Contents: This course aims to activate students' oral language skills and is intended for those students preparing to take the oral skills test for the National Language Requirement (Kie-98.5002). Literature: To be announced later.

Prerequisites: Secondary-school level Swedish.

CEF Target Level: B1

Kie-98.5110 Swedish for Engineering Students 1 (2-4 cr)

26+78 I-II, II-III, III-IV and II, III

Teachers: Swedish teachers

Contents: The aim is to develop students' written and oral language skills. Students read articles on current technical topics and focus on general and technical language. Exercises include vocabulary and written assignments, group work, presentations and discussions in small groups. The course consists of both contact and distance learning. Final exam. Successful completion of this course fulfils the National Language Requirement (5001+5002). The student's workload for the course is 4 cr, part of which can be used towards the National Language Requirement (Swedish). Even groups focusing only on writing skills can be arranged.

Literature: Course materials provided by teacher.

Prerequisites: Secondary-school level (at least 7 as final grade), or one of the following courses: Kie-98.340, Kie-98.5340, Kie-98.5339.

Additional info: This course replaces Kie-98.191, Kie-98.192, Kie-98.519, Kie-98.5191, Kie-98.5192, and Kie-98.5519.

CEF Target Level: B1

Kie-98.5111 Suggestopedic Course in Swedish (2-4 cr)

26+78 I-II, III-IV

Teachers: Swedish teachers

Contents: During this course, students revise previously learned Swedish and learn new expressions in a relaxed atmosphere. The course is based on the Suggestopedic method (<http://kie-likeskus.tkk.fi/opetus/ruotsi/suggestopedia.htm>) which makes use of music to introduce texts and as the background for a variety of interesting activities. Successful completion of this course fulfils the National Language Requirement (5001+5002). The student's workload for the course is 4 cr, part of which can be used towards the National Language Requirement (Swedish).

Literature: Course materials provided by teacher.

Prerequisites: Good command of secondary-school Swedish (at least 7 as final grade), or one of the following courses Kie-98.340, Kie-98.5340 or Kie-98.5339.

Additional info: This course replaces Kie-98.5354.

CEF Target Level: B1

Kie-98.5220 Swedish for Engineering Students 2 (1-3 cr)

24+54 I, II, III, IV

Teachers: Swedish teachers

Contents: The aim of the course is to activate students' language skills with a special emphasis on spoken language. The course focuses on general, technical and/or economic language. Exercises include presentations, discussing in small groups, summaries and other written assignments. Final exam. Successful completion of this course fulfils the National Language Requirement (5001+5002). The student's workload for the course is 3 cr, part of which can be used towards the National Language Requirement (Swedish).

Literature: To be announced later.

Prerequisites: Good command of secondary-school Swedish or equivalent knowledge.

CEF Target Level: B2

Kie-98.5229 Practising Presentation and Meeting Skills in Swedish (2-3 cr)

24+54 III

Teachers: Swedish teachers

Contents: The aim of the course is to build on students' communicative competence in Swedish. The course focuses on meeting and negotiation techniques, talks and presentations. There is a possibility for the students to record their presentations on video. Successful completion of this course fulfils the National Language Requirement (5002). The student's workload for the course is 3 cr, part of which can be used towards the National Language Requirement (Swedish).

Literature: To be announced later.

Prerequisites: Good command of secondary-school Swedish or equivalent knowledge.

CEF Target Level: B2

Kie-98.5230 Focus on Nordic Countries (3 cr)

24+54 III+IV

Teachers: Heidi Rontu

Contents: The course is planned for those who want to work and travel or establish relations within the Nordic region. The course develops the student's ability to communicate and cooperate in a Nordic setting. The course sets out to build on students' understanding of Nordic languages and work culture. Final exam.

Literature: To be announced later.

Prerequisites: Good command of secondary-school Swedish or equivalent knowledge.

CEF Target Level: B2

Kie-98.5600 Self-access Revision Course in Swedish (3 cr)

6 + 72 (self-study course) I, II, III, IV

Teachers: Swedish teachers

Contents: This course revises basic vocabulary and key points of Swedish grammar. During the course students write an essay and a summary. Final exam.

Literature: Grammatik Galleri or Svenska utifrån (on loan in Room U 401d). Promentor multimedia materials "Nyttä eller nöje 3 and 4" according to specific instructions. The materials can be accessed from any Windows-based computer maintained by the TKK Computer Centre.

Prerequisites: Recommended for those with either weak Swedish language skills or who have studied less than 6 years of Swedish. Additional info: This course partly replaces Kie-98.340 (self-study option) + Kie-98.350 and Kie-98.5339 + Kie-98.5350.

CEF Starting Level: A2

Kie-98.5610 Autonomous Technical Swedish (2-4 cr)

10+94 (self-study course) I, II, III, IV

Teachers: Swedish teachers

Contents: Students build on their basic technical vocabulary, develop their ability to understand professional literature as well as Swedish grammar. The course includes vocabulary and grammar exercises, written assignments and summaries. Written final exam and interview (20 min). Successful completion of this course fulfils the National Language Requirement (5001+5002). The student's workload for the course is 4 cr, part of which can be used towards the National Language Requirement (Swedish). Literature: Course materials that include exercises and articles from different fields of technology. According to specific instructions also Promentor multimedia materials/ Protocall Teknikbiten which can be accessed from any Windows-based computer maintained by the TKK Computer Centre.

Prerequisites: Secondary-school Swedish (at least 7 as final grade), or one of the following courses: Kie-98.340, Kie-98.5340, Kie-98.5339 or Kie-98.5610.

CEF Target Level: B1

Kie-98.5620 Autonomous Reading in Swedish (3-4 cr)

4+74 (3 cr); 6+99 (4 cr) (self-study course) I, II, III, IV

Teachers: Swedish teachers

Contents: Students read books from either part a) Swedish literature or part b) technical and professional literature. Alternatively, students can combine books from both parts (4 cr). At the end of the course students take an oral language examination given in Swedish.

Grade: pass/fail

Literature: See <http://kielikeskus.tkk.fi/opetus/ruotsi/kurssit.htm>

Prerequisites: Good Swedish skills

Additional info: This course replaces Kie-98.345 and/or Kie-98.346, Kie-98.5345 and/or Kie-98.5346.

CEF Target Level: B2

Kie-98.5621 Optional Course in Swedish (3-5 cr)

6+72 (3 cr); 8+96 (4 cr); 10+120 (5 cr) (self-study course) I, II, III, IV

Teachers: Swedish teachers

Contents: Advanced studies according to students own needs. Contents to be negotiated with the teacher at the start of the course. Students create an individualized learning plan. Students hand in written assignments as well as give oral reports.

Grade: pass/fail

Prerequisites: Good Swedish skills

CEF Target Level: B2

Kie-98.5900 Student Tutoring in Swedish (1 cr)

1 + 25 (self-study course) I, II, III, IV

Teachers: Swedish teachers

Contents: This course offers students an opportunity to earn one foreign language credit for tutoring international students. This option requires that the tutor submits a written report in Swedish concerning the tutoring process. Students interested should contact the Swedish teacher for further details.

Prerequisites: Good Swedish skills

Grade: Pass/Fail.

Additional info: This course replaces Kie-98.011. See

<http://language.hut.fi/information/tutoring.htm>

CEF Target Level: B1

Kie-98.5905 Glossary Project (1 cr)

1 + 25 (self-study course) I, II, III, IV

Teacher: Swedish teachers

Contents: In this course, students compile a 100-word, Swedish-Finnish vocabulary of terms from their own field of study. Materials are to be negotiated with head Swedish teacher.

Additional info: This course replaces Kie-98.005.

CEF Target Level: B1

Kie-98.5001 National Language Requirement (Swedish) Writing Test (1 cr)

Kie-98.5002 National Language Requirement (Swedish) Oral Skills Test (1 cr)

I, II, III, IV

CEF Target Level: B1 – C1

Contents: Demonstrating proficiency in Swedish is required of all Finnish-speaking students studying according to the Degree Regulations of 1979 (Statutes §14 and §15). Starting autumn 2005, students can separately receive one credit and a grade for the writing and oral skills tests. There are five alternative ways to fulfil the National Language Requirement:

1. Passing both the writing and oral skills tests for the National Language Requirement (Swedish) offered at TKK. Dictionaries are available in the test room and can be used for the Reading Component of the test. However, students are not allowed to use their own dictionaries.

2. Completing one of the following courses: Kie-98.5110, Kie-98.5111, Kie-98.5220 or Kie-98.5610. In addition, students can complete the oral skills part (Kie-98.5002) by participating in the Kie-98.5229 course. In order to fulfil the National Language Requirement, students must demonstrate "Good" or "Satisfactory" skills throughout the course as well as on the final exam.

3. Completion of an equivalent test for the National Language Requirement held at another Finnish tertiary-level institution.

4. Completion of a Swedish course at TKK. See

<http://kielikeskus.tkk.fi/yleistieto/ruotsinkopjakso.htm>

5. A certificate of Finnish language proficiency awarded by State Board of Language Examinations (See <http://www.oph.fi/english/SubPage.asp?path=447,490,5373>) supplemented by an oral proficiency test given at the Helsinki University of Technology. The oral proficiency test consists of an interview, in which the student demonstrates command of the vocabulary from their own technical field.

LIBRARY (KIR)

<http://lib.hut.fi/>

The Library of Helsinki University of Technology is the National Resource Library for Technology. Its task is to collect and make available literature and other information sources in technology and allied sciences. It offers information services to anyone in need of scientific and technological information. Its services include circulation, interlending, the routing of periodicals, copying service and micro-enlargements, information retrieval on-line and manually, computer-based selective dissemination of information and user training. The library information systems TEEMU, TENTTU and CD-ROM databases are available for independent use. The electronic campus library on the web-site contains a large number of resources such as full text journals and reference databases accessible from workstations around the campus. In the main library building there are also workstations and e-mail terminals reserved for users. Library guides in English as well as other additional information can be found through the WWW- information service of the library. The department libraries and a score of smaller satellite libraries also belong to the library system.

SEARCHING FOR SCIENTIFIC INFORMATION

Eri-0.5001 Searching for Scientific Information (Architecture) (2 cr)

2+30 I, II, IV

Teacher in charge: M.Sc. Virpi Palmgren

Contents: The course acquaints international students with the use of scientific information sources in the library and in information networks. It also introduces the principles of scientific communication and information retrieval. The elements concerning information quality assessment will also be presented. Distance education, guided exercises and e-mail are the main tools for the course.

Literature: The course material can be found via library's WWW-pages

<http://lib.tkk.fi/Opetus/Informaatiikka/english/>

Coursebook is the "Into Info" -study package

<http://educate.lib.chalmers.se/> (Campus Access).

Eri-0.5002 Searching for Scientific Information (Automation and Systems Technology) (2 cr)

(2 cr)

For detailed information please see Eri-0.5001

Eri-0.5003 Searching for Scientific Information (Physics and Mathematics) (2 cr)

(2 cr)

For detailed information please see Eri-0.5001

Eri-0.5004 Searching for Scientific Information (Information Networks) (2 cr)

(2 cr)

For detailed information please see Eri-0.5001

Eri-0.5005 Searching for Scientific Information (Chemistry) (2 cr)

(2 cr)

For detailed information please see Eri-0.5001

Eri-0.5006 Searching for Scientific Information (Mechanical Engineering) (2 cr)

For detailed information please see Eri-0.5001

Eri-0.5007 Searching for Scientific Information (Surveying) (2 cr)

For detailed information please see Eri-0.5001

Eri-0.5008 Searching for Scientific Information (Materials Science Engineering) (2 cr)

For detailed information please see Eri-0.5001

Eri-0.5009 Searching for Scientific Information (Forest Products Technology) (2 cr)

For detailed information please see Eri-0.5001

Eri-0.5010 Searching for Scientific Information (Civil and Environmental Engineering) (2 cr)

For detailed information please see Eri-0.5001

Eri-0.5011 Searching for Scientific Information (Electrical and Communications Engineering) (2 cr)

For detailed information please see Eri-0.501

Eri-0.5012 Searching for Scientific Information (Computer Science) (2 cr)

For detailed information please see Eri-0.5001

Eri-0.5013 Searching for Scientific Information (Industrial Management) (2 cr)

For detailed information please see Eri-0.5001

OTHER SEPARATE COURSES**Eri-0.1145 Orientation Course for New Students (0 cr)**

Teacher in charge: Milla Vaisto-Oinonen, planning officer.

The course is produced by the university, TKY and the library
Contents: The course provides the students with facilities for studying at the university: planning of studies, study counselling, degree structure, wwwTopi database, use of library, study-social issues, internationalisation, training and the functions of TKY.

Requirements: Completed study plan, library use training, active participation

Additional: This course replaces Eri-0.145.

Language: Finnish

Eri-0.2160 Conducting Small Group Activities (1 cr)

Teacher in charge: Pia Rydestedt, planning officer

The course is produced by the office for Academic Affairs, the teachers and the student unions TKY and TF and the guilds.

Content: The objective of the course is to train skills for conducting small group activities. Acting as the tutor of the first year students and counselling them in studies, study social issues and study environment. During the training period that is part of the course, the group dynamics, the interaction between group members and conducting group activities are studied.

Requirements: Participation in the training period, active conducting small group activities in the autumn, completed report about group dynamics. Further information from Pia Rydestedt.

Additional: This course replaces Eri-0.160.

Language: Finnish

Eri-0.4 TEACHING AND LEARNING DEVELOPMENT

The objective is to enhance the teaching and learning in Helsinki University of Technology by supporting teachers and students in their development activities.

Teachers: Anna-Kaarina Kairamo 451 4015, Anu Yanar 451 4476, Tiina Pylkkönen 451 5643, Riikka Rissanen 451 4486, Olli

Hyppönen 451 4002, Taru Jokinen 451 4669, Anna-Maija Ahonen 451 5426

Eri-0. 4001 "Myself as a teacher - Teaching + Learning + Teaching" (5 cr)

Teacher: Riikka Rissanen

The objective of the course is to provide those interested in teaching with ideas, thoughts, working methods and tools for use in their own teaching.

Contents: basic concepts in teaching and learning, planning lessons, different ways of teaching, evaluation and developing one's own teaching. Course can be done en bloc or as a part of Program on higher education pedagogy (see Eri-0.4002-0.4004).

Language: Finnish

Additional: <http://www.dipoli.hut.fi/ok/p/o3>

Eri-0.4002 Teacher's Professional Development (5 cr)

Lecturer: Anu Yanar

Contents: Developing as a teacher and supporting the development process. Building knowledge, critical thinking and developing into an expert. Planning the teaching and learning processes, implementation and basic assumptions. Values, attitudes, norms and other background factors. Course is a part of Program on higher education pedagogy (20 cr). Further information and applying for the program: <http://www.dipoli.hut.fi/ok/p/yoop/>

Language: Finnish

Eri-0.4003 Development Project for Own Teaching (7 cr)

Lecturer: Anu Yanar

Contents: Advanced studies in one subject area of teaching, gathering information and developing the topic together with other teachers while linking it to own development as a teacher. Course is a part of Program on higher education pedagogy (20 cr). Further information: <http://www.dipoli.hut.fi/ok/p/yoop/>

Language: Finnish

Eri-0.4004 Study Module on Higher Education in Varying Fields (3 cr)

Lecturer: Anu Yanar

Contents: Elected courses and written assignments on variable themes. Course is a part of Program on higher education pedagogy (20 cr). Further information: <http://www.dipoli.hut.fi/ok/p/yoop/>

Language: Finnish

Eri-0. 4011 ABC of teaching (2 cr)

Teacher: Tiina Pylkkönen

Contents: Course consist of five halfdaysessions and two learningtasks. Themes: learning, teaching, tutoring, communication skills, planning of teaching event and teaching training (students teach and give and get feedback in small groups).

Requirements: Active participation and learning tasks completed.

Additional: Course is targeted to students working as an assistant and tutor. Course can be included into undergraduate studies. Max 20 participants.

Language: Finnish.

Eri-0. 4012 Studying techniques (2 cr)

Teacher: Tiina Pylkkönen

Contents: "Studying techniques as professional skills". Improving practical studying skills. Themes eq. Technical writing, Studying mathematics and physics, Reading techniques, Notes, Designing presentations and performing and Preparing for exams.

Requirements: Lectures and learning excercises

Language: Finnish