

SCHOOL OF ENGINEERING / BACHELORS DEGREE IN ENGINEERING

- Mechanical and Production Engineering Degree Programme
- Construction Engineering Degree Programme
- Information Technology Degree Programme

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DEGREE PROGRAMMES IN MECHANICAL AND PRODUCTION ENGINEERING, CONSTRUCTION ENGINEERING AND INFORMATION TECHNOLOGY

The above degree programmes lead to a Bachelors Degree Qualification in Engineering with graduates being able to use the title 'Engineer' (University of Applied Sciences). The Bachelors Degree in Engineering is worth 240 cr and takes about 4 years to complete.

GENERAL OBJECTIVES

The general objectives of the degree programme are:

- 1) to provide knowledge on the structures of the devices, systems and procedures and how they work for each Engineering Major and also different planning, design, implementation and maintenance methods.
- 2) to develop students' skills in applying knowledge and skills acquired from their studies so that they will be able to work with initiative, independently and in co-operation with others after a short period of work experience.

- 3) to provide basic knowledge of production economics, human resources, international co-operation and environmental protection required in marketing, administration and management posts.
- 4) to provide students with the competence and skills to continue their education by participating in further study or complimentary training.

The degree programmes furnishes students with skills for control and maintenance planning, leadership, and expert posts as well as business and entrepreneurial activities. The degree should also create a technological overview on which graduate engineers can base their decisions and take responsibility taking into account the demands made by economics, labour, environmental protection, saving energy and society.

SPECIAL INFORMATION

The School of Engineering organises differentiated courses in Maths, English and Physics for first year students based on their previous level of achievement in these subjects. These courses cover the theory of indispensable mathematical tools and they include practical Maths and Physics exercises. The English courses provide the competence to make use of available engineering literature.

Special training provided by the armed forces has been approved for accreditation as part of free-choice studies where appropriate.

MECHANICAL AND PRODUCTION ENGINEERING

This degree programme focuses on industrial means of production, machines and processes. It provides the basis for planning, use, quality and material management posts in industry. The programme emphasises practice and it furnishes students with in depth knowledge of production processes management from the beginning to the finished product.

The courses and studies covered during this degree programme are supported by design and planning software for product planning to virtual modelling as well as automation, production and testing laboratories with their versatile machines and equipment, providing an environment for practical implementation and practice.

Degree Programme Specific Competences

Production Engineering Degree Programme	Description of Competence
Basic skills in machine engineering	<ul style="list-style-type: none"> • ability to use maths and physics to describe mechanical phenomena and to solve problems • knowledge of the most common components and machine parts used in mechanical engineering and how the most common machines work • knowledge of basic mechanical measurements • knowledge of principles of energy technology and use
Planning and design skills	<ul style="list-style-type: none"> • knowledge of basic technical documentation and use of 3D modelling in design and

	<p>planning</p> <ul style="list-style-type: none"> • knowledge of the most common structural materials and their features of use • understanding of the significance of standardisation in product planning and production • ability to take into account the whole life-cycle of the product during the planning stage • comprehension of the significance of group work in product planning and the competence to work as a member of an international planning organisation
Manufacturing technology skills	<ul style="list-style-type: none"> • knowledge of manufacturing engineering methods, equipment and opportunities • understanding of the principles of production systems and automation and its effect on product structure • knowledge of the principles of logistics
Machine safety skills	<ul style="list-style-type: none"> • knowledge of the demands in product planning resulting from mechanical directives and regulations • ability to plan safe and user-friendly devices and structures
Business economics competence	<ul style="list-style-type: none"> • knowledge of the requirements for profitable business operations • ability to carry out simple investment calculations
Mathematics and natural science competence	<ul style="list-style-type: none"> • ability to use mathematics and physics to solve problems • ability to work systematically and logically • knowledge of the effects of the laws of nature on the functioning of equipment and structures
Automation competence	<ul style="list-style-type: none"> • knowledge of the basic systems of machine automation, components and equipment • ability to plan and construct automated structures
Production competence	<ul style="list-style-type: none"> • knowledge of basic industrial production operations • ability to plan and control production

	<ul style="list-style-type: none"> • knowledge of the main production methods, equipment and systems for the manufacturing industry
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THEMES FOR EACH YEAR OF STUDY:

1st yr

Acquisition of basic engineering competence

Students will gain an overview of the most important areas of mechanical and production engineering that are involved in all manufacturing activities and will be able to acquire knowledge and skills to control such areas.

2nd yr

Deeper knowledge for automation competence

This theme covers learning how to make production more efficient and usability and reliability technologies in order to achieve profitable production as well as the development of communication and social interaction skills.

3rd yr

Specialised production competence

This theme includes the acquisition of specialist skills and competence in a specific field and an expansion of knowledge to enable graduates to control and develop production.

4th yr

Finalising engineering competence

Application of skills and knowledge in practice and a broadening of horizons at work.

DEGREE PROGRAMME IN MECHANICAL AND PRODUCTION ENGINEERING

BASIC STUDIES **51 cr**

GENERAL STUDIES **30 cr**

Mathematics	12 cr
Physics	12 cr
Industrial Chemistry	3 cr
Introduction to Data Processing	3 cr

LANGUAGE AND COMMUNICATION STUDIES **9 cr**

Communication Skills in Finnish	3 cr
Text and Terminology	3 cr
Svenska för Maskin- och produktionsingenjörer	3 cr

BUSINESS ADMINISTRATION **12 cr**

Introduction to Business Economics	3 cr
Corporate Law	3 cr
Leadership and Occupational Psychology	3 cr
Marketing and Customer Relationships	3 cr

COMPULSORY PROFESSIONAL STUDIES **99 cr**

English Language and Communication Studies	3 cr
Design Technology	15 cr
Production Engineering	27 cr
Mechanical Engineering	16 cr
Electrical Engineering	9 cr
Automation Technology	29 cr

OPTIONAL PROFESSIONAL STUDIES **30 cr**

Electronics Production	15 cr
Extractive Technology	15 cr
Machine Planning	15 cr
Maintenance	15 cr
Production Management	15 cr
Automation Technology	15 cr

FREE-CHOICE STUDIES **15 cr**

PRACTICAL TRAINING (autumn of 4th yr) **30 cr**

THESIS **15 cr**

COURSE DESCRIPTIONS OF DEGREE PROGRAMME IN MECHANICAL AND PRODUCTION ENGINEERING

BASIC STUDIES

(TKPY0Z) BASIC STUDIES 30 cr

This module provides basic skills in mathematical and natural science subjects for engineering and data handling.

(TKPY001) Mathematics 1-2

Credits: 6 cr Timing: 1st yr

Objective: This course partially revises and adds to high school and vocational college mathematics with an aim to develop systematic and disciplined learning and interaction skills.

Contents: Number systems
Functions
Trigonometry
Vectors
Determinants and matrices
Introduction to a mathematics programme

Learning Strategies: Lectures and exercises

Assessment: To be announced

Bibliography: Majaniemi, A., Algebra I
Majaniemi, A., Algebra II
Majaniemi, A., Geometria

(TKPY002) Mathematics 3

Credits: 3 cr Timing: 2nd yr

Objective: Students will gain an overview of the principles and basic applications of differential and integral calculus.

Contents: Differentiation and graphs of functions
Maximum and minimum values of functions
Integration and area between curves

Learning Strategies: lectures and assignments

Assessment: To be announced

Bibliography: Majaniemi, A., Matematiikka I

(TKPY003) Mathematics 4

Credits: 3 cr Timing: 2nd yr

Objective:	This course will provide students with an overview of statistical thinking.
Contents:	Probability calculus Basic concepts of statistics Statistical process control
Learning Strategies:	Lectures and exercises, independent and group work
Assessment:	To be announced
Bibliography:	Majaniemi, A., Matematiikka IV

(TKPY008) Physics 1

Credits:	4 cr	Timing:	1st yr
Objective:	This module will provide the necessary background in physical science for the other courses of the degree programme.		
Contents:	Physics quantity and unit system Mechanics		
Learning Strategies:	Lectures and exercises		
Assessment:	Exam		
Bibliography:	Inkinen,P., Tuohi,J., Momentti 1 Insinöörifysiikka, Otava		

(TKPY009) Physics 2

Credits:	5 cr	Timing:	1st yr
Objective:	This course builds on the knowledge provided in Physics 1 and provides a background in physical science for use in other courses of the degree programme.		
Prerequisite:	Physics 1		
Contents:	Thermal physics Electricity and magnetism Wave motion theory and acoustics		
Learning Strategies:	Lectures and exercises		
Assessment:	Interim exams		
Bibliography:	Inkinen,P., Tuohi,J., Momentti 1 Insinöörifysiikka, Otava Inkinen,P., Tuohi,J., Momentti 2 Insinöörifysiikka, Otava		

(TKPY005) Physics, Laboratory Work

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will become conversant with basic physics through experimentation. The course also covers measurement technology and written reporting.		
Contents:	Completion of laboratory work and written reporting		

Learning Strategies: laboratory exercises

Assessment: Completion of laboratory work and written reports (assessment 1 - 5)

Bibliography: Inkinen, P., Tuohi, J., Momentti 1 Insinöörifysiikka , Otava
Inkinen, P., Manninen, R., Tuohi, J., Momentti 2 Insinöörifysiikka , Otava

(TKPY006) Industrial Chemistry

Credits: 3 cr Timing: 3rd yr

Objective: This course revises and adds to high school chemistry. Students will gain knowledge of environmental chemistry and study the use of dangerous materials and poisons.

Contents: The periodic table, mol and reactions
Energy
Corrosion
Environmental chemistry
Dangerous materials and pollutants

Learning Strategies: Lectures and course-work

Assessment: To be announced

Bibliography: Arvonen, A., Levonen, H., Ammattikorkeakoulun kemia
Antila, A., Karppinen, M., Leskelä, M.,
Mölsä, H., Pohjakallio, M.,
Tekniikan kemia
Handouts

(TKPY007) Introduction to Data Processing

Credits: 3 cr Timing: 1st yr

Objective: Students will be conversant with the basic structure of a microcomputer and the use of Kajaanin amk computers and their most common tools programmes and software for study purposes.

Contents: Computer hardware
Operating systems and user interfaces
Use of networks
Installation and configuration of a system
The Kajaanin ammattikorkeakoulu computer network, user names and passwords
An introduction to word processing
Spreadsheet calculation and graphics

Learning Strategies: Small group work and course-work

Assessment: Exam and assignments

Bibliography: Reading list/material provided by lecturer

(TKPK1Z) LANGUAGE AND COMMUNICATION SKILLS 9 cr

This module develops and strengthens communication skills so that students will be able to cope in different professional communication situations.

(TKPK001) Communication Skills in Finnish

Credits:	3 cr	Timing:	1st yr
Objective:	Students will practise the different spoken and written tasks required in their profession.		
Contents:	An introduction to spoken and written communication Academic writing Spoken situations (preparation, participation and analysis)		
Learning Strategies:	Independent work, group work, complimentary lectures		
Assessment:	Participation in group work		
Bibliography:	Kauppinen, A., Nummi, J., Savola, T., Tekniikan viestintä (4., uudistettu painos) Handout		

(TKPK005) Text and Terminology 1

Credits:	1.5 cr	Timing:	1st yr
Objective:	This course aims to develop and strengthen machine and production engineering students' English skills so they will be able to read their own professional literature and write technical documents.		
Prerequisite:	Proficiency test and Build up Your English course if required		
Contents:	Technical language as a tool The special grammatical features of technical language Vocabulary building Developing reading techniques Documentation		
Learning Strategies:	Contact teaching, assignments, independent, pair and group work.		
Assessment:	Active participation, assignments; written exam		
Bibliography:	Handout		

(TKPK006) Text and Terminology 2

Credits:	1.5 cr	Timing:	2nd yr
Objective:	This course aims to develop and strengthen machine and production engineering students' English skills so they will be able to read their own professional literature, write technical documents, search for and process information.		
Contents:	The special grammatical features of technical language Vocabulary building Developing reading techniques Documentation Oral and written reporting and summarising.		

Learning Strategies: Contact teaching, independent, pair and group work.

Assessment: Active participation, searching for and processing technical texts, oral presentations (in assessment 50 %); written exam (in assessment 50 %)

Bibliography: Texts processed by students

(TKPK004) Swedish for Mechanical and Production Engineers

Credits: 3 cr Timing: 3rd yr

Objective: Students will develop their oral and writing skills in Finland's second official language specifically to aid their own professional development. Students will practise speaking Swedish in everyday communication situations as well as being able to discuss professional issues in Swedish. Students will also be able to find and use information in Swedish concerning their own specific field.

Contents: Central vocabulary and communication situations for mechanical and production engineering students

Learning Strategies: Small group teaching

Assessment: Active participation, spoken and written exercises, spoken and written exam

Bibliography: Handouts

(TKPH2Z) BUSINESS ECONOMICS 12 cr

The aim of the course is to provide an in depth introduction to business operations and the domestic economy as well as to strengthen internal entrepreneurship.

(TKPH001) Business Economics, Basics

Credits: 3 cr Timing: 3rd yr

Objective: Students will be conversant with the principles of business operations will gain an overview of business planning.

Contents: Basic concepts of business operations
Internal and external entrepreneurship
Functional processes and operational environment
Financing and profitability control
Profit margin and investment calculation
Business planning.

Learning Strategies: lectures and exercises

Assessment: Exam and business plan

Bibliography: Kinkki, Isokangas, Yrityksen perustoiminnot, WSOY 2004

(TKPH002) Corporate Law

Credits: 3 cr Timing: 4th yr

Objective: Students will be conversant with the general principles of contract law and they will

be aware of the central agreements and liability related to business activity.

Contents: The law system
Contracts and making contracts
Forms of business
Contract of employment, working time and holidays
Commercial agreements
Compensation

Learning Strategies: Lectures and course-work

Assessment: Exam and assignments

Bibliography: To be announced

(TKPH003) Management and Leadership

Credits: 3 cr Timing: 3rd yr

Objective: This course covers administrative and leadership tasks, different management cultures and humans as a resource within an organisation.

Contents: Administration and leadership in an organisation
Leadership theory
Individual and group behaviour in a working community
Organisation theory
Professional ethics

Learning Strategies: Lectures, course-work

Assessment: Exam or portfolio

Bibliography: Joutsenkunnas, T., Heikurainen, P., Esimiehenä palveluyrityksessä
Further reading on professional ethics

(TKPH004) Marketing and Customer Relationships

Credits: 3 cr Timing: 4th yr

Objective: Students will gain a general overview of customer oriented marketing, sales and service concepts and content as well as PR and publicity.

Prerequisite: Introduction to Business Economics

Contents: Basic concepts of marketing and marketing thinking
Selecting and segmenting target groups
Customer oriented marketing and PR
Long-term relations and goal driven operations
Image marketing
Competitive strategy in marketing
Personal sales
Marketing strategy

Learning Strategies: Lectures and course-work

Assessment: Exam and assignments

Bibliography: Lahtinen, Isoviita, Asiakaspalvelu ja markkinointi

Handout

COMPULSORY PROFESSIONAL STUDIES**(TKAE0Z) ENGLISH LANGUAGE AND COMMUNICATION STUDIES 3 cr****(TKAE002) Intercultural and Business Skills 1**

Credits: 1.5 cr Timing: 2nd yr

Objective: This course develops machine and production engineering students' intercultural competence so that they have qualifications to communicate in English in international and multicultural working life contexts.

Contents: Concepts of culture and communication
Variables used to compare cultures
Cultural differences in communication The process of adapting to another culture

Learning Strategies: Contact teaching, assignments, independent work, pair and group work

Assessment: Active participation, project and its oral introduction (in assessment 50 %); written exam (in assessment 50 %)

Bibliography: Handouts

(TKAE003) Intercultural and Business Skills 2

Credits: 1.5 cr Timing: 3rd yr

Objective: This course develops machine and production engineering students' intercultural competence so that they have qualifications to communicate in English in international and multicultural working life contexts.

Contents: Company, production and product presentations
Telephone conversations
Written business communication
Meetings and negotiations

Learning Strategies: Contact teaching, assignments, independent work, pair and group work

Assessment: Active participation, oral assignments (in assessment 65 %) and written assignments (in assessment 35 %); written exam

Bibliography: Handouts

(TKAS0Z) DESIGN TECHNOLOGY 15 cr

students will be conversant with the principles of technical drawing, modern product development methods and the use of computers in Design technology.

(TKAS001) Technical Drawing

Credits: 3 cr Timing: 1st yr

Objective: Students will be able to read and make technical and assembly drawings for machine construction and draft and draw technical drawings of individual parts and of the assembly of small constructions.

Contents: Standards
Projections and axonometry
Cross section outlines
Design and tolerances
Use of field specific symbols, schematic diagrams and special notations.

Learning Strategies: Lectures and course-work

Assessment: Exam, assignments

Bibliography: Hasari, H., Salonen P., Teknillinen piirtäminen
Material also provided by lecturer

(TKAS002) Computer Aided Design

Credits: 3 cr **Timing:** 1st yr

Objective: Students will be conversant with CAD software in 2 dimensional design and the opportunities of computer aided design.

Contents: CAD systems and their features
Basic drawing functions and commands
Edit functions
Design measurement
Symbols and their use
Printing drawings

Learning Strategies: Small group teaching and course-work

Assessment: Course assignments and a practical test (assessment 1 - 5)

Bibliography: Autocadin perusteet pdf-tiedostona
Further reading list/material provided by lecturer

(TKAS003) 3D Modelling (CAD)

Credits: 6 cr **Timing:** 2nd yr

Objective: Students will be able to use 3-D applications for product modelling purposes.

Prerequisite: An Introduction to Data Processing Computer Aided Design

Contents: An introduction to 3-dimensional modelling
Using a graphic work station
Visualisation
Producing drawings
Compositions
Features modelling
Sheet metal products

Learning Strategies: Lectures and course-work. Programmes in use Autocad, Inventor and Pro Engineer

Assessment: Exam (assessment 1 - 5) 50 % coursework (assessment 1 - 5) 50 %

Bibliography: McFarlane, B., Introducticing 3D AutoCAD
 Kautonen, H., Manner, J., Muotoja Cadilla, Edita
 Laakko, T., Tuotteen 3D-CAD -suunnittelu, WSOY
 Further reading list/material provided by lecturer

(TKAS005) Project/Laboratory Work, Design Technology

Credits: 3 cr Timing: 3. year

Objective: Students will gain practical experience of planning and design and problems encountered during the design process while at the same time applying previously acquired theoretical knowledge.

Contents: Practical research and/or design tasks linked to design and product development studies.

Learning Strategies: Supervised project work for businesses or educational institutions.

Assessment: Completion of work set, appropriate documentation and presentation

Bibliography: Students search for their topic material using different sources of information.

(TKAC0Z) PRODUCTION TECHNOLOGY 27 cr

(TKAC001) Manufacturing Technology

Credits: 3 cr Timing: 1st yr

Objective: Students will gain a general overview of how manufacturing units are made and which devices and machines are used for this purpose.

Contents: Casting technique
 Moulding techniques
 Sheet and coupling techniques
 Machine cutting
 Coating methods

Learning Strategies: Lectures and course-work

Assessment: Exam and assignments

Bibliography: Ihalainen, E., Aaltonen, K., Aromäki, M., Sihvonen, P., Valmistustekniikka
 Further reading/material provided by lecturer

(TKAC008) Introduction to NC-Technology

Credits: 3 cr Timing: 2nd yr

Objective: Students will gain a general overview of the opportunities provided by NC technology in production and will be able to create effective NC programmes for basic machine tools.

Contents: NC machines and their structures
 The use and function of NC machines
 NC programming
 NC machinery in its own environment

The maintenance and servicing of NC machinery

Learning Strategies: Lectures, exercises and labs

Assessment: Exam (evaluation 1 - 5) 80 % and participation (20 %)

Bibliography: Pikkarainen, E., NC -tekniikan perusteet

(TKAC009) Project Management

Credits: 5 cr Timing: 1st and 2nd yr

Objective: Students will adopt a systematic way of working, and different techniques that are usually applied in working life and society during temporary, one-off jobs and tasks.

Contents: Project concept
Project cycle
Planning and control methods
Management and follow-up
use of ADP applications in project management

Learning Strategies: Lectures and exercises

Assessment: Exams and assignments

Bibliography: Silfverberg, P., Ideasta projektiksi
Pelin, R., Projektihallinnan käsikirja
Virkki, P., Somermeri, A., Projektityö, kehittämisen moottori

(TKAC003) Quality Management

Credits: 3 cr Timing: 1st yr

Objective: Students will gain in depth knowledge of quality and quality management as well as how these are linked to business operations. Students will know the most common business quality control operations and be able to analyse and use collected information from quality control systems to develop operations.

Contents: Concepts of quality
Quality leadership
Quality control systems
ISO9000 etc Quality standards
Quality control methods
Sampling methods
Statistical methods
Quality costs

Learning Strategies: Lectures and course-work

Assessment: Exam and assignments

Bibliography: Andersson, Tikka, Mittaus- ja laatutekniikat, 1997
Pesonen, H., Saarinen, T., Asiantuntijayrityksen laatujärjestelmän kehittäminen
ISO9000 laatustandardit
Kume, H., Laadun parantamisen tilastolliset menetelmät
Veräjänkorva, J., Laatutekniikka
Further reading/material provided by lecturer

(TKAC004) Introduction to Maintenance Technology

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will understand the significance of maintenance in ensuring uninterrupted production in manufacturing and be conversant with the modern principles of maintenance and their application.		
Prerequisite:	Quality Management		
Contents:	Introduction to maintenance Maintenance operations Maintenance profit and efficiency Maintenance data systems Failures Reliability		
Learning Strategies:	Lectures and course-work		
Assessment:	Exam and assignments		
Bibliography:	Aalto, H., Kunnossapitotekniikan perusteet, Kunnossapitoyhdistys ry Further reading/material provided by lecturer		

(TKAC005) Operational Reliability

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will be conversant with the theory of production engineering and maintenance and its applications. Students will be able to survey the reliability of a production line and manage the reliability features of products with aid of planning, acquisitions and a service concept.		
Prerequisite:	Introduction to Maintenance Technology		
Contents:	The significance and concepts of reliability Modelling and analysis procedures Reliability calculations Use of applications		
Learning Strategies:	Lectures and course-work		
Assessment:	exam and assignments		
Bibliography:	Reading list/material provided by lecturer		

(TKAC006) Production Planning

Credits:	4 cr	Timing:	3rd yr
Objective:	Students will have wide knowledge of the operations of a manufacturing company and how the production processes are managed. The course also provides students with skills required in planning and implementing economically viable production process.		
Contents:	The basic concepts of production planning and control. Layout and procedural planning		

Loading
Material operations
Production control operational models

Learning Strategies: Lectures and course-work

Assessment: Exam and exercises

Bibliography: Lapinleimu, I. et al, Kone- ja metalliteollisuuden tuotantojärjestelmät
Harju, A. et al, Teollisuustalous, tuotantotalous
Karrus, K., Logistiikka

(TKAC007) Project/Laboratory Work, Manufacturing Technology

Credits: 3 cr Timing: 1st yr

Objective: Students will gain practical experience of production and the types of problems encountered in the manufacturing process and be able to apply previously acquired theoretical knowledge to solve practical problems.

Contents: Practical tasks linked to Production Technology studies.

Learning Strategies: Project work completed under supervision for businesses and educational institutions with required theoretical backup.

Assessment: Completion of work set, appropriate documentation and presentation.

Bibliography: Students search for their topic information themselves using different information sources.

(TKAK2Z) MECHANICAL ENGINEERING 16 cr

This module introduces students to the basic functioning of machines, devices and structures as part of a larger unit.

(TKAK001) Construction Materials

Credits: 4 cr Timing: 1st yr

Objective: Students will gain an in depth overview of the economic significance of materials in product manufacturing, cost structure and use.

Contents: The common features of metals
Materials testing methods
Metals
The general principles of polymers
Technical plastics
Technical ceramics
Composite materials

Learning Strategies: Lectures and group work

Assessment: Lectures and assignments

Bibliography: Koivisto, K., Laitinen, E., Niinimäki, M., Tiainen, T., Tiilikka, P., Tuomikoski, J.,
Konetekniikan materiaalioppi

(TKAK002) Mechanics and Mechanisms

Credits: 3 cr Timing: 1st yr

Objective: Students will be able to determine the stress levels of a statically determined solid and rigid part in simple structures and mechanisms.

Contents: Particle statics
Rigid part plane-statics
Centre of gravity
Load levels of simple supports
Beam structures
Joint mechanisms

Learning Strategies: Lectures and course-work

Assessment: 2 interim exams

Bibliography: Kärkkäinen, Mikkonen, Insinöörin mekaniikka
Further reading/material provided by lecturer**(TKAK003) Strength of Materials**

Credits: 3 cr Timing: 2nd yr

Objective: Students will understand the link between structural loads and stress levels in a structure and be able to calculate strain in a completed structure in different basic cases and assess the importance of the result.

Contents: Introduction
Deformation
Types of strain
Different strain cases
Stability
Fatigue endurance limit

Learning Strategies: Lectures and course-work

Assessment: 2 interim exams

Bibliography: Kärkkäinen, Mikkonen, Insinöörin mekaniikka
Further material and reading provided by lecturer**(TKAK004) Mechanical Components**

Credits: 3 cr Timing: 2nd yr

Objective: Students will be conversant with the usual components used in machine construction and be able to select the appropriate components according to the manufacturer's instructions and/or with the aid of ADP programmes.

Contents: Couplings
Bearings
Gears, breaks
Power transfer
Springs
Sealing

Learning Strategies: Lectures and course-work

Assessment: Final exam

Bibliography: Blom, S., Lahtinen, P., Nuutio, E., Pekkola, K., Pyy, S., Rautiainen, H., Sampo, A., Seppänen, P., Suosara, E., Koneenelimet ja mekanismit
Further reading/material provided by lecturer

(TKAK005) Project/Laboratory Work Tool Technology

Credits: 3 cr Timing: 3rd yr

Objective: Students will gain practical experience of work tool planning and design and the problems encountered in such a process thus having the opportunity to apply previously acquired theoretical knowledge to solve such problems.

Contents: A practical research and/or planning task linked to mechanical engineering studies.

Learning Strategies: Supervised project work/laboratory tasks for businesses or educational institutions with the aid of theoretical backup.

Assessment: Completion of set work, appropriate documentation and presentation.

Bibliography: Students will search for project/laboratory topic linked material themselves using different sources of information.

(TKAJ3Z) ELECTRICAL ENGINEERING 9 cr

This module opens up the world of electrical engineering applications, electricity safety issues as well as state-of-the-art working methods and procedures.

(TKAJ001) Electronics

Credits: 3 cr Timing: 2nd yr

Objective: Students will be conversant with the principles of analog and digital electronics and how to carry out laboratory work.

Prerequisite: Physics Theory Of Electricity

Contents: The principle equations of electronics
The principle components and connections of analog electronics
The principles of digital electronics
The principles of laboratory work

Learning Strategies: Lectures, course-work and laboratory work

Assessment: Exam and laboratory exercises (assessment 1 - 5)

Bibliography: Rantala, P., Tietokonetekniikka osa 1, Digitaalitekniikka osa A
Salo, P., Sähkötekniikan perusoppi, osat 4 ja 5
Salo, P. Analogista elektroniikkaa, Periaatteita ja sovellutuksia

(TKAJ002) Electrical Power Engineering

Credits: 3 cr Timing: 2nd yr

Objective:	Students will understand how electrical energy is produced, transferred, the distribution system, the conditions of use demands and protection methods. Students will be able to select the appropriate motors, start-up and control methods for different uses of electricity. Students will be able to calculate price comparisons for different forms of energy and electricity prices and they will be proficient in power calculation.
Prerequisite:	Physics / Theory of Electricity
Contents:	Electricity accidents and emergency aid Conditions of use and protection methods Production, transfer and distribution systems of electrical power Pricing electricity and other forms of energy The principles of electric motor engineering
Learning Strategies:	Lectures, course-work and laboratories
Assessment:	exams, assignments and laboratory work
Bibliography:	Suomen sähkö- ja teleurakoitsijaliitto ry sähköturvallisuuden edistämiskeskus ry, Käsikirja rakennusten sähköasennuksista(D1-2006) Aura, L., Tonteri, A., Sähkölaitostekniikka Aura, L., Tonteri, A., Teoreettinen sähkötekniikka ja sähkökoneiden perusteet lecture handouts

(TKAJ003) Data Systems

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will be aware of the opportunities provided by up-to-date data transfer systems in making operations more efficient.		
Contents:	The structure and functions of a computer, hardware and software Local area networks Data transfer technology Databases EDI Internet		
Learning Strategies:	Lectures, course-work and laboratories		
Assessment:	Exam and assignments		
Bibliography:	Reima, S., Organisaatioiden väliset tietojärjestelmät Lapinleimu, I., Kauppinen, Torvinen, Kone- ja metalliteollisuuden tuotantojärjestelmät Further reading/material provided by lecturer		

(TKAP5Z) AUTOMATION TECHNOLOGY 29 cr

(TKAP001) Pneumatics

Credits:	3 cr	Timing:	1st yr
Objective:	Students will be conversant with the principles and components of pneumatics and how to apply this knowledge when working with machine automation devices. The course also covers service issues.		

Contents:	The production and transfer of pressurised air Pneumatics graphical symbols Regulating elements valves Control of a compressed air system Planning a compressed air system
Learning Strategies:	Lectures, course-work, laboratory work
Assessment:	exam, assignments
Bibliography:	Ellman, A., Hautanen, J., Järvinen, K., Simpura, A., Pneumatiikka Further reading/material provided by lecturer

(TKAP012) Workpiece Handling Equipment

Credits:	2 cr	Timing:	1st yr
Objective:	Students will be conversant with the devices used in automated manufacturing such as conveyors, storage and dosing devices.		
Contents:	Introduction Different manufacturing systems Conveyors and piece storage Dosing and turning devices, palettes		
Learning Strategies:	Lectures, assignments and industrial study visit		
Assessment:	Exam (graded 1 - 5), attendance and accomplished study visit		
Bibliography:	Lecture handout Further reading to be announced		

(TKAP013) Robotics

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will gain a general overview of how modern robots can be used in piece goods production and in the machine workshop and will be able to apply and programme robots.		
Prerequisite:	Piece Goods Processing Equipment		
Contents:	Robot statistics Robot structures Grippers and tools Robot sensors Use and programming of robots Application examples and peripheral equipment Connecting robots to other automation systems Robot systems' safety and security		
Learning Strategies:	Lectures, exercises, labs and industrial study visit		
Assessment:	Exam (evaluation 1-5), attendance and completed industrial study visit		
Bibliography:	Lecture handouts Kuivanen, R., Robotiikka, Suomen robotiikkayhdistys RY:n julkaisu, 1999		

Salmelin, B., Temmes, J., Robottiautomaatio, Suomen robotiikkayhdistys RY:n julkaisu 9.

(TKAP003) Sensor Technology

Credits:	3 cr	Timing:	1st yr
Objective:	This course emphasises the significance of sensors and their usual structure and enables students to select the correct sensor for a particular use.		
Contents:	Principles of sensors Connecting position transducers Telltale and twist sensors Velocity measurement Acceleration and vibration measurement Power and pressure measurement Temperature and flow measurement Bar code and piece recognition Automation safety procedures Connecting sensors to the control system.		
Learning Strategies:	Lectures, course-work, laboratory work		
Assessment:	Exam (assessment 1 - 5), assignments		
Bibliography:	Lecture handout Reading list/material provided by lecturer		

(TKAP004) Control Systems

Credits:	3 cr	Timing:	2nd yr
Objective:	This course covers the implementation principles of different automation systems and the importance of control systems, as well as the structures of programmable devices and the principles of programming.		
Contents:	Principles of control Coupling function Programmable controllers Programming controllers The hierarchical structures of control systems Frequency variables		
Learning Strategies:	Lectures, exercises, laboratory work		
Assessment:	Exam (assessment 1 - 5), assignments		
Bibliography:	Reading list/material provided by lecturer, handouts Airila, Mekatroniikka, Otatiето, julakaisu no. 897, ISBN 951-672-239-3 Ohjaustekniikan perusteet, Festo		

(TKAP014) Flexible Manufacturing Systems

Credits:	3 cr	Timing:	2nd yr
Objective:	This course provides students with the ability to picture automated production		

possibilities in different production environments and to understand how production management works as a whole and at device level. Students will be able to combine previously acquired knowledge of different automation technology fields to form a cohesive whole and apply this knowledge when planning manufacturing systems.

Prerequisite: Pneumatics Robots and Piece Goods Handling Equipment Sensor Technology Control Systems

Contents: The principles of automated production
The levels of flexible manufacturing
Information management in MFS
Work safety and automated systems
Finance for automated systems

Learning Strategies: Lectures and exercises

Assessment: Exam and assignments

Bibliography: Reading list/material provided by lecturer

(TKAP006) Computer Programming (C)

Credits: 3 cr **Timing:** 2nd yr

Objective: Students will understand programming and software planning as well as being able to programme simple applications.

Contents: Programming languages and stages
The structure of C-language
Reserved words
The structure of C-language
Handling files
Control structures
Mathematical functions
Subprograms

Learning Strategies: Lectures and exercises

Assessment: Exam (assessment 1 - 5), assignments

Bibliography: Reading list/material provided by lecturer
Handout

(TKAP007) Project/Laboratory Work, Automation Technology

Credits: 3 cr **Timing:** 2nd - 4rd yr

Objective: Students will gain practical experience of different areas of automation and systems and will learn how to apply acquired theoretical knowledge in practice.

Contents: Automation technology labs

Learning Strategies: Project/labs completed under the supervision of the teacher for companies or the university combined with related theoretical back-up.

Assessment: Completion of all tasks set and documentation

Bibliography: Students procure the material required for the project/lab using different sources of

information.

(TKAP008) Project/Laboratory Work, Pneumatics

Credits:	3 cr	Timing:	2nd - 3rd yr
Objective:	Students will gain a practical overview of the different areas and systems of pneumatics and how to apply theory in practice.		
Contents:	Pneumatics lab work		
Learning Strategies:	Project/laboratory work for companies or educational institutions under supervision and related theory		
Assessment:	Accomplishment of project/lab assignment and its documentation		
Bibliography:	Students should find appropriate material for their project/lab work themselves		

(TKAP016) Project/Laboratory Work, Flexible Manufacturing Systems

Credits:	3 cr	Timing:	2nd - 3rd yr
Objective:	Students will gain experience of the practical tasks associated with flexible manufacturing systems and will learn to apply acquired theoretical knowledge during these tasks.		
Contents:	Practical research and planning assignments related to flexible manufacturing systems studies.		
Learning Strategies:	Projects/labs carried out in companies and educational establishments and related theoretical back-up information.		
Assessment:	Accomplishment of all set tasks and documentation.		
Bibliography:	Students will procure all the material required for the project/lab topic themselves using different sources of information.		

OPTIONAL PROFESSIONAL STUDIES

Students may select one of the following modules as their professional studies: Electronics Manufacturing or Computer-aided Production. Within optional studies groups will be formed of a minimum of 10 and maximum of 15 students. If the groups cannot be formed according to which module students have selected, access to each module will be based on the number of and performance in courses passed. For Electronics Manufacturing these courses are: Manufacturing Technology, Quality Management, Electronics, Control Systems. Computer-aided Production: Manufacturing Technology, English Studies, 3-D Modelling, Introduction to Maintenance Technology, Piece Goods Process Equipment and Robots

(TKVK0Z) MECHANICAL PLANNING 15 cr

(TKVK001) The Principles of Mechanical Planning

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will understand the significance of a systematic product planning method and financial issues in product planning.		
Contents:	Systematic mechanical planning Product planning for flexible and economically viable production Planning a modular product concept Reliability and safety Protecting an invention		
Learning Strategies:	Lectures and exercises		
Assessment:	Exam		
Bibliography:	Airila M, co Koneenosien suunnittelu		

(TKVK002) Vibration Mechanics

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will understand vibrations while being able to analyse the size of a vibration, use vibration management planning methods and measure vibrations.		
Contents:	The parts of a vibrating system The natural vibration for one degree of freedom The harmonic forced vibration of one degree of freedom The general forced movement for one degree of freedom The equations of motion for a system of several degrees of freedom The natural vibration for a system of several degrees of freedom The forced vibration of several degrees of freedom		
Learning Strategies:	Lectures and exercises		
Bibliography:	To be announced		

(TKVK003) Finite Element Method (FEM)

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will know the principles of the FEM and FEM calculations using application programmes.		
Prerequisite:	Strength of Materials		
Contents:	Principles of the Finite Element Method. The stages of FEM calculation. Exercises		
Learning Strategies:	Lectures and exercises		
Assessment:	Exercises		
Bibliography:	Reading List provided by the lecturer		

(TKVK004) Tuotekehitys - Product Development

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will gain knowledge of product development in industrial operations and the different stages of product development.		
Contents:	Recognising customer needs Applying creative working techniques during product development Specifying the product, outlining, documentation and finalising		
Learning Strategies:	lectures, exercises, project assignment		
Assessment:	Exam and project assignment		
Bibliography:	Välimaa, et al, Tuotekehitys. Asiakastarpeesta tuotteeksi.		

(TKVK005) Mechanical Planning Project Work

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will carry out practical mechanical planning tasks and learn to apply acquired theoretical knowledge.		
Prerequisite:	Product Development		
Contents:	practical research, development and planning assignments		
Learning Strategies:	Project cooperation with companies		
Assessment:	Completion of project assignment and reporting		
Bibliography:	Source material related to the topic covered by the project assignment		

(TKVN0Z) NC PRODUCTION 15 cr

(TKVN001) NC Machines

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will gain an overview of modern NC technology and the opportunities it provides in production while being able to make effective NC programmes for basic machinery.		
Prerequisite:	The Basics of NC Technology		
Contents:	NC programming NC machinery in its own environment The maintenance and servicing of NC machinery		
Learning Strategies:	Lectures, exercises and labs		
Assessment:	Exam (evaluation 1-5) 50 % and assignments (evaluation 1-5) 50 %		
Bibliography:	Pikkarainen, E., NC -tekniikan perusteet		

(TKVN002) Computer-Aided NC Programmimg

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will know how to use CAD 3D applications and how to programme machining paths based on a created geometry to be produced by NC programmes for NC machining tools.		
Prerequisite:	Introduction to Data Processing CAD 3D Modelling Introduction to NC Technology		
Contents:	The stages of CAD NC programming The transfer of data from the design system to the NC programming system Creating machining paths Simulations Intermediate file, the path of the tool's point Postprocessor and its significance The produced NC programme and NC machining and testing		
Learning Strategies:	lectures and exercises		
Assessment:	Exam (evaluation 1 - 5), assignments and attendance (40%) and study visits (10 %)		
Bibliography:	Pikkarainen, E., Tietokoneavusteinen NC -ohjelmointi Further reading will be provided by the lecturer		

(TKVN003) The Integrated Production System

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will know the concepts of integrated production and how to apply and plan the different areas of integrated production systems.		
Prerequisite:	Introduction to NC Technology 3D Modelling		
Contents:	CAM and CIM Group technology CIM in practice		
Learning Strategies:	Lectures, study visits and team work		
Assessment:	Assignment (evaluation 1-5)		
Bibliography:	Pikkarainen, E., Integroitu tuotantolaitos Further reading will be provided by the lecturer		

(TKVN004) Sheet Metal Piece Production

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will know the properties and production opportunities of sheet metal pieces. They will also be able to apply modern sheet metal production methods.		
Prerequisite:	Introduction to NC Technology and 3D Modelling		
Contents:	Thin sheet pieces and their planning Traditional methods of sheet metal production Modern methods of thin sheet metal production Layout programmes The sheet metal work centre and its structure Laser cutting		

Learning Strategies: Lectures, study visits and exercises

Assessment: Exam (evaluation 1-5) 50 %, exercises and study visits 50 %

Bibliography: Reading list provided by the lecturer
Handout

(TKVN005) NC Production Project Work

Credits: 3 cr Timing: 3rd or 4th yr

Objective: Students will gain practical experience of NC machining tools, problems that may arise and they will also learn to apply their acquired theoretical knowledge to practical problems.

Prerequisite: 3D Modelling Introduction to NC technology CAD NC Programming and The Integrated Production System

Contents: Practical research and/or production assignments related to NC production studies.

Learning Strategies: Project assignments carried out under the teacher's supervision for companies or the university with the required theoretical back-up.

Assessment: Completion of the assignment and its documentation and presentation

Bibliography: The students must procure the material covering the topic of their project assignment using different sources of information.

(TKVV0Z) VIRTUAL PRODUCTION 15 cr

(TKVV001) Virtual Modelling of Production

Credits: 6 cr Timing: 3rd yr

Objective: Students will be proficient in the opportunities provided by computer-aided modelling for production system planning and they will learn the basic techniques of modelling in practice.

Contents: The concepts and principles of modelling
The parts and equipment of virtual production
Use of workers in the model
Piece handling and conveyor devices
The kinematics of the computer model
Analysing performance of the model

Learning Strategies: Lectures and group work

Assessment: Practical skills test

Bibliography: Tutorials with visiting experts

(TKVV002) Robots in Manufacturing

Credits: 3 cr Timing: 3rd yr

Objective: Students will be able to make and use a virtual model to programme and simulate

robot applications.

Contents: Modelling robots and the work environment
Use of basic models
Programming
Simulating the system
Connecting to the production system

Learning Strategies: Lectures and assignments

Assessment: Assignments

Bibliography: Material will be provided by the lecturer

(TKVV003) ProEngineer/Inventor

Credits: 3 cr Timing: 3rd yr

Objective: Students will gain wide-ranging knowledge of 3 D CAD software for use in design.

Prerequisite: Computer Aided Design, Basic Course

Contents: User interface
Partial modelling
Creating drawings from a 3 D model
Assembly drawings, limitations, adaptability and collision checks
Assembly animations
Parameters and integration, product family
Sheet metal design

Learning Strategies: Lectures and exercises

Assessment: Skills demonstration test and assignments

Bibliography: Handout

(TKVV004) Virtual Production Project Work

Credits: 3 cr Timing: 3rd yr

Objective: Students will model a production environment as realistically as possible. This course trains students to outline different types of production situations to discover where there should be developments made to make production more efficient using the computer model.

Contents: Finding a suitable project
Modelling the system
Analysis
Compilation of development plan

Learning Strategies: Project work completed under supervision for companies or educational establishments including relevant theoretical back-up knowledge.

Assessment: Independent work completed as agreed including documentation and presentation.

Bibliography: Students must acquire their own material for the project using different sources of information.

(TKVP0Z) MAINTENANCE 15 cr**(TKVP001) Maintenance of Production Systems**

Credits: 3 cr Timing: 3rd yr

Objective: This course provides in depth knowledge of maintenance concepts and specific engineering skills to ensure the functioning of equipment and structures and their economic and long-term use.

Prerequisite: Introduction to Maintenance

Contents: Maintenance operations in a manufacturing plant
Corrosion prevention, general corrosion
Surface treatments
Lubrication
Rotating devices
Vibration measurements
Corrosion and electronics
ESD
Reliability-oriented maintenance

Learning Strategies: Lectures and assignments

Assessment: Exam and assignment consisting of a selected device's or system's maintenance plan

Bibliography: To be announced

(TKVP002) Energy Technology

Credits: 3 cr Timing: 3rd yr

Objective: Students will be familiar with energy production and use, the basics of thermal technology and saving energy.

Prerequisite: Introduction to Maintenance

Contents: Heat transfer.
Steam technology
The production of energy

Learning Strategies: Lectures and exercises

Assessment: Exams and assignments

Bibliography: Material will be provided by the lecturer

(TKVP003) Industrial Pipelines

Credits: 3 cr Timing: 3rd yr

Objective: Students will know the basics of pipeline planning and be able to select and survey the components required in the pipeline

Prerequisite: Introduction to Maintenance

Contents: Pipeline flow charts and drawings

The basics of flow technology
Pumps and pipeline equipment
Preparation and installation of pipelines

Learning Strategies: Lectures and exercises

Assessment: Exams and assignments

Bibliography: Kesti, M. Teollisuusputkistot
Further material will be provided by the lecturer

(TKVP004) Technical Diagnostics

Credits: 3 cr Timing: 3rd yr

Objective: Students will gain in depth knowledge of fault and condition monitoring diagnostics.

Prerequisite: Introduction to Maintenance

Contents: Technical methods in condition monitoring
How faults come about
Practical measurements and laboratory work

Learning Strategies: lectures, exercises and lab work

Assessment: Exam and assignments

Bibliography: Material will be provided by the lecturer

(TKVP005) Maintenance Project Work

Credits: 3 cr Timing: 3rd yr

Objective: Students will gain experience in practical maintenance tasks and learn to apply acquired theoretical knowledge.

Prerequisite: Introduction to Maintenance

Contents: Practical research, development and planning assignments

Learning Strategies: Project assignments in collaboration with businesses

Assessment: Completion and documentation of the project assignment

Bibliography: Source material related to the project assignment topic

(TKVE1Z) ELECTRONICS MANUFACTURING 15 cr

(TKVE002) Electronic Components

Credits: 3 cr Timing: 3rd yr

Objective: Students will be conversant with the manufacturing processes and structures of the most common components and characteristics of their use.

Contents: Circuit boards and their manufacturing processes

Electronic components and their manufacturing processes
 Enclosing components
 Coating methods
 Handling and storage
 Recognising different components

Learning Strategies: Lectures and coursework

Assessment: Lectures and assignment

Bibliography: Lantto, V., Elektroniikan komponentit ja materiaalit
 Volonen, V., Analoginen elektroniikka Komponentit ja peruskytkennät
 Scottish Electronic Manufacturing Centre, Elektroniikan komponenttitekniikka
 Petäjäjärvi, A., Komponenttien kotelotyypit ja liitostekniikat

(TKVE008) CAD Circuit Board Design

Credits: 3 cr Timing: 2nd yr

Objective: Students will be able to use computer programmes to design circuit diagrams and to plan circuit boards.

Prerequisite: Introduction to Data Processing

Contents: Drawing circuit diagrams
 Planning and designing circuit boards

Learning Strategies: Lectures and exercises

Assessment: Exam (assessment 1 - 5), assignments

Bibliography: Material as advised by teacher

(TKVE009) Electronics Manufacturing

Credits: 3 cr Timing: 3rd yr

Objective: Students will be conversant with the structures and features of component handling devices and will be able to programme them for the required product. They will also be proficient in electronics connecting methods and choosing the correct methods, materials, devices and control values for specific products.

Contents: Automated assembly
 Pasting
 Component handling and feed equipment
 The structures and technical features of assembly machines
 Programming assembling machines
 Electronics connecting during assembly
 An introduction to the soldering process
 Reflow soldering
 Wave soldering
 Vapour phase
 Other connecting methods

Learning Strategies: Lectures and group work

Assessment: exam and assignments

Bibliography:

- Scottish Electronic Manufacturing Centre, training material
- PohTo, RampUp 3 training material
- Rautionaho, R., Elektroniikan liittämismenetelmät
- Mercasystems Oy, No-clean Juotospasta
- IPC-A-610 -standardi

(TKVE010) **Quality Management in Electronic Production**

Credits: 3 cr Timing: 3rd yr

Objective: Students will be able to analyse the product and production quality by clarifying the effects of different production elements using a clear, sensible testing system.

Contents:	Tools and methods for problem solving
	Testing system
	The taguchi method
	the Shainin method
	SPC application to the production process

Learning Strategies: Lectures and group work

Assessment: Exam and assignments

Bibliography: Laatumieto Oy, Laatumenetelmät
Järnefelt, G., Tuoteprosessin tilastollinen valvonta: SPC
Karjalainen, E., Tuotteen ja prosessin optimointi koesuunnittelulla
Taguchi-menetelmä

(TKVE011) Electronic Production, Project Work

Credits: 3 cr Timing: 3rd yr

Objective: Students will be able to prepare a typical production line for use according the requirements of specific products.

Contents: Circuit Board Planning and Production 4 cr (TEVE34S)
 Circuit Board Testing 2 cr (TEVE35S)

Learning Strategies: Lectures and group work

Assessment: Practical skills test and device specific reports

(TKVJ0Z) PRODUCTION LEADERSHIP 15 cr

(TKVJ001) Company Operations and Leadership

Credits: 3 cr Timing: 3rd yr

Objective: Students will understand the strategy and production process stages related to company operations and products.

Contents:

- A company's operational environment and changes in the environments
- Product life-cycle and cost structure
- from idea to product (techniques and analyses)
- Forms of production and data systems
- Testing and quality
- Patenting and funding

Suppliers and subcontracting

Learning Strategies: Lectures and exercises

Assessment: Exam and assignment

Bibliography: Karjalainen, E., Quality Function Deployment
Material as advised by teacher

(TKVJ002) Operation Supervision Methods

Credits: 3 cr Timing: 3rd yr

Objective: Students will become familiar with different operation supervision methods and their features and will learn to use the different principles of operation supervision in different practical situations and surroundings.

Contents: Concepts of operation supervision
Basic methods
Operation supervision and organisation
Business networks
Outsourcing production
Acquisition of operation supervision systems

Learning Strategies: Lectures and exercises

Assessment: Exam, assignment

Bibliography: Karjalainen, J. et al, Kehittyvä toiminnohjaus
Möller, K. et al, Tulevaisuutena liiketoimintaverkot
Karjalainen, J. et al, Tuotannollinen ulkoistaminen
Vilpola, I. et al, Toiminnanohjausjärjestelmän hankinta C-CEI-menetelmän avulla

(TKVJ003) Manufacturing Process's and Logistics

Credits: 3 cr Timing: 3rd year

Objective: Students will learn to understand production operations as processes while adopting a process-oriented way of thinking and the principles of process leadership. Students will become proficient in process modelling for practical situations and they will gain an overview of the logistics chain and how to manage it using different control and rationalization methods.

Contents: Process leadership
Process modelling
Logistics of industrial production
Controlling logistics
Logistics efficiency and technologies
Organisation of logistics operations

Learning Strategies: Lectures and exercises

Assessment: Exam, assignments

Bibliography: Karrus, K., Logistiikka
Material as advised by the lecturer

(TKVJ004) Commodification and Production

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will understand the significance of commodification and production in successful business ventures by doing exercises and using examples.		
Contents:	Customer needs recognition. Product development Product life-cycle Organising production and bringing the product to the customer.		
Learning Strategies:	Lectures and assignments		
Assessment:	Exam and exercises		
Bibliography:	Reading list provided by lecturer		

(TKVJ005) Production Leadership Project Work

Credits:	3 cr	Timing:	3rd year
Objective:	Students will gain practical experience of production leadership and management, problems that can arise and how to apply theory in practice.		
Contents:	Practical research and/or planning assignments linked to production leadership studies.		
Learning Strategies:	Supervised project work for companies or educational establishments and relevant theoretical back-up.		
Assessment:	Accomplishment and documentation of all agreed tasks and presentation.		
Bibliography:	Students must acquire the required material for their project work from different sources.		

(TKVA0Z) EXTRACTIVE TECHNOLOGY 15 cr**(TKVA001) Extractive Industry**

Credits:	3 cr	Timing:	3rd yr
Objective:	To provide information on the legislation and permit procedures of the extractive industry. Students will gain knowledge of stoping methods as well as stoping and ore transportation devices. The course also provides basic knowledge of the special features of environmental issues linked to the extractive industry and how they are dealt with, as well as legislation and permit procedures.		
Contents:	The extractive industry in Finland. Claiming and environmental effects evaluation procedure Stoping and ore handling The special features of underground mining operations Environmental technology Environmental protection and legislation		
Learning Strategies:	Lectures, assignments		

Assessment:	Exam, assignments
Bibliography:	Lecture handout Other material as indicated by the lecturer

(TKVA002) Introduction to Geology

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will get to know the basic concepts of geology and the most important minerals as well as an overview of mineralogical raw materials.		
Prerequisite:	Introduction to Chemistry		
Contents:	Basic geological processes The geology of Finland Stone types and minerals Searching for ore The use of ore deposits Pre-mining surveys		
Learning Strategies:	Lectures, assignments		
Assessment:	Exam, assignments		
Bibliography:	Lecture handout Other material as indicated by the lecturer		

(TKVA003) Particle Technology

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will gain knowledge of the principles of mineral technology, the properties of granular material, the unit processes of particle technology and the equipment used in these processes.		
Prerequisite:	Introduction to Geology		
Contents:	Crushing, grinding and classification Making crushing and grinding circuits Crushing and grinding equipment		
Learning Strategies:	Lectures, assignments		
Assessment:	Exam, assignments		
Bibliography:	Lecture handout Other material as indicated by the teacher		

(TKVA004) Benefication Technology

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will be proficient in the basic methods of benefication and the structures of benefication equipment. They will also gain knowledge of pumps and pumping, the transfer of solids-fluid suspensions, and of the separation of solids from water/gas		

mixtures.

Prerequisite: Particle Technology

Contents: Flotation
Specific gravity and magnetic separation
Fluid mechanics and transfer of fluids
Separation of solids
Pumping and filtering
Equipment maintenance

Learning Strategies: Lectures, calculation exercises

Assessment: Exam, assignments

Bibliography: Lecture handout
Further material as indicated by the teacher

(TKVA005) Hydrometallurgical

Credits: 3 cr Timing: 3rd yr

Objective: Students will be proficient in the basics of hydrometallurgical chemistry and core processes such as leaching, the purification and filtration of the leaching (pregnant)solution and the reduction of metal from a water-based pregnant solution.

Prerequisite: Introduction to Chemistry Particle Technology Benefication Technology

Contents: Introduction to hydrometallurgy
The chemical principles of hydrometallurgy
Leaching and pregnant solution purification
The reduction of metal from a water-based pregnant solution
The core processes of hydrometallurgy
The peripheral processes of hydrometallurgy

Learning Strategies: Lectures, calculation exercises

Assessment: Exam

Bibliography: Lecture handout
Other material as indicated by the teacher

(VAPAAZ) FREE-CHOICE STUDIES 15 cr

Students can freely select 15 cr of studies that will support their professional development, from their own field/degree programme or from another degree programme in their own university of applied sciences, from another university of applied sciences or science university. Students will achieve wide-ranging business expertise.

(TRW007) Bygg Upp Din Svenska

Credits: 1.5 cr Timing: To be announced

Objective: This course develops and strengthens Swedish skills acquired during earlier courses

so that students will be able to cope with UAS level Swedish language studies in their own field of studies. The aim is also to develop language study skills.

Prerequisite: Proficiency test

Contents: Basic grammar and vocabulary.
Activating speaking and writing skills as well as listening and reading comprehension.

Learning Strategies: Small groups

Assessment: Active participation 100 %, oral and written exercises, exam, evaluated on a scale of 0 - 5

Bibliography: Handout

(TRW008) Build up Your English

Credits: 1.5 cr Timing: 1st yr

Objective: Students will develop and strengthen their language skills acquired during previous courses in order to be able to cope with their compulsory professional language studies. The aim is also to develop language learning skills.

Prerequisite: Proficiency test

Contents: Basic grammar and vocabulary
Activation of speaking and writing skills as well as reading and listening comprehension.

Learning Strategies: Small group teaching

Assessment: Active participation 100 %, oral and written exercises, exam

Bibliography: handout

(TKOO0Z) THESIS 15 cr

(TKOO001) Thesis

Credits: 15 cr Timing: 4th yr

Objective: The thesis enables students to apply acquired theoretical knowledge and skills to tasks of an expert linked to their own chosen field of studies. The thesis subject is usually agreed upon and commissioned by a client in real working life which supports students' professional growth in their own field. The thesis provides a wide ranging view of the author's abilities.

Contents: Finding a suitable topic from the business world
Completion of necessary documentation
Acceptance process
Choosing a supervisor
Completion of thesis
Presentation of thesis
Maturity test

Assessment: The progress and evaluation form must be returned to the supervisor.

(TKHH0Z) PRACTICAL TRAINING 30 cr

(TKHH001) Practical Training

Credits: 30 cr Timing: 4th yr

Objective: The aim of the practical training period is to provide students with good post graduation employment opportunities and to familiarise students with working life. Students will gain knowledge of different job tasks, working procedures, devices and professional terminology related to their chosen specialism in a real working environment under supervision. The practical training period takes place during the autumn semester of the fourth study year. Mr Eero Soininen is the practical training co-ordinator responsible for informing students of practical training issues together with the head of the degree programme.

Prerequisite: Students must have 135 cr before starting their practical training period.

Contents: A usually continuous approx five month training period (800 working hours) in working life

CONSTRUCTION ENGINEERING DEGREE PROGRAMME

This degree programme covers building production, renovation building and long-term facility management planning. Shared professional studies provide wide-ranging basic knowledge of different areas of construction engineering. Optional studies deepen knowledge of production technology or facility management.

Construction Engineering Degree Programme	Description of competence
Environmental responsibility and life-cycle competence in construction	<ul style="list-style-type: none"> • Life-cycle technology management • Knowledge and control of the environmental effects of construction products and production • Lifetime measurement management • Facility maintenance and finance management
Structural design competence	<ul style="list-style-type: none"> • Structural planning competence involving different materials for house and environmental structures • Static structure operation management • Management of physical and chemical phenomena in construction and the ability to take them into account during planning • Understanding of the effects of other fields (architectural design and geotechnical planning, housing engineering) of planning
Construction process competence	<ul style="list-style-type: none"> • Outsourcing construction of houses and environmental structures, contracting and leadership • Customer-orientation • Production control management • Taking into account the effects of heating, plumbing, air conditioning, electrics and automation technologies • Construction quality and safety management
Economic competence for the construction industry	<ul style="list-style-type: none"> • Building project cost management • Investment calculation and running cost management • Understanding how costs are incurred • Knowledge of construction entrepreneurship within business economics
Management and leadership competence	<ul style="list-style-type: none"> • Management system control • Quality management • Occupational safety and well-being management • Organizational leadership • Work contract competence • Competence in interpersonal relationships
Specialist competence for renovation building	<ul style="list-style-type: none"> • Renovation building process and technology management • Understanding of the functional, historic and

	<p>aesthetic value of buildings during different eras</p> <ul style="list-style-type: none"> • Comprehension of the opportunities provided by the protection of buildings • Knowledge of building materials, structures and methods from different eras • Understanding of factors affecting the evaluation of a building's functional capacity and condition and of methods of renovating different building parts and structures
Facility management competence	<ul style="list-style-type: none"> • Comprehension of facility maintenance as a systematic process covering the whole life-cycle of a facility or property

THEMES FOR EACH YEAR OF STUDY

1st yr

Engineering orientation

Students will gain an overview of the most significant areas in building production and facilities maintenance and will be able to acquire the knowledge and skills to manage such areas.

2nd yr

Deeper knowledge

This theme covers learning how to apply technological economic thinking to real targets and communication and group work skills.

3rd yr

Specialisation

Students will gain specialised knowledge of a particular area and learn to apply theory in practice.

4th yr

Finalisation of competence

This theme covers the deepening and application of independent, responsible and wide-ranging thinking to a practical problem and familiarisation with management level and expert operations.

DEGREE PROGRAMME IN CONSTRUCTION ENGINEERING

BASIC STUDIES	53 cr
LANGUAGE AND COMMUNICATION SKILLS	12 cr
Finnish Communication Skills	3 cr
Text and Terminology	3 cr
Svenska för Byggingenjörer	3 cr
Introduction to Data Processing	3 cr
BUSINESS STUDIES	11 cr
Introduction to Business Economics	3 cr
Leadership and Interpersonal Skills	5 cr
Marketing Project	3 cr
STUDIES IN MATHEMATICS AND NATURAL SCIENCES	30 cr
Mathematics 15 cr	15 cr
Physics 12 cr	12 cr
Chemistry 3 cr	3 cr
COMPULSORY PROFESSIONAL STUDIES AND PROJECT WORK	109 CR
English Language and Communication Studies	3 cr
Device Technology	8 cr
Business Economics and Law	6 cr
Building Design and Construction	16 cr
Construction Economics	10 cr
Production Technology	13 cr
Construction Technology	19 cr
Renovation Building	23cr
Facility Maintenance	11 cr
ALTERNATIVE PROFESSIONAL STUDIES	18 cr
Facility Management	12 cr
Production Technology	12 cr
Optional Project Work	6 cr
FREE-CHOICE STUDIES	15 cr
PRACTICAL TRAINING	30 cr
THESIS	15 cr

COURSE DESCRIPTIONS OF DEGREE PROGRAMME IN CONSTRUCTION ENGINEERING

BASIC STUDIES

(TRPV0Z) LANGUAGE AND COMMUNICATION SKILLS 12 cr

(TRPV001) Communication Skills in Finnish

Credits:	3 cr	Timing:	1st year
Objective:	Students will practice oral and written communication required in working life and their chosen profession.		
Contents:	An introduction to oral and written communication Academic writing Situations requiring oral communication (preparation, participation, analysis)		
Learning Strategies:	Independent work, group work, lectures		
Assessment:	Participation in group work, exercises, portfolio and exam		
Bibliography:	Kauppinen, A., Nummi, J., Savola, T., Tekniikan viestintä (4., uudistettu painos) Handout		

(TRPV007) Text and Terminology 1

Credits:	1.5 cr	Timing:	1st yr
Objective:	This course aims to develop and strengthen construction engineering students' English skills so they will be able to read their own professional literature and write technical documents.		
Prerequisite:	Proficiency test and Build up Your English course if required		
Contents:	Technical language as a tool The special grammatical features of technical language Vocabulary building Developing reading techniques Documentation		
Learning Strategies:	Contact teaching, assignments, independent, pair and group work		
Assessment:	Active participation, assignments; written exam		
Bibliography:	Handout		

(TRPV008) Text and Terminology 2

Credits:	1.5 cr	Timing:	2nd yr
Objective:	This course aims to develop and strengthen construction engineering students' English skills so they will be able to read their own professional literature, write		

technical documents, search for and process information.

Contents: The special grammatical features of technical language
Vocabulary building
Developing reading techniques
Documentation
Oral and written reporting and summarising.

Learning Strategies: Contact teaching, independent, pair and group work

Assessment: Active participation, searching for and processing technical texts, oral presentations (in assessment 50 %); written exam (in assessment 50 %)

Bibliography: Texts processed by students

(TRPV005) Swedish for Construction Engineers

Credits: 3 cr Timing: 1st or 2nd year

Objective: Students will develop their oral and writing skills in Finland's second official language specifically to aid their own professional development. Students will practise speaking Swedish in everyday communication situations as well as being able to discuss professional issues in Swedish. Students will also be able to find and use information in Swedish concerning their own specific field.

Contents: Construction engineering terminology, vocabulary and communication situations

Learning Strategies: Small group teaching

Assessment: Active participation, spoken and written exercises, oral and written exam

Bibliography: Handout

(TRPV006) Introduction to Data Processing

Credits: 3 cr Timing: 1st year

Objective: Students will be conversant with the basic structure of a microcomputer and know how to use the university's computers and the most common tools programmes and equipment in their studies.

Contents: Microcomputer equipment
Operating systems and user interfaces
Using information networks
Tools programmes
System installation and configuration
The university of Applied Sciences computer network, usernames and passwords
An introduction to word processing
Spreadsheet calculation

Learning Strategies: Small group work and exercises

Assessment: Exam and assignments

Bibliography: Reading list/material provided by lecturer

Clarifying customer needs
 Setting targets
 Competition methods in marketing
 Marketing strategy
 Feedback system
 Developing operations

Learning Strategies: Lectures, assignment

Assessment: Assignment, exam

Bibliography: Handout

STUDIES IN MATHEMATICS AND SCIENCE 30 cr

This module serves as an introduction to mathematics and science for engineering.

(TRPM2Z) MATHEMATICS 15 cr

This module serves as an introduction to mathematics and science for engineering.

(TRPM001) Mathematics 1-2

Credits: 6 cr Timing: 1st year

Objective: This course partially revises and adds to high school and vocational college mathematics with an aim to develop systematic and disciplined learning and interaction skills.

Contents: Number systems
 Functions
 Trigonometry
 Vectors
 Determinants and matrices
 Introduction to a mathematics programme

Learning Strategies: Lectures and exercises

Assessment: Exam

(TRPM002) Mathematics 3

Credits: 6 cr Timing: 1st year

Objective: Students will develop their calculation skills and at the same time they will gain an overview of the basic principles and applications of differential and integral calculus.

Contents: Revision of basic calculus
 Differentiation and graphs of functions
 Maximum and minimum of functions
 Integration
 Area between curves
 Volume of a surface of revolution
 Work

Learning Strategies: Lectures and exercises

Assessment: Exam

Bibliography: Majaniemi, A., Matematiikka I

(TRPM003) Mathematics 4

Credits: 3 cr Timing: 2nd year

Objective: Students will be introduced to statistical thinking.

Contents: Probability calculus
Basic concepts of statistics

Learning Strategies: Lectures and exercises

Assessment: Exam

Bibliography: Majaniemi, A., Matematiikka IV

(TRPF3Z) PHYSICS 12 cr

Students will gain basic knowledge of Physics and be introduced to different measurement techniques.

(TRPF001) Physics 1

Credits: 4 cr Timing: 1st year

Objective: This course aims to provide background knowledge required in other modules of the degree programme.

Contents: Physics system of units and quantities
 Mechanics

Learning Strategies: Lectures and exercises

Assessment: Exam

Bibliography: Inkinen, P., Tuohi, J., Momentti 1 Insinöörfysiikka , Otava

(TRPF002) Physics 2

Credits: 5 cr Timing: 1st year

Objective: This course aims to provide the physical background knowledge required in other modules of the degree programme.

Contents: Thermodynamics, Electricity
Wave motion and acoustics,
Atomic and nuclear physics

Learning Strategies: Lectures and exercises

Assessment: Interim exams

Bibliography: Inkinen, P., Tuohi, J., Momentti 1 Insinöörifysiikka, Otava
Inkinen, P., Manninen, R., Tuohi, J., Momentti 2 Insinöörifysiikka, Otava

(TRPF003) Physics, Laboratory Work

Credits:	3 cr	Timing:	2nd year
Objective:	Students will gain concrete knowledge of physics through experimentation. This course also provides an introduction to measurement techniques and written reporting.		
Contents:	Practical applications of physics topics presented during previous physics courses in this module.		
Learning Strategies:	Laboratory exercises		
Assessment:	Completion of all laboratory assignments and written reports (assessment grades 1 - 5)		
Bibliography:	Inkinen, P., Tuohi, J., Momentti 1 Insinöörifysiikka , Otava Inkinen, P., Manninen, R., Tuohi, J., Momentti 2 Insinöörifysiikka , Otava		

(TRPK4Z) CHEMISTRY 3 cr**(TRPK001) An Introduction to Chemistry**

Credits:	3 cr	Timing:	1st - 2nd year
Objective:	To provide an overview of high school chemistry and to increase students' knowledge of environmental chemistry. This course also covers the chemical properties of construction materials and how they age and corrode.		
Contents:	The periodic table, mol and reactions Concentration and PH. Chemical balance The chemical properties of cement Corrosive features of concrete and steel		
Learning Strategies:	Lectures and exercises		
Assessment:	Exams		
Bibliography:	Arvonen, A., Levonen, H., Ammattikorkeakoulun kemia Handouts		

COMPULSORY PROFESSIONAL STUDIES**COMPULSORY PROFESSIONAL STUDIES AND PROJECT WORK 109 cr**

Students will be conversant with the central issues and knowledge concerning facilities management and will also know how and where to find further information on the subject.

(TRAK0Z) ENGLISH LANGUAGE AND COMMUNICATION STUDIES 3 cr**(TRAK002) Intercultural and Business Skills 1**

Credits:	1.5 cr	Timing:	3rd yr
Objective:	This course develops construction engineering students' intercultural competence so that they have qualifications to communicate in English in international and multicultural working life contexts.		
Contents:	Concepts of culture and communication Variables used to compare cultures Cultural differences in communication The process of adapting to another culture		
Learning Strategies:	Contact teaching, assignments, independent work, pair and group work		
Assessment:	Active participation, project and its oral introduction (in assessment 50 %); written exam (in assessment 50 %)		
Bibliography:	Handouts		

(TRAK003) Intercultural and Business Skills 2

Credits:	1.5 cr	Timing:	3rd yr
Objective:	This course develops construction engineering students' intercultural competence so that they have qualifications to communicate in English in international and multicultural working life contexts.		
Contents:	Company, production and product presentations Telephone conversations Written business communication Meetings and negotiations		
Learning Strategies:	Contact teaching, assignments, independent work, pair and group work		
Assessment:	Active participation, oral assignments (in assessment 65 %) and written assignments (in assessment 35 %); written exam		
Bibliography:	Handouts		

(TRAL2Z) HOUSING TECHNOLOGY 8 cr

Students will gain knowledge of the significance and limitations of facility automation and device technology from the facility financial upkeep point of view.

(TRAL005) Automation Systems

Credits:	4 cr	Timing:	2nd yr
Objective:	Students will gain a general overview of the general structure of an automation system, cabling and data transfer.		
Contents:	Sensor technology Programmable logic systems Digital instrumentation systems Pneumatic instrumentation systems Remote drive systems		
Learning Strategies:	Lectures and exercises		

Assessment: Exam

Bibliography: To be announced

(TRAL006) Housing Engineering

Credits: 4 cr Timing: 3rd yr

Objective: Students will gain knowledge of the technical equipment and systems of buildings and how they work

Contents: Heating, plumbing and ventilation systems
Automated systems

Learning Strategies: Lectures and assignments

Assessment: Exams

Bibliography: To be announced

(TRAO5Z) BUSINESS ECONOMICS AND LAW 6 cr

(TRAO003) Environmental Law

Credits: 3 cr Timing: 4th yr

Objective: Students will be conversant with Finnish environmental law, the license and permits system and legislation concerning land use and construction through practical examples. Students will be introduced to different planning procedures and their significance in terms of property end use.

Contents: Environmental protection legislation
Assessment of environmental consequences law
Nature conservation laws
Land use and construction laws
Land use and construction statutes
Planning system: provincial planning, general and town planning

Learning Strategies: Lectures and course-work

Assessment: Assignments, summary and exam

Bibliography: Hollo E.J., Ympäristönsuojelu- ja luonnonsuojeluoikeus. Talentum 2004
Maankäyttö- ja rakennuslaki perusteluineen. Edita lakikokoelma 1999.
Handout

(TRAO004) Contract Law and Legislation in a Housing Company

Credits: 3 cr Timing: 4th yr

Objective: This course covers the common principles and regulations of contract law and the central aspects of housing company law.

Contents: The judicial system
Making contracts and representation
Work contracts, annual holidays and working time

Room leasing
Housing company structure: administration, housing company charge regulations, maintenance responsibility

Learning Strategies: Lectures and course-work

Assessment: Exam and assignments

Bibliography: To be announced

(TRAH4Z) BUILDING DESIGN AND CONSTRUCTION 16 cr

(TRAH001) Building Materials

Credits: 3 cr Timing: 1st yr

Objective: Students will gain knowledge of the properties, manufacturing technology and use of building materials and implements.

Contents: The most common building framework and building parts materials
The mechanical, thermal and moisture properties of building materials
The manufacture of building materials

Learning Strategies: Lectures - small group and independent

Assessment: Exam and assignments

Bibliography: Handouts during lectures
Siikanen, U., Rakennusaineoppi
Construction engineering register (applicable parts)

(TRAH002) Construction Physics

Credits: 5 cr Timing: 2nd yr

Objective: Students will gain basic knowledge of the technical behaviour of thermal, moisture and air currents in building constructions. They will also have the necessary know-how to carry out thermal and moisture planning for buildings.

Contents: Building regulations
The principles of planning in structural physics
The transfer and movement of heat and moisture in building structures
Convection physics in building structures
ADP applications
Laboratory exercises

Learning Strategies: Lectures, exercises and laboratory work

Assessment: Exam and assignments

Bibliography: Building regulations
Björkholtz, D., Lämpö ja kosteus. Rakennusfysiikka
Ympäristöministeriö, Ympäristöoppaat 28, 29 ja 51

(TRAH003) Building Frames

Credits:	4 cr	Timing:	1st year
Objective:	This course covers building construction parts, load-bearing frame and supplementary building parts, their functional properties and building procedures as well as the requirements of fire technical and coustic planning.		
Contents:	Building frame parts sorted according to building parts Different frameworks and their function Loads on the building frame Fire safety and sound insulation of buildings The construction principles of wood, concrete and steel framed buildings Supplementary building parts		
Learning Strategies:	lectures, course-work and building site visits		
Assessment:	Exam and assignments		
Bibliography:	Handouts Building regulations and construction engineering register - applicable parts		

(TRAH004) Construction Drawing

Credits:	4 cr	Timing:	1st yr
Objective:	Students will be able to utilise AutoCAD and create construction and structural drawings using application programmes.		
Contents:	Creating drawings using AutoCAD 2005 and ARK 10.		
Learning Strategies:	Lectures and course-work		
Assessment:	Exam and assignment		
Bibliography:	To be announced		

(TRAR6Z) CONSTRUCTION ECONOMICS 10 cr

(TRAR001) Building and Construction

Credits:	4 cr	Timing:	2nd yr
Objective:	Students will understand the basic principles of project implementation, planning and management. They will be able to manage the main tasks, duties and procedures of contract building and they will be conversant with different types of contract work and contracts.		
Contents:	Project work The different stages of contract building Managing the project from beginning to end from the developer's point of view Different types of contract work Contractual Dealing		
Learning Strategies:	Lectures, course-work and group work		
Assessment:	Exam and assignments		
Bibliography:	HandoutsKankainen, J., Junnonen, J., Rakennuttaminen		

Liuksiala, A., Rakennussopimukset

(TRAR002) Cost and Quality Management

Credits:	3 cr	Timing:	2nd yr
Objective:	This course provides in depth knowledge of building project financial management and monitoring, as well as property quality engineering taking into account property life cycles.		
Prerequisite:	Building and Construction		
Contents:	The principles of project financial management Cost planning, quantity calculation and monitoring costs Property life cycle client and production quality		
Learning Strategies:	Lectures, course-work		
Assessment:	Exam		
Bibliography:	Handouts		

(TRAR004) Building and Construction Economics, Project

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will know how to carry out a quantity survey for a construction project that takes into account construction quality and life-cycle costs. Students will be able to select building materials based on ecological and economic principles.		
Prerequisite:	Cost control and quality thinking of the construction site.		
Contents:	Quantity survey for a real building project.		
Learning Strategies:	Supervised project		
Assessment:	Approved project work		
Bibliography:	To be announced		

(TRAT1Z) PRODUCTION TECHNOLOGY 13 cr

(TRAT003) Construction Machinery and Equipment

Credits:	3 cr	Timing:	1st yr
Objective:	Students will become familiar with the most usual construction machines and equipment. They will be able to use them safely and effectively and to anticipate dangerous situations. They will also learn to be aware of the checks and official regulations for such machines and devices. They will also gain an overview of the effect of the construction machine/type of device on economic, high quality and safe construction work.		
Prerequisite:	None		
Contents:	Most significant construction machinery and equipment, their use and maintenance.		

Safety issues and inspections
 The effect of machinery on cost effectiveness and quality.
 The regulations and inspections linked to the procurement of machinery and equipment,
 Management responsibility in the use of machinery and equipment.

Learning Strategies: Lectures, group work, case evaluation and analysis

Assessment: Exam. Assignments

Bibliography: To be announced

(TRAT004) Occupational Safety in Construction and Facility Management

Credits: 4 cr Timing: 2nd year

Objective: Students will understand the significance of occupational safety in facility management and construction. They will be able to manage on site safety inspections, occupational safety notices and official regulations. They will recognise the responsibility of the site manager and how work safety advances the construction process.

Prerequisite: None

Contents: Occupational safety during the different stages of facility management
 Occupational safety inspections and notices.
 Official regulations and permit-based work
 The employer's responsibilities and duties in ensuring occupational safety
 Emergency aid action
 First Aid 1 course

Learning Strategies: Lectures, group work and assignments.

Assessment: Exam and accomplished first aid course

Bibliography: Aitomaa, K. Luoto, T. Marjamäki, M. Niskanen, T. Patrikainen, H. Päiväranta, K. Rakennustöiden turvallisuismääräykset selityksineen. 2007. ISBN

(TRAT005) Building Site Management and Inspection Work

Credits: 3 cr Timing: 3rd yr

Objective: Students will learn to differentiate between the duties of the site superintendent (manager) and site inspector in a construction project. They will gain an overview of the opportunities for cooperation and responsibilities of different interest groups and of the importance of leadership, communication and interaction skills in such projects.

Contents: The site superintendent's (manager's) cooperation with the developer or client, the inspector, contractors, and planners.
 The special features of leading a building project
 The duties of the site manager/superintendent
 Building site inspection, meetings, guidelines from the authorities and documentation

Learning Strategies: Lectures and assignments

Assessment: Active participation and exam

Bibliography: To be announced

(TRAT006) Introduction to Project Management

Credits: 3 cr Timing: 2nd yr

Objective: Students will learn to understand different types of project opportunities and the special features associated with project work on building sites. Students will be able to recognise the significance of communication and scheduling to achieve cost-effective construction targets.

Contents: The principles and opportunities of projects in construction work.
Use of project management IT programme for construction projects.
Scheduling and resource planning.
How management and leadership affects projects

Learning Strategies: Lectures and assignments

Assessment: Exam and completed assignments

Bibliography: To be announced

(TRAE6Z) STRUCTURAL TECHNOLOGY 19 cr

This module covers the functioning principles of load-bearing structures.

(TRAE001) Statics

Credits: 3 cr Timing: 1st yr

Objective: Students will understand the static functioning of single building parts and they will be able to estimate the effects of loads on vertical and horizontal structures that are supported in different ways.

Prerequisite: Physics 1, Mathematics 1-2

Contents: Mass point planar statics
Stiff piece planar statics
Stress and stress patterns.

Learning Strategies: Lectures and course-work

Assessment: Exam

Bibliography: Outinen, H., Statiikka tekniikan opiskelijoita varten, osat I ja II
Handouts

(TRAE002) Strength of Materials

Credits: 3 cr Timing: 1st yr

Objective: Students will comprehend the effects of different stress and cross-sectional shape on structural tension and changes in structure shape.

Prerequisite:	Statics
Contents:	The link between stress and changes in shape Tension, compression, cutting Bending stress of a straight beam The concepts of buckling, lateral torsional instability, buckling of plate
Learning Strategies:	Lectures and course-work
Assessment:	Exam
Bibliography:	Hietikko, E., Palkki, Lujuuslaskennan perusteet, Otava, Keuruu 2004

(TRAE003) Steel and Wooden Structures

Credits:	4 cr	Timing:	2nd yr
Objective:	This course introduces students to the properties of the most common steel and wooden structures as well as their design and manufacture.		
Prerequisite:	Statics Strength of Materials		
Contents:	Usual steel and wooden products and their uses Official regulations Design of beam and column structures wooden and steel joints		
Learning Strategies:	Lectures and calculation exercises		
Assessment:	Exam and assignments		
Bibliography:	RIL 201-1999, Rakenteiden kuormat, Euronormi Eurocode 3, Teräsrakenteiden mitoitus RakMk B1, Rakenteiden varmuus ja kuormitukset RakMk B10, Puurakenteet RIL 120, Puurakenteiden suunnitteluohjeet		

(TRAE004) Concrete and Masonry Structures

Credits:	3 cr	Timing:	2nd yr
Objective:	This course provides an introduction to the structural features of reinforced concrete and masonry structures as well as equipping students with the ability to design and plan reinforced concrete structures.		
Prerequisite:	Statics The strength of Materials		
Contents:	An introduction to planning and designing reinforced concrete and masonry structures The design of reinforced concrete beam and column structures The design of reinforced concrete tile and wall structures		
Learning Strategies:	Lectures, calculation exercises and assignment		
Assessment:	Exam and exercises		
Bibliography:	Handouts RakMk B4, Betonirakenteiden mitoitus		

Credits: 3 cr Timing: 2nd yr

Objective: Students will gain a sound knowledge of concrete engineering, concrete work and the manufacture of concrete structures, the ingredients of concrete, freshly mixed concrete and hardened concrete and the factors affecting the properties of concrete. Students will learn concrete proportioning, how to choose the correct ingredients to make the desired concrete mix, how to mix concrete and test freshly mixed concrete and also trial use of concrete.

Contents: The course consists of laboratory exercises, calculation drills and lectures. The laboratory exercises consist of practical exercises and reports. Dry aggregate tests, casting and related quality control tests and test piece trials will be carried out in the laboratory. Additionally the functioning of a reinforced steel concrete structure will be studied by test loading a beam.

Learning Strategies: Lectures and laboratory exercises

Assessment: Exam and compulsory laboratory assignments

Bibliography: Handouts
BY 201, Betonitekniiikan oppikirja 2004

Credits: 3 cr Timing: 2nd yr

Objective: This course provides insight into the birth of Finnish soil, the features of the soil layers and how foundations are laid for different buildings and yards, preventing ground frost damage and drying.

Contents:

- Soil types and their geotechnical properties
- Ground surveying
- Laying foundations for buildings and yards
- Foundation damage and repairing old foundations
- Radon protection
- Ground frost prevention
- Drying out the foundation area

Learning Strategies: Lectures and exercises

Assessment: Exam and exercises

Bibliography: Rantamäki, M., Jääskeläinen, R., Tammirinne, M., Geotekniikka
Rantamäki, M., Tammirinne, M., Pohjarakennus
Talorakennuksen routasuojausohjeet, VTT geotekniikan laboratorio
Jääskeläinen, R., Pohjarakennuksen perusteet

(TRAM001) Renovation Technology

Credits:	5 cr	Timing:	1st - 2nd yr
Objective:	Students will gain insight into how microbes damage buildings and how to repair such damage. This course will provide students with basic facilities maintenance knowledge of the properties of building structure, building parts or the whole building for the purposes of future repair or renovation activities.		
Contents:	The properties of microbes, species of microbes and where they can be found Damp, mould and problems with rot and decay in buildings The principles of repairing and rebuilding after microbe damage Preventing microbe damage during planning and building Concepts and general economic significance Style and materials history in the recent past Healthy building and problem materials Typical damage to materials and damage mechanisms Typical structural damage and damage mechanisms Damage surveys The possibility of repairing microbe induced damage		
Learning Strategies:	Lectures, av teaching, group assignments		
Assessment:	Exam and approved group assignments		
Bibliography:	Handouts To be announced		

(TRAM004) Condition Surveys and Inspections

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will be able to survey structural defects in property themselves, using available surveying devices and procedures. They will also be able to compile a residential property condition estimate and carry out condition surveys on concrete elevations.		
Contents:	Condition estimate of residential property Basic survey of a property's energy economy Housing market condition survey Condition survey of a concrete elevation		
Learning Strategies:	Supervisory lectures and exercises for project work		
Assessment:	Exam		
Bibliography:	KH-kortisto soveltuvien osien BY 42, Betonijulkisivun kuntotutkimus 2002		

(TRAM007) Condition Surveying Project Work

Credits:	6 cr	Timing:	3rd yr
Objective:	Students will learn to put acquired theory of renovation building into practice		
Prerequisite:	Condition Surveys and Inspections		
Contents:	During the course students will carry out a condition evaluation and/or a condition survey of a real property.		

Learning Strategies: Independent work in small groups

Assessment: Condition evaluation or satisfactory compilation of a condition survey report

Bibliography: Appropriate parts of the KH file
Lecture handouts for Condition Surveys and Inspection course

(TRAM005) Renovation Planning

Credits: 3 cr Timing: 4th yr

Objective: Students will be conversant with large elevation renovation methods and they will also be able to make renovation plans using the condition estimate and compile the necessary documents.

Contents: Renovation methods and renovation planning for concrete elevations
Life cycle calculations
Renovation work specifications
Renovation request for quotation documents

Learning Strategies: Lectures and assignments

Assessment: Exam and assignments

Bibliography: To be announced

(TRAM008) Planning Renovation Building Project Work

Credits: 6 cr Timing: 4th yr

Objective: Students will be able to compile a technical renovation building plan taking into account the effects of heating, plumbing, ventilation, electrical installation and sanitation planning on building planning

Prerequisite: Renovation Technology and Renovation Planning Mould and Moisture Damage
Condition Surveys and Inspections

Contents: A technical renovation building plan for a real property

Learning Strategies: Supervised project work

Assessment: Approved Technical Renovation Building Plan

(TRAN9Z) FACILITIES MAINTENANCE 11 cr

Students will learn to consider facilities maintenance as systematic process applicable to the whole life-cycle of the facility.

(TRAN006) Facility Upkeep

Credits: 5 cr Timing: 1st and 4th yr

Objective: Students will gain a general overview of the status and significance of facility upkeep in society and the national economy. They will also understand the significance of long-term maintenance planning in terms of property value and upkeep costs. The course also looks at properties as a target for investment.

Contents:	Principles of facility upkeep - distribution of property - facility upkeep parties and duties during the lifecycle of a property - Sustainable development in the real estate business Principles of the real Estate Business - determining the value of a property, predicting the need for property - determining market prices and how prices will develop - the requirements for changing the use of (conversion) a facility - surveying and comparing options, property conversion/development Principles of facility upkeep - continual condition monitoring
Learning Strategies:	Lectures, assignments. Partly taught in English
Assessment:	Exams, assignments
Bibliography:	Isännöitsijän käsikirja Kurtelius J., Kestävä kehitys kiinteistöalalla - ekologiaa isännöitsijöille ja rakennuttajille Study handouts

(TRAN005) Facility Upkeep, Project

Credits:	6 cr	Timing:	4th yr
Objective:	Students will learn how to implement a long-term property maintenance plan in practice.		
Contents:	Students will draw up a long term technical and economic plan for a real property in the form of a project carried out in small groups.		
Learning Strategies:	Supervised project work completed in small groups		
Assessment:	Completing the project		
Bibliography:	To be announced		

OPTIONAL PROFESSIONAL STUDIES 12 cr

Students must select one 12 cr study module from optional professional studies in addition to 6 cr of optional project work.

(TRVI0Z) FACILITY MANAGEMENT 12 cr

Students will understand the significance of the management of information produced by the facility's devices in managing the facility. Students will also learn about housing and real estate company staff and financial administration.

(TRVI001) Construction Automation and Information Systems in Maintenance

Credits:	6 cr	Timing:	3rd - 4th yr
Objective:	This course covers the automation application of house technology and the		

importance of information management in terms of the technical devices used.

Prerequisite: Introduction to Automation Technology Automation Systems and House Technology

Contents: Measurement of temperature, flow and pressure, adjustment and reporting
Measurement of consumption
Burglar, fire and heating, plumbing and ventilation alarms and controls
Consumption data registers
Certification of devices
Connection and service contracts
The link between data systems and facility automation

Learning Strategies: Lectures and exercises

Assessment: Exams

Bibliography: To be announced

(TRVI003) Accounting in a Housing Company

Credits: 3 cr Timing: 3rd-4th year

Objective: Students will be familiar with the principles and methods of bookkeeping and internal and external accounting requirements of a housing company.

Contents: Double entry bookkeeping
Budget
Routine bookkeeping
Financial statement and cost accounting

Learning Strategies: Lectures and exercises

Assessment: Exam and exercises

Bibliography: To be announced

(TRVI004) Economy and Administration in Real Estate Communities

Credits: 3 cr Timing: 3rd-4th yr

Objective: Students will be familiar with the funding and security issues of real estate communities, long-term financial planning, personnel administration and liability issues.

Contents: Obligation of debtor to creditor
Securities
Financial planning
Personnel administration
Liability and compensation

Learning Strategies: Lectures and course-work

Assessment: Exam and assignments

Bibliography: To be announced

Learning Strategies: Lectures and exercises, site visit

Assessment: Exam and assignments

Bibliography: to be announced

(TRVT004) Measurement Technology

Credits: 3 cr Timing: 3rd - 4th yr

Objective: Students will learn how to carry out different types of procedures related to construction measuring and the sizing of work. They will gain an appreciation of the effects of measurement technology on construction quality and work quantity surveying on the costs of the project.

Contents: How to use building site measuring devices
Measuring the building, construction parts and structures
Permitted tolerances
Quantifying the construction work

Learning Strategies: Lectures and assignments

Assessment: Exam and successfully completed assignments

Bibliography: To be announced

(TRVV0Z) AN OPTIONAL PROJECT 6 cr

Students will gain in depth practical knowledge of facilities management.

(TRVV001) An Optional Project

Credits: 6 cr Timing: 3rd - 4th yr

Objective: Students will gain in depth working knowledge of facilities management and construction technology.

Contents: Students will focus on a real problem of a real target within their own optional studies topics or from another subject area and draw up a plan on how to solve the problem.

Learning Strategies: Independent supervised work

Assessment: In groups or individually

(VAPAAZ) FREE-CHOICE STUDIES 15 cr

Students can freely select 15 cr of studies that will support their professional development, from their own field/degree programme or from another degree programme in their own university of applied sciences, from another university of applied sciences or science university. Students will achieve wide-ranging business expertise.

(TRW007) Bygg Upp Din Svenska

Credits:	1.5 cr	Timing:	To be announced
Objective:	This course develops and strengthens Swedish skills acquired during earlier courses so that students will be able to cope with UAS level Swedish language studies in their own field of studies. The aim is also to develop language study skills.		
Prerequisite:	Proficiency test		
Contents:	Basic grammar and vocabulary. Activating speaking and writing skills as well as listening and reading comprehension.		
Learning Strategies:	Small groups		
Assessment:	Active participation 100 %, oral and written exercises, exam, evaluated on a scale of 0 - 5		
Bibliography:	Handout		

(TRW008) Build up Your English

Credits:	1.5 cr	Timing:	1st yr
Objective:	Students will develop and strengthen their language skills acquired during previous courses in order to be able to cope with their compulsory professional language studies. The aim is also to develop language learning skills.		
Prerequisite:	Proficiency test		
Contents:	Basic grammar and vocabulary Activation of speaking and writing skills as well as reading and listening comprehension.		
Learning Strategies:	Small group teaching		
Assessment:	Active participation 100 %, oral and written exercises, exam		
Bibliography:	handout		

(TROO0Z) THESIS 15 cr

(TROO001) Thesis

Credits:	15 cr	Timing:	4th yr
Objective:	The aim of the thesis is to develop the ability to apply acquired knowledge and skills to jobs requiring the expertise in a specific professional field and subjects. It is usual that the thesis is tailored to the requirements of working life and supports professional development and growth. A clear indication of students' know-how is provided by the thesis.		
Contents:	Topic search - within a business/company Compilation of required documents according to thesis regulations Topic clearance Presentation of topic Maturity test		

Assessment: Thesis progress and evaluation form to be returned to thesis supervisor

(TRHH0Z) PRACTICAL TRAINING 30 cr

(TRHH001) Practical Training

Credits:	30 cr	Timing:	The training period takes place during the spring semester of the third year.
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Objective: The aim of the practical training period is to provide students with good post graduation employment opportunities and to familiarise students with working life. Students will gain knowledge of different job tasks, working procedures, devices and professional terminology related to their chosen specialism in a real working environment under supervision.

Contents: An uninterrupted five-month training period (about 800 working hours) in working life.

DEGREE PROGRAMME IN INFORMATION TECHNOLOGY

Measurement and vehicle information systems

During this degree programme students will design, build and programme smart electronics required in vehicles, industrial measuring devices or for different telecommunications applications such as mobile phones and mobile terminal devices. This degree programme also covers computer measuring systems based on modern information transfer and programming solutions or machine vision.

The competences covered in the Information Technology Degree Programme

Information Technology Degree Programme	Description of range of competence
Competence in mathematics and natural sciences	<ul style="list-style-type: none"> • able to use a mathematical and logical approach and way of thinking in technical problem solving • ability to use mathematical principles, methods and tools • awareness of important physical properties of applications and the principles of sustainable development
Device engineering competence	<ul style="list-style-type: none"> • conversant with electrical engineering and safety in electrical work • knowledge of the most important electronic components, how they work and basic connections • proficiency in electrical engineering measurements • understanding of the electronics design and production process • knowledge of computer architecture and how key components work • basic IT skills • conversant in the use of simulation and design software
Software engineering competence	<ul style="list-style-type: none"> • proficiency in programming technology; comprehension of programming logic, knowledge of the most common algorithms, information structures and tools • ability to interpret programming language and to use programming to solve problems • awareness on object-oriented design and programming basics • ability to participate in software projects in a client and company oriented manner • competence in device-oriented programming basics

	<ul style="list-style-type: none"> • Knowledge of the planning and programming principles of communication applications
Information technology design competence	<ul style="list-style-type: none"> • possesses knowledge of the theoretical foundations of own application field (1st major – design competence emphasised) • ability to find, combine and apply the latest technical knowledge of own field using typical design methods and procedures and ability to document the results of one's own work • ability to participate in disciplined product development work independently and as a member of a project working group
Electrical measuring competence	<ul style="list-style-type: none"> • ability to participate in disciplined product development work independently and as a member of a project working group • comprehension of the general structure of a measurement system • knowledge of measuring systems of basic electrical magnitudes • comprehension of the statistical nature of measurements and questions relating to their reliability • knowledge of disturbances in measuring
Measuring systems competence	<ul style="list-style-type: none"> • knowledge of the sensors used to measure the most common quantities • knowledge of optical measuring methods and the required components • ability to create measurement systems using graphical programming environments • knowledge of devices required in machine vision applications • Ability to create machine vision applications in a graphical programming environment
Signal processing competence	<ul style="list-style-type: none"> • Will know the basic principles related to signals • Will know the basic editing methods for analogue signals • Will know how to convert different signals • Will know how to use signal processing to produce digital filters • Will be able to use signal processing for digital image manipulation
Applied electronics competence	<ul style="list-style-type: none"> • Will be able to design, test and document electronic applications based on microcontrollers, for demanding conditions • Will be conversant with electronics testing methods

	<ul style="list-style-type: none"> • will be conversant with basic information transfer methods
Product development competence	<ul style="list-style-type: none"> • will understand client-oriented product development • will be conversant with the different stages of product development and will understand the significance of project planning and documentation • will be conversant with product and product development quality control methods

THEMES FOR EACH YEAR OF STUDY

1st yr

Engineering orientation

This theme covers the development of the basic knowledge, mathematical and natural sciences thinking processes, and communication and information retrieval skills required during engineering studies.

2nd yr

Deeper knowledge

This theme includes the supplementation of basic skills and knowledge and choosing major courses of study. It also covers group work skills and introduces project working methods.

3rd yr

Specialisation

Students will gain specialised knowledge of their major subject and learn to apply theory in practice through participation in working life.

4th yr

Application

This theme includes the supplementing of existing skills and knowledge for the requirements and transfer into the world of work. Students will learn to work independently in typical engineering positions.

INFORMATION TECHNOLOGY DEGREE PROGRAMME

BASIC STUDIES **62 cr**

LANGUAGE AND COMMUNICATION SKILLS **17 cr**

Communication Skills in Finnish	5 cr
Text and Terminology	3 cr
Svenska för IT-ingenjörer	3 cr
Introduction to Project Management	3 cr
Introduction to Data Processing	3 cr

BUSINESS STUDIES **9 cr**

Introduction to Business Economics	3 cr
Corporate Law	3 cr
Leadership Skills	3 cr

STUDIES IN MATHEMATICS AND NATURAL SCIENCES **36 cr**

Mathematics	18 cr
Physics	15 cr
Chemistry	3 cr

COMPULSORY PROFESSIONAL STUDIES **73 cr**

English Language and Communication Skills	5 cr
Information Technology	9 cr
Theory of Electrical Engineering	9 cr
Electronics	12 cr
Computer Technology	12 cr
Telecommunications Technology	8 cr
Digital Signal Processing	5 cr
Professional Subjects, Laboratory Work	13 cr

OPTIONAL PROFESSIONAL STUDIES **45 cr**

Measurement Systems	45 cr
Vehicle Information Systems	45 cr

FREE-CHOICE STUDIES **15 cr**

PRACTICAL TRAINING **30 cr**

THESIS **15 cr**

COURSE DESCRIPTIONS OF DEGREE PROGRAMME IN INFORMATION TECHNOLOGY

BASIC STUDIES

(TTPV0Z) LANGUAGE AND COMMUNICATION SKILLS 17 cr

(TTPV008) Communication Skills in Finnish 1

Credits:	3 cr	Timing:	1st yr
Objective:	Students will practise oral and written communication required in working life and their chosen profession.		
Contents:	An introduction to oral and written communication Academic writing Situations requiring oral communication (preparation, participation, analysis)		
Learning Strategies:	Independent work, group work, lectures		
Assessment:	Participation in group work, exercises and exam		
Bibliography:	Kauppinen, A., Nummi, J., Savola, T., Tekniikan viestintä (4., uudistettu painos)		

(TTPV009) Communication Skills in Finnish 2

Credits:	2 cr	Timing:	4th yr
Objective:	Students will learn technical writing skills.		
Contents:	Documentation of the engineering thesis Technical writing Language issues		
Learning Strategies:	Independent work, group work, supplementary lectures		
Assessment:	Participation in group work, assignments and exam		
Bibliography:	Kauppinen, A., Nummi, J., Savola, T., Tekniikan viestintä (4., uudistettu painos) Nykänen, O., Toimivaa tekstiä. Opas tekniikasta kirjoittaville.		

(TTPV010) Text and Terminology 1

Credits:	1.5 cr	Timing:	1st yr
Objective:	This course aims to develop and strengthen information technology students' English skills so they will be able to read their own professional literature and write technical documents.		
Prerequisite:	Proficiency test and Build up Your English course if required		
Contents:	Technical language as a tool The special grammatical features of technical language		

Vocabulary building
Developing reading techniques
Documentation

Learning Strategies: Contact teaching, assignments, independent, pair and group work.

Assessment: Active participation, assignments; written exam

Bibliography: Handout

(TTPV011) Text and Terminology 2

Credits: 1.5 cr Timing: 2nd yr

Objective: This course aims to develop and strengthen information technology students' English skills so they will be able to read their own professional literature, write technical documents, search for and process information.

Contents: The special grammatical features of technical language
Vocabulary building
Developing reading techniques
Documentation
Oral and written reporting and summarising.

Learning Strategies: Contact teaching, independent, pair and group work.

Assessment: Active participation, searching for and processing technical texts, oral presentations (in assessment 50 %); written exam (in assessment 50 %)

Bibliography: Texts processed by students

(TTPV005) Swedish for IT Engineers

Credits: 3 cr Timing: 3rd yr

Objective: Students will develop their oral and writing skills in Finland's second official language specifically to aid their own professional development. Students will practise speaking Swedish in everyday communication situations as well as being able to discuss professional issues in Swedish. Students will also be able to find and use information in Swedish concerning their own specific field.

Contents: Central terminology, vocabulary and language use situations for computer engineering

Learning Strategies: Small group teaching

Assessment: Active participation, exercises, spoken and written exercises, spoken and written exam

Bibliography: Handout

(TTPV006) Introduction to Project Management

Credits: 3 cr Timing: 1st yr

Objective: Students will adopt a goal-oriented way of working that will be applied to one-off

administrative and productive tasks.

Contents:	Project concept Compiling a project plan Documentation Ending the project
Learning Strategies:	Lectures, assignments and project plan
Assessment:	Exam, assignments and project plan
Bibliography:	Silfverberg, P., Ideasta projektiksi Pelin, R., Projektihallinnan käsikirja Välimaa, et al, Tuotekehitys. Asiakastarpeesta tuotteeksi. Lecture handouts

(TTPV007) Data Processing, Basics

Credits:	3 cr	Timing:	1st yr
Objective:	Students will be conversant with basic computer structure and the polytechnic computers, their most usual tools programmes and peripheral devices used during studies at the polytechnic.		
Contents:	User systems and interfaces Tools programmes Installing and configuring the system The Polytechnic computer network, user ID and passwords. An introduction to word processing Spreadsheet accounting and graphics		
Learning Strategies:	Small group work and course work		
Assessment:	Exam and assignments		
Bibliography:	Reading list/material provided by lecturer		

(TTPB1Z) BUSINESS STUDIES 9 cr

Students will be conversant with the foundations and different areas of entrepreneurship. The course also covers basic terminology and orientation into financial thinking.

(TTPB001) An Introduction to Business Economics

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will be conversant with the foundations of business operations and they will also gain a general overview of business planning.		
Contents:	Basic concepts of business operations Internal and external entrepreneurship Business processes and operational environment Business funding and budget monitoring Business planning		
Learning Strategies:	Lectures and assignments		

Assessment: Exam and compiling a business plan

Bibliography: Kinkki, Isokangas, Yrityksen perustoiminnot, WSOY 2004

(TTPB002) Corporate Law

Credits: 3 cr Timing: 4th yr

Objective: Students will be able to apply the basic principles of contract law while being aware of the central agreements and liabilities involved in business activity.

Contents: The law system
Contracts and their compilation
Company form
Terms of employment, working time and annual holidays
Commercial agreements
Insurance claims

Learning Strategies: Lectures and assignments

Assessment: Exam and assignments

Bibliography: to be announced

(TTPB003) Leadership Skills

Credits: 3 cr Timing: 4th yr

Objective: This course covers the principle administrative and leadership tasks, leadership cultures and people as a resource in an organisation.

Contents: Administration and leadership as part of an organisation
Leadership theories
Individual and group behaviour in the work community
Organisation theory
Professional ethics

Learning Strategies: Lectures, course work

Assessment: Exam or portfolio

Bibliography: Joutsenkunnas, T., Heikurainen, P., Esimiehenä palveluyrityksessä
Further appropriate reading on professional ethics to be announced

STUDIES IN MATHEMATICS AND SCIENCE 36 cr

This module provides the mathematical skills required in engineering subjects.

(TTPM2Z) MATHEMATICS 18 cr

(TTPM001) Mathematics 1-2

Credits: 6 cr Timing: 1st yr

Objective: This course partially revises and adds to high school and vocational college

mathematics with an aim to develop systematic and disciplined learning and interaction skills.

Contents: Number systems
Functions
Trigonometry
Vectors
Determinants and matrices
Complex numbers
Introduction to a mathematics programme

Learning Strategies: Lectures and exercises

Assessment: To be announced

Bibliography: Majaniemi, A., Algebra I
Majaniemi, A., Algebra II
Majaniemi, A., Geometria

(TTPM002) Mathematics 3

Credits: 6 cr Timing: 1st and 2nd yr

Objective: This course provides students with further skills in mathematical techniques and also with an understanding of how mathematical analysis can be used to describe a variety of phenomena.

Contents: Differentiation and graphs of functions
Maximum and minimum of functions
Integration
Area between curves
Volume of a surface of revolution
Work

Learning Strategies: Lectures and exercises

Assessment: To be announced

Bibliography: Majaniemi, A., Matematiikka I

(TTPM003) Mathematics 4

Credits: 6 cr Timing: 2nd yr

Objective: Students will gain further in depth knowledge of mathematical analysis for the specialised purposes of modern data transfer and handling.

Contents: Differential equations
The Laplace transform
Power series
Fourier series and the Fourier transform

Learning Strategies: Lectures and exercises

Assessment: To be announced

Bibliography: Majaniemi, A., Matematiikka II
Majaniemi, A., Sarjaoppia.

Majaniemi, A., Fourier, Laplace ja Runge-Kutta-menetelmistä

(TTPF3Z) PHYSICS 15 cr

(TTPF001) Physics 1

Credits:	6 cr	Timing:	1st yr
Objective:	This module will provide the necessary background in physical science for the other courses of the degree programme.		
Contents:	Physics quantity and unit system, Mechanics		
Learning Strategies:	Lectures and exercises		
Assessment:	Interim exams		
Bibliography:	Inkinen, P., Tuohi, J., Momentti 1, Insinöörifysiikka		

(TTPF002) Physics 2

Credits:	6 cr	Timing:	1st and 2nd yr
Objective:	Students will gain physics skills required in other courses		
Prerequisite:	Physics 1		
Contents:	Thermology Electricity Wave motion and acoustics Optics and photometry		
Learning Strategies:	Lectures and exercises		
Assessment:	interim exams		
Bibliography:	Inkinen, P., Tuohi, J., Momentti 1, Insinöörifysiikka Inkinen, P., Manninen, R., Tuohi, J., Momentti 2, Insinöörifysiikka		

(TTPF003) Physics, Laboratory Work

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will become conversant with basic physics through experimentation. The course also covers measurement technology and written reporting.		
Contents:	Topics covered during Physics 1 and 2		
Learning Strategies:	Completion of laboratory work and written reporting in small groups		
Assessment:	Completion of set assignments and reports for assessment (1 - 5)		
Bibliography:	Instructions provided by polytechnic Inkinen, P., Tuohi, J., Momentti 1 ja 2, Insinöörifysiikka		

Inkinen, P., Manninen, R., Tuohi, J., Momentti 2, Insinöörifysiikka

(TTPC4Z) CHEMISTRY 3 cr

(TTPC001) Chemistry

Credits: 3 cr Timing: 1st yr

Objective: This course revises and adds to high school chemistry. Students will gain knowledge of environmental chemistry and study the use of dangerous materials and poisons.

Contents: The periodic table, mol
Chemical reactions
Energy
Acid-alkali theory
pH
Electrolysis
Corrosion
Environmental chemistry
Dangerous materials and pollutants

Learning Strategies: Lectures and course work

Assessment: To be announced

Bibliography: Arvonen, H., Levonen, A., Ammattikorkeakoulun kemia
Handouts

COMPULSORY PROFESSIONAL STUDIES

(TTAK0Z) ENGLISH LANGUAGE AND COMMUNICATION STUDIES 5 cr

(TTAK002) Intercultural and Business Skills 1

Credits: 1.5 cr Timing: 3rd yr

Objective: This course develops information technology students' intercultural competence so that they have qualifications to communicate in English in international and multicultural working life contexts.

Contents: Concepts of culture and communication
Variables used to compare cultures
Cultural differences in communication The process of adapting to another culture

Learning Strategies: Contact teaching, assignments, independent work, pair and group work

Assessment: Active participation, project and its oral introduction (in assessment 50 %); written exam (in assessment 50 %)

Bibliography: Handouts

(TTAK003) Intercultural and Business Skills 2

Credits:	3.5 cr	Timing:	4th yr
Objective:	This course develops information technology students' intercultural competence so that they have qualifications to communicate in English in international and multicultural working life contexts.		
Contents:	Company, production and product presentations Telephone conversations Written business communication Meetings and negotiations		
Learning Strategies:	Contact teaching, assignments, independent work, pair and group work		
Assessment:	Active participation, oral assignments (in assessment 65 %) and written assignments (in assessment 35 %); written exam		
Bibliography:	Handouts		

(TTAA1Z) INFORMATION TECHNOLOGY 9 cr

(TTAA001) An Introduction to Programming

Credits:	6 cr	Timing:	1st yr
Objective:	This course provides a foundation on which students will be able to build their studies in C programming and programming in general. Students will know basic programming concepts and how to solve small-scale problems using the C programming language. This course acts as an introduction to computer engineering laboratory work.		
Prerequisite:	An Introduction to Data Processing		
Contents:	The basic concepts of programming, problem-solving oriented thinking and modular programming Forms of data, variables and operators Input and output functions The structure of the C-programme; control structures, main programme and subprogrammes Pointers and character strings Handling tables Records and file handling Visual studio.Net programming environment		
Learning Strategies:	Lectures, supervised exercises and e-learning		
Assessment:	Theory exam, computer test, assignment and classwork and e-exercises for assessment		
Bibliography:	Silander Simo, Ohjelmointi Pro Training, latest publication		

(TTAA002) Computer Programming (C++)

Credits:	3 cr	Timing:	1st yr
Objective:	The aim of this course is to deepen and widen students' knowledge of and skills in programming gained during 'An Introduction to Programming' using the C++ Programming language. Students must have a prior knowledge of basic		

programming concepts and structures. Students will be conversant with the central structures of C++ and they will gain background knowledge of object oriented technologies and their basic concepts. This course acts as an introduction to device oriented programming.

Prerequisite: An Introduction to Programming

Contents: An introduction to programming with C++, problem solving and object oriented thinking, modularity
Forms of data, variables and operators
Input and output functions
Basic control structures of the C++ programme; main programme and subprogrammes
Table handling, character strings and pointers
Records and file handling
Object oriented thinking and an introduction to modelling with UML
Objects, classes and relationships between classes
The programming environment used will be Visual Studio.Net

Learning Strategies: Lectures and supervised exercises, e-learning

Assessment: Theory exam, computer test, assignment and class and e-exercises for assessment

Bibliography: Reading list/material provided by lecturer

(TTAT2Z) THEORY OF ELECTRICAL ENGINEERING 9 cr

(TTAT001) Theory of Electrical Engineering 1

Credits: 3 cr Timing: 1st yr

Objective: Students will be conversant with the most common AC/DC circuit solution methods and the basic principles of electric and magnetic fields.

Contents: Ohm's and Kirchhoff's laws
Power and energy in direct current circuits
Current, voltage, power and energy measurements
The birth of electric and magnetic fields
The power and potential of an electric field
Induction and the structure of a magnetic circuit
An introduction to alternating current

Learning Strategies: Lectures and small group teaching/assignments

Assessment: To be announced

Bibliography: Tarkka, P., Määttänen, K., Hietalahti, L., Piirialyysi 1
Aura, L., Tonteri, A., Sähkömiehen käsikirja

(TTAT002) Theory of Electrical Engineering 2

Credits: 6 cr Timing: 1st and 2nd yr

Objective: Students will be able to analyse alternating current circuits. They will gain knowledge of y, z, and h and scattering coefficient presentations and they will be able to synthesize passive filters.

Contents:

- Alternating currents and magnetic circuits
- The principles of the three-phase system
- Four-pole parametre presentations
- Use of Laplace transformation for analysing current circuits
- Transfer function, amplification and phase descriptors
- The most common filters
- Synthesis of passive filters

Learning Strategies: Lectures and small group teaching/exercises

Assessment: To be announced

Bibliography: Tarkka, P., Määttänen, K., Hietalahti, L., Piirrianalyysi II
Alasaarela, E., Elektroniikan suodattimet

(TTAE3Z) ELECTRONICS 12 cr

Students will be conversant with the uses and design of central electronic components and be able to plan and carry out analog electronic connections.

(TTAE001) Electronics 1

Credits: 6 cr Timing: 1st yr

Objective: Students will be conversant with the basic electronic components and connections, as well as being able to apply the basic laws of electricity to make small scale connections.

Contents:

- Passive components and filters
- Types of diodes, diode response curves and basic connections
- Calculating bipolar and field-effect transistor operating points
- An introduction to operation amplifiers
- An introduction to computer aided simulation methods (Micro-Cap)
- The basic structure of CMOS logic circuits

Learning Strategies: Lectures and exercises

Assessment: Interim exams

Bibliography: Silvonen, K., Tiilikainen, M., Helenius, K., Analogiaelektroniikka
Volotinen, V., Analoginen elektroniikka, Komponentit ja peruskytkennät
Salo, P., Sähkötekniikan perusoppi 4, elektroniikka 1
Salo, P., Sähkötekniikan perusoppi 5, elektroniikka 2
Salo, P., Analogista elektroniikkaa, Periaatteita ja sovellutuksia

(TTAE002) Electronics 2

Credits: 6 cr Timing: 2nd yr

Objective: Students will be able to plan and analyse electronic coupling on a component and module level and as a whole. They will be able to use virtual planning environments and take into account EMC demands at the planning stage.

Prerequisite: Electronics 1

Contents:	The functional features and solutions of the most common components
	The functions, features and design of the most common electronic coupling

Metrological solutions
 Powers sources and feed
 Thermal planning
 An introduction to planning an electronic device
 Programmable circuits
 An introduction to computer aided planning
 Connecting to and eliminating electromagnetic disturbances

(TTAD4Z) COMPUTER TECHNOLOGY 12 cr

(TTAD001) Computer Technology 1

Credits: 6 cr Timing: 1st yr

Objective: Students will be able to understand the principles of digital engineering and components and they will also be able to plan and analyse digital connections.

Contents: An introduction to digital engineering:
 Planning and analysing connections in combinational and sequential logic circuits

Learning Strategies: Lectures and course work

Assessment: Interim exams

Bibliography: Rantala Pekka, Digitaalitekniikka

(TTAD002) Computer Technology 2

Credits: 6 cr Timing: 2nd yr

Objective: Students will be able to understand the structural parts and functioning of a microprocessor system as well as being able to plan a device based on a processor.

Prerequisite: Computer Technology 1

Contents: Microprocessor engineering
 - the functioning principles of microprocessors
 - Planning and programming a microprocessor based device using Assembly and C-language

Learning Strategies: Lectures and exercises

Assessment: Interim exams

Bibliography: Rantala Pekka, Mikrotietokonetekniikka
 Intel, MCS-51:n manuaalit

(TTAL5Z) TELECOMMUNICATIONS TECHNOLOGY 8 cr

This module provides an overview of telecommunications technology from the past to the present day, also of different telecommunications systems, how they function and their limitations.

(TTAL001) Telecommunications

Credits: 8 cr Timing: 2nd yr

Objective:	Students will gain an in depth overview of telecommunications past and present, the principles of telecommunications engineering - such as basic technologies and techniques as well as the theoretical background.
Contents:	<p>Concepts, organisations and standardisation</p> <p>Signal, noise, S/N ratio and its significance, transmission routes, an introduction to information theory</p> <p>Basic telecommunications - structures and functioning</p> <p>An introduction to sound and image transfer techniques</p> <p>The most common telephone, data and mobile station networks</p> <p>Television and radio systems</p> <p>Analog and digital modulation methods</p> <p>An introduction to information networks and how they function</p> <p>Laboratory work on different areas of telecommunications</p>
Learning Strategies:	Lectures, exercises, laboratory work in small groups, supervised laboratory work
Assessment:	Exam, laboratory exercises with written reports
Bibliography:	K. Granlund: Tietoliikenne, e-material in course folder, lecture handouts, instructions for exercises, device and circuit manuals and specifications

(TTAS6Z) DIGITAL SIGNAL PROCESSING 5 cr

(TTAS001) Signal Processing

Credits:	5 cr	Timing:	2nd and 3rd yr
Objective:	Students will be able to use different signal processing techniques.		
Contents:	<p>Analogue signals</p> <p>Discrete-time signals</p> <p>Linear systems</p> <p>Sampling</p> <p>Transforms</p>		
Learning Strategies:	Lectures and calculation exercises, use of programmes		
Assessment:	To be announced		
Bibliography:	<p>Phillips, C., Parr, J., Signals, Systems, and Transforms</p> <p>Kamen, E., Heck, B., Fundamentals of Signals and Systems using Matlab</p>		

(TTAC7Z) PROFESSIONAL SUBJECTS, LABORATORY WORK 13 cr

(TTAC001) Laboratory Work, Basics

Credits:	3 cr	Timing:	1st yr
Objective:	Students will be conversant with the use of basic measurement devices and how to build simple electronic and digital connections.		
Prerequisite:	Electronics 1 and Computer Technology 1 Theory Sessions		
Contents:	Measurement device orientation and implementation of basic measurements		

Building and testing basic electronic connections
 Combinational and sequential logic circuit connections
 An introduction to circuit planning programmes (Micro-Cap, PADS)

Learning Strategies: Laboratory work in small groups

Assessment: Laboratory work, written reports and laboratory test (assessment 1 - 5)

Bibliography: Rantala P., Digitaalitekniikka,
 Elektronics 1 - material
 Component data pages
 Measurement device manuals

(TTAC004) Electronics, Laboratory Work

Credits: 5 cr Timing: 2nd and 3rd yr

Objective: Students will have the competence to carry out measurements on analog electronic components and to build connections and measure them using the usual measuring devices. Students will also be able to plan, build, measure and report on a set of connections consisting of several functions. Students will also know how to use a circuit card planning programme and how to make a circuit card.

Prerequisite: An Introduction to Laboratory Work

Contents: Planning, building, measuring and reporting on connections
 Circuit card planning and assembly

Learning Strategies: Small group teaching and exercises

Assessment: Laboratories, written reports and exam (assessment 0 - 5)

Bibliography: Electronics lecture handouts

(TTAC006) Computer Technology, Laboratory Work

Credits: 5 cr Timing: 2nd and 3rd yr

Objective: Students will learn how to plan a processor-based card and to use programming tools.

Prerequisite: Computer Technology 1 An Introduction to Laboratory Work

Contents: Introduction to device based programming tools.
 Planning, assembling, programming and testing a processor-based card.
 Circuit card planning and assembly

Learning Strategies: Small group teaching

Assessment: Laboratory work, written reports and exam

Bibliography: Circuit manuals
 Rantala Pekka, Mikrotietokonetekniikka
 Intel, MCS-51 manuals

Credits:	4 cr	Timing:	3rd yr
Objective:	Students will gain knowledge of the most common sensors used in industry and how they work.		
Prerequisite:	Introduction to Measurement Technology		
Contents:	Basic features of sensors The most common methods of measuring electric and mechanical quantities Measuring temperature, flow, pressure and humidity Microsensors Introduction to commercial sensors		
Learning Strategies:	Lectures, exercises and seminar presentations		
Assessment:	Exams and seminar papers		
Bibliography:	Bentley, J., Principles of measurement systems Kuivalainen, P., Mikroanturit Halko, P., Härkönen, S., Lähteenmäki, I., Välimaa, T., Teollisuuden mittaustekniikka, Perusmittauksia Härkönen, S., Lähteenmäki, I., Välimaa, T., Teollisuuden mittaustekniikka, Analyysimittauksia		

(TTVJ004) Digital Signal Processing

Credits:	4 cr	Timing:	4th yr
Objective:	Students will be conversant with the basic concepts and modern methods of digital signal processing.		
Contents:	Correlation Random signals and noise Digital filters		
Learning Strategies:	Lectures and exercises		
Assessment:	To be announced		
Bibliography:	Denbigh, P., System Analysis & Signal Processing Ifeachor, E., Jervis, B., Digital Signal Processing Denbigh, P., System Analysis & Signal Processing Ifeachor, E., Jervis, B., Digital Signal Processing Kamen, E., Heck, B., Fundamentals of Signals and Systems - Using the Web and Matlab Aumala, O. ym, Mittaussignaalien käsittely		

(TTVJ005) Optical Measurement Technology

Credits:	5 cr	Timing:	2nd and 3rd yr
Objective:	Students will be conversant with the most common optical measurement techniques and required components.		
Contents:	Geometrical and physical optics Optical materials and components Light sources and indicators Optical measurement methods		

Learning Strategies: Lectures and exercises

Assessment: To be announced

Bibliography: Handout

(TTVJ006) Wireless Technology

Credits: 4 cr Timing: 4th yr

Objective: Students will understand the basic principles and difficulties of wireless data transfer and be able to apply this knowledge to implement wireless data transfer and instrumentation.

Contents: Structures of transmitters and receivers
Aerials
The features and propagation of electromagnetic radiation
Modulation methods

Learning Strategies: Lectures and exercises

Assessment: Exam and assignment

Bibliography: Handouts
ARRL Handbook

(TTVJ007) Computer Vision

Credits: 3 cr Timing: 3rd yr

Objective: Students will be conversant with the necessary equipment used to implement computer vision and the basic methods of digital image processing.

Contents: CCD and CMOS cameras
Lighting
Lighting and image recording geometries
Digital imaging and pre-handling
Segmentation
Descriptors and classification

Learning Strategies: Lectures and exercises

Assessment: To be announced

Bibliography: Handout

(TTVJ008) Embedded Systems

Credits: 6 cr Timing: 4th yr

Objective: Students will learn how to plan, implement and test a processor based system and to programme the different functions of the device.

Prerequisite: ComputerTechnology 1 - 2 C language Computer Technology and Electronics
Laboratory Work

Contents:	Challenging planning and programming exercises on a processor card.
Learning Strategies:	Small group teaching
Assessment:	Laboratories and planning exercises, with written reports (assessment 1 - 5)
Bibliography:	Circuit manuals Koskinen, Mikrotietokonetekniikka

(TTVJ009) Specialized Professional Studies 1, Laboratory Work

Credits:	4 cr	Timing:	2nd and 3rd yr
Objective:	Students will learn the basic principles of programming using LabVIEW and they will be aware of the advantages of using this programming language in measurement technology applications.		
Contents:	An introduction to programming with LabVIEW Applications based on data acquisition boards and bus connection devices		
Learning Strategies:	Lectures, supervised exercises, small group teaching		
Assessment:	Exercises and assignment (assessment: 1 - 5)		
Bibliography:	LabVIEW Basics I, Hands-On Course -materiaali Handout		

(TTVJ010) Specialized Professional Studies 2, Laboratory Work

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will be conversant with applications used in automation and be able to plan and programme automation systems.		
Contents:	Conveyors Pressurized air systems Sensors Stepper motors Bar codes Programmable logic systems		
Learning Strategies:	Laboratory work in small groups		
Assessment:	Completed laboratory work and related written reports		
Bibliography:	Automaatiotekniikan laboratoriotyöohjeet Reading list/material provided by lecturer		

(TTVJ011) Specialized Professional Studies 3, Laboratory Work

Credits:	3 cr	Timing:	4th yr
Objective:	Students will be conversant with machine vision equipment and how to test it. They will also experience image formation and digital image handling in practice.		
Contents:	Cameras and lighting		

Image processing cards
LabView image handling library
IMAQ Vision Assistant

Learning Strategies: Lectures, supervised exercises, small group work

Assessment: Laboratory work with written reports and assignments (assessment 1 - 5)

Bibliography: Assignment instructions, handouts

(TTVJ012) Specialized Professional Studies 4, Laboratory Work

Credits: 3 cr Timing: 4rd yr

Objective: Students will gain in depth wide-ranging knowledge of wireless technology via laboratory work.

Prerequisite: Wireless Technology

Contents: Different wireless data transfer laboratory exercises

Learning Strategies: Small group teaching

Assessment: Completed laboratory exercises and documentation

Bibliography: ARRL Handbook

(TTVA0Z) VEHICLE INFORMATION SYSTEMS/SHARED COURSES 31 cr

(TTVS001) An Introduction to Embedded Systems

Credits: 3 cr Timing: 2nd yr

Objective: Students will gain basic knowledge of embedded systems, their applications, customer requirements and specifications and of the development process for embedded systems.

Contents: Embedded systems and challenging conditions - demands and specifications
Customer requirements and specifications
The embedded system development process from customer requirements to working product, testing during different stages of system life-cycle

Learning Strategies: Lectures and supervised exercises

Assessment: exams and assignments

Bibliography: reading list/material provided by lecturer, handouts

(TTVS002) Specifications and Product Development

Credits: 3 cr Timing: 2nd yr

Objective: Students will be conversant with the basic methods of product specifications and the different stages of product development.

Prerequisite:	Introduction to Embedded Systems
Contents:	Customer oriented product development The stages of emebedded system product development
Learning Strategies:	Lectures and supervised exercises
Assessment:	Exam and assignments
Bibliography:	Reading list/material provided by lecturer, handouts

(TTVS003) Testing of an Embedded System

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will be conversant with the basic testing methods for embedded systems.		
Prerequisite:	Introduction to Embedded Systems		
Contents:	Life-cycle testing Production testing methods Embedded testing PC and PXI based tester structures Students will plan the testing of their own embedded system		
Learning Strategies:	Lectures and supervised exercises		
Assessment:	Exam and assignments		
Bibliography:	Reading list/material provided by lecturer, handouts		

(TTVS004) Object-Oriented Software Design

Credits:	5 cr	Timing:	2nd and 3rd yr
Objective:	Students will be conversant with the object oriented software development process and modelling methods, as well as with tools programmes used in software development.		
Contents:	The stages of software development and modelling according to UML: - analysis and planning - from planning models to implementation - case software - Prosa		
Learning Strategies:	Lectures and supervised exercises		
Assessment:	Exam and assignment		
Bibliography:	Eriksson, H-E., Penker, M., UML, IT-Press 2000		

(TTVS005) Programming and Tools of an Embedded Device

Credits:	5 cr	Timing:	3rd and 4th yr
Objective:	Students will be able to use C++ and UML to create software for an embedded device and they will also be conversant with the development tools for this process.		

Prerequisite:	Introduction to Embedded Systems
Contents:	Embedded C++ Programming tools Debuggers and simulators
Learning Strategies:	Lectures and supervised exercises
Assessment:	Exam and assignments
Bibliography:	Reading list/material provided by lecturer, handouts

(TTVS007) Exercises/Laboratory Assignments 1

Credits:	4 cr	Timing:	2nd - 3rd yr
Objective:	To be announced		
Contents:	To be announced		

(TTVS008) Exercises/Laboratory Assignments 2

Credits:	4 cr	Timing:	3rd - 4th yr
Objective:	To be announced		
Contents:	To be announced		

(TTVS009) Exercises/Laboratory Assignments 3

Credits:	4 cr	Timing:	4th yr
Objective:	To be announced		
Contents:	To be announced		

(TTVA1Z) VEHICLE INFORMATION SYSTEMS/SOFTWARE DESIGN 14 cr

(TTVSO01) Programming in Visual C++

Credits:	4 cr	Timing:	4th yr
Objective:	This course provides skills in Windows programming using C++ using development tools and the MFC class library.		
Prerequisite:	C++ programming course		
Contents:	VC++ programming environment Structure of the Windows MFC programme MFC class library Menus Programming dialogues Use of device resource serial and parallel ports		
Learning Strategies:	Lectures and supervised exercises		
Assessment:	Exam and assignments		

Bibliography: Bates, J.,Tompkins, T, Microsoft Visual C++ 6 ohjelmoijan käsikirja,1999

(TTVSO02) Operating Systems

Credits: 5 cr Timing: 4th yr

Objective: Students will be able to plan, test and implement different real time systems according to different real time requirements using an operating system.

Contents: Real time operating systems

Learning Strategies: Lectures and supervised exercises

Assessment: Exam and assignment

Bibliography: Lecture handouts

(TTVSO03) Communication Software Programming

Credits: 5 cr Timing: 3rd yr

Objective: Students will be conversant with the basic principles of communication applications planning and implementation.

Prerequisite: Object-oriented Software Design

Contents: Planning and implementing protocol

Learning Strategies: Lectures and supervised exercises

Assessment: Exam and assignment

Bibliography: To be announced

(TTVA2Z) VEHICLE INFORMATION SYSTEMS/ELECTRONICS DESIGN 14 cr

(TTVSE01) Electronics System and Testing Design

Credits: 3 cr Timing: 3rd year

Objective: Students will know how to plan an embedded system electronics and compile a system/unit level specification. Students will be conversant with the basic methods of test planning.

Contents: Systems planning
Compiling a specification
Test planning
Planning own product

Learning Strategies: Lectures and supervised exercises

Assessment: Exams and assignments

Bibliography: Reading list/material provided by lecturer

(TTVSE02) Signal Processing

Credits:	3 cr	Timing:	4th yr
Objective:	Students will be conversant with the basic concepts of digital signal processing and applications.		
Prerequisite:	Digital Signal Processing		
Contents:	Screening and converting an analog signal to a digital signal, discrete yimed signal processing, discrete Fourier transformation, signal reconstruction (DA-transformation), FIR and IIR filters.		
Learning Strategies:	Lectures, supervised exercises, group work		
Assessment:	Exam and assignment. Project work		
Bibliography:	Reading list/materials and handout provided by lecturer		

(TTVSE03) An Embedded System and its Structure

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will be conversant with the electronics and components of an embedded system.		
Contents:	Processors, programmable logic circuits (FPGA, CPLD), memories, A/D and D/A transformers, DSP-processors		
Learning Strategies:	Lecures, supervised assignments, small group work		
Assessment:	Exam and assignment. Planning own product.		
Bibliography:	Reading list/material provided by lecturer, handouts		

(TTVSE04) Electronics Design

Credits:	5 cr	Timing:	3rd and 4rd yr
Objective:	Students will be albe to plan the electronics required of a simple microprocessor based device.		
Contents:	Planning the electronics for own product The contents will be more accurately determined by the products being planned.		
Learning Strategies:	Lectures, supervised exercises, group work		
Assessment:	Exam and assignment. Planning and manufacturing own product.		
Bibliography:	Reading list/material provided by lecturer		

(VAPAAZ) FREE-CHOICE STUDIES 15 cr

Students can freely select 15 cr of studies that will support their professional development, from their own field/degree programme or from another degree programme in their own university of applied sciences, from another university of applied sciences or science university. Students will achieve wide-ranging business expertise.

(TRW007) Bygg Upp Din Svenska

Credits:	1.5 cr	Timing:	To be announced
Objective:	This course develops and strengthens Swedish skills acquired during earlier courses so that students will be able to cope with UAS level Swedish language studies in their own field of studies. The aim is also to develop language study skills.		
Prerequisite:	Proficiency test		
Contents:	Basic grammar and vocabulary. Activating speaking and writing skills as well as listening and reading comprehension.		
Learning Strategies:	Small groups		
Assessment:	Active participation 100 %, oral and written exercises, exam, evaluated on a scale of 0 - 5		
Bibliography:	Handout		

(TRW008) Build up Your English

Credits:	1.5 cr	Timing:	1st yr
Objective:	Students will develop and strengthen their language skills acquired during previous courses in order to be able to cope with their compulsory professional language studies. The aim is also to develop language learning skills.		
Prerequisite:	Proficiency test		
Contents:	Basic grammar and vocabulary Activation of speaking and writing skills as well as reading and listening comprehension.		
Learning Strategies:	Small group teaching		
Assessment:	Active participation 100 %, oral and written exercises, exam		
Bibliography:	handout		

(TTOO0Z) THESIS 15 cr

(TTOO001) Thesis

Credits:	15 cr	Timing:	
Objective:	The aim of the thesis is to demonstrate and develop the skills that students possess in applying their knowledge and know-how to professional studies and tasks requiring in their chosen field. The topic of the thesis is usually agreed beforehand with the		

client and is based on the requirements of working life to support students' professional development. The thesis provides a wide-ranging demonstration of students' knowledge and know-how.

Contents: Selecting a subject appropriate to working life
 Creating the necessary documents
 Acceptance processes
 Selecting the supervisor
 Thesis
 Presentation of thesis
 Maturity test

(TTHH0Z) PRACTICAL TRAINING 30 cr

(TTHH001) Practical Training

Credits: 30 cr Timing:

Objective: The aim of the practical training period is to provide students with good post graduation employment opportunities and to familiarise students with working life. Students will gain knowledge of different job tasks, working procedures, devices and professional terminology related to their chosen specialism in a real working environment under supervision. The practical training period takes place during the spring semester of the third study year. Mr Eero Soininen is the practical training co-ordinator responsible for informing students of practical training issues together with the head of the degree programme.

Prerequisite: Students must have 135 cr before starting their practical training period.

Contents: A usually continuous approx five month training period (800 working hours) in working life

DEGREE PROGRAMME IN INFORMATION TECHNOLOGY

Information Security Technology

The aim of the degree programme is to increase students' awareness of information security so that they think of information security as being part of a company's general security strategy and will be able to work in an expert capacity within companies to achieve this goal.

The competences covered in the Information Technology Degree Programme

Information Technology Degree Programme	Description of range of competence
Competence in mathematics and natural sciences	<ul style="list-style-type: none"> • able to use a mathematical and logical approach and way of thinking in technical problem solving • ability to share acquired knowledge within the working community • ability to use mathematical principles, methods and tools • awareness of important physical properties of applications and the principles of sustainable development
Device engineering competence	<ul style="list-style-type: none"> • conversant in electrical engineering and safety in electrical work • knowledge of the most important electronic components, how they work and basic connections • proficiency in electrical engineering measurements • understanding of the electronics design and production process • knowledge of computer architecture and how key components work • basic IT skills • conversant in the use of simulation and design software
Software engineering competence	<ul style="list-style-type: none"> • knowledge of the different stages of software development • ability to compile specifications, technical planning and testing documentation • knowledge of object-oriented software development and programming basics • conversant with programming technology, comprehension of programming logic, knowledge of the most common algorithms, information structures and tools • knowledge of software testing basics, ability to test software parts/software programmes according to a test plan

	<ul style="list-style-type: none"> • ability to interpret programming language and to use programming in problem solving • ability to participate in software projects in a company and client-oriented manner • knowledge of data communication applications design and programming basics • knowledge of mobile device software development and programming basics
Information technology design competence	<ul style="list-style-type: none"> • possesses knowledge of the theoretical foundations of own application field (1st major – design competence emphasised) • ability to find, combine and apply the latest technical knowledge of own field using typical design methods and procedures and ability to document the results of one's own work • ability to participate in disciplined product development work independently and as a member of a project working group
Administrative information security competence	<ul style="list-style-type: none"> • conversant with corporate law issues • knowledge of data security legislation and regulations • knowledge of company administration data security and company data security management
Technical information security competence	<ul style="list-style-type: none"> • conversant with data security thinking, basic concepts and methods of data security • knowledge of different fields of data security • knowledge of the different stages of development of secure data security systems and ability to develop secure data security systems • knowledge of and ability to develop device and data communications data security • ability to plan, test and implement normal wired and wireless information networks • knowledge of and ability to develop physical data security
Information security awareness	<ul style="list-style-type: none"> • knowledge of privacy laws • ability to develop data security awareness, plan, compile and start to use a data security awareness programme in a company.

THEMES FOR EACH YEAR OF STUDY, DATA SECURITY TECHNOLOGY

1st yr

Engineering orientation

This theme covers the development of the basic knowledge, mathematical and natural sciences thinking processes, and communication and information retrieval skills required during engineering studies.

2nd yr

Deeper knowledge

This theme includes the supplementation of basic skills and knowledge and choosing major courses of study. It also covers group work skills and introduces project working methods.

3rd yr

Specialisation

Students will gain specialised knowledge of their major subject and learn to apply theory in practice through participation in working life.

4th yr

Application

This theme includes the supplementing of existing skills and knowledge for the requirements and transfer to the world of work. Students will learn to work independently in typical engineering positions.

INFORMATION TECHNOLOGY DEGREE PROGRAMME

BASIC STUDIES **71 cr**

LANGUAGE AND COMMUNICATION SKILLS **17 cr**

Communication Skills in Finnish	5 cr
Text and Terminology	3 cr
Svenska för IT-ingenjörer	3 cr
Introduction to Project Management	3 cr
Introduction to Data Processing	3 cr

ADMINISTRATIVE DATA SECURITY **18 cr**

Introduction to Business Economics	3 cr
Corporate Law and data Security	3 cr
Data security laws and regulations	3 cr
Data Security Leadership	3 cr
Data Security Management	3 cr
Data Security Awareness	3 cr

STUDIES IN MATHEMATICS AND NATURAL SCIENCES **36 cr**

Mathematics	18 cr
Physics	15 cr
Chemistry	3 cr

COMPULSORY PROFESSIONAL STUDIES **61 cr**

English Language and Communication Skills	5 cr
Information Technology	9 cr
Data Security	9 cr
Electronics	6 cr
Computer Technology	12 cr
Telecommunications Technology	8 cr
Professional Subjects, Laboratory Work	12 cr

OPTIONAL PROFESSIONAL STUDIES **48 cr**

Data Security Technology	48 cr
Development of Safe Data Security Systems	23 cr
Device and Data Communications Security	25 cr

FREE-CHOICE STUDIES **15 cr**

PRACTICAL TRAINING **30 cr**

THESIS **15 cr**

COURSE DESCRIPTIONS OF DEGREE PROGRAMME IN INFORMATION TECHNOLOGY

BASIC STUDIES

(TUPV0Z) LANGUAGE AND COMMUNICATION SKILLS 17 cr

(TUPV001) Communication Skills in Finnish 1

Credits:	3 cr	Timing:	1st yr
Objective:	Students will practise the oral and written forms of communication they require for work.		
Contents:	Introduction to oral and written communication Writing academic texts Speeches (preparation, participation, analysis) Introduction to team work, negotiation situations and meetings		
Learning Strategies:	Independent work, group work, lectures		
Assessment:	Participation in group work, exercises and exam		
Bibliography:	Kauppinen, A., Nummi, J., Savola, T., Tekniikan viestintä (4., uudistettu painos)		

(TUPV002) Communication Skills in Finnish 2

Credits:	2 cr	Timing:	4 th yr
Objective:	Students will gain the technical writing skills required for work.		
Contents:	How to document the engineering thesis Writing for engineering Issues in language usage and maintenance		
Learning Strategies:	independent work, group work, lectures		
Assessment:	participation in group work and exam		
Bibliography:	Kauppinen A., Nummi, J., Savola, T., Tekniikan viestintä (4., uudistettu painos) Nykänen, O., Toimivaa tekstiä. Opas tekniikasta kirjoittaville		

(TUPV003) Text and Terminology 1

Credits:	1.5 cr	Timing:	1st yr
Objective:	This course aims to develop and strengthen information technology students' English skills so they will be able to read their own professional literature, write technical documents.		
Prerequisite:	Proficiency test and Build up Your English course if required		
Contents:	Technical language as a tool		

The special grammatical features of technical language
 Vocabulary building
 Developing reading techniques
 Documentation

Learning Strategies: Contact teaching, assignments, independent, pair and group work.

Assessment: Active participation, assignments; written exam

Bibliography: Handout

(TUPV004) Text and Terminology 2

Credits: 1.5 cr Timing: 2nd yr

Objective: This course aims to develop and strengthen information technology students' English skills so they will be able to read their own professional literature, write technical documents, search for and process information.

Contents: The special grammatical features of technical language
 Vocabulary building
 Developing reading techniques
 Documentation
 Oral and written reporting and summarising.

Learning Strategies: Contact teaching, independent, pair and group work.

Assessment: Active participation, searching for and processing technical texts, oral presentations (in assessment 50 %); written exam (in assessment 50 %)

Bibliography: Texts processed by students

(TUPV005) Swedish for IT Engineers

Credits: 3 cr Timing: 3rd year

Objective: Students will develop their oral and writing skills in Finland's second official language specifically to aid their own professional development. Students will practise speaking Swedish in everyday communication situations as well as being able to discuss professional issues in Swedish. Students will also be able to find and use information in Swedish concerning their own specific field.

Contents: Central IT and data security vocabulary and situations of language use

Learning Strategies: Small group teaching

Assessment: Active participation, supervised exercises, oral and written exam

Bibliography: Handout

(TUPV006) Introduction to Project Management

Credits: 3 cr Timing: 1st yr

Objective: Students will adopt a goal-oriented way of working for use in one-off administrative and manufacturing tasks.

Contents:	Project concept Project planning Documentation Ending the project
Learning Strategies:	Lectures, exercises and project plan
Assessment:	Exam, assignments and project plan
Bibliography:	Silfverberg, P., Ideasta projektiksi Pelin, R., Projektihallinnan käsikirja Välimaa, et al, Tuotekehitys. Asiakastarpeesta tuotteeksi. Lecture handouts

(TUPV007) Data Processing, Basics

Credits:	3 cr	Timing:	1st yr
Objective:	Students will be conversant with basic computer structure and the polytechnic computers, their most usual tools programmes and peripheral devices used during studies at the polytechnic.		
Contents:	User systems and interfaces Tools programmes Installing and configuring the system The Polytechnic computer network, user ID and passwords. An introduction to word processing Spreadsheet accounting and graphics		
Learning Strategies:	Small group work and course work		
Bibliography:	Reading list/material provided by lecturer		

(TUPH1Z) DATA SECURITY FOR ADMINISTRATION 18 cr

(TUPH001) An Introduction to Business Economics

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will be conversant with the foundations of business operations and they will gain a general overview of business planning.		
Contents:	Basic concepts of business operations Internal and external entrepreneurship Business processes and operational environment Business funding and budget monitoring Business planning		
Learning Strategies:	Lectures and assignments		
Assessment:	Exam and compiling a business plan		
Bibliography:	Kinkki, Isokangas, Yrityksen perustoiminnot, WSOY 2004		

(TUPH002) Legal Issues and Data Security for Companies

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will be conversant with the general principles of contract law as well as knowing the central contracts, responsibilities and data security issues involved in business.		
Contents:	The system of law Contracts and making contracts Company form Term of employment, work time and annual holidays Commercial agreements Compensation		
Learning Strategies:	Lectures and course-work		
Assessment:	Exam and assignments		
Bibliography:	To be announced		

(TUPH003) Data Security Laws and Statutes

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will be conversant with legislation and legal regulations concerning the handling of personal data and data security as well as the principles of document management and archiving.		
Contents:	basic rights Personal data legislation Data security in working life Document management Filing		
Learning Strategies:	Lectures and course-work		
Assessment:	Exam and exercises		
Bibliography:	to be announced		

(TUPH004) Leadership in the Field of Data Security

Credits:	3 cr	Timing:	4th yr
Objective:	Students will become familiar with an organisation's data security issues using the questions why?, what? and how?.		
Contents:	The logical levels of data security The basic elements of data security The tools of data security leadership Security guidelines as a management tool Costs, liability and personnel resources Data security development programme		
Learning Strategies:	lectures, exercises		
Assessment:	Exam or portfolio		
Bibliography:	To be announced		

(TUPH005) Data Security Management

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will gain knowledge of data security management and how to develop data security within an organisation.		
Prerequisite:	Introduction to Data Security		
Contents:	Compiling a data security strategy and policy Analysis of the current situation: risk analysis Operational processes and data security Planning and development of data security Ensuring continuity: recovery plan Technical data security User rights management Evaluation and testing of data security		
Assessment:	Exam or essay		
Bibliography:	To be announced		

(TUPH006) Data Security Awareness

Credits:	3 cr	Timing:	4th yr
Objective:	Students will gain knowledge of a person's privacy protection and the development of data security awareness as well as how to establish data security awareness in an organisation. The aim of this course is to create a data security awareness programme that includes data security information flashes, instructions and training.		
Contents:	What is protection of privacy? What is data security awareness? Designing, implementing and using a data security awareness programme.		
Learning Strategies:	Lectures and group work		
Assessment:	Exam or essay		
Bibliography:	To be announced		

STUDIES IN MATHEMATICS AND SCIENCE**(TUPM2Z) MATHEMATICS 18 cr****(TUPM001) Mathematics 1-2**

Credits:	6 cr	Timing:	1st yr
Objective:	This course partially revises and adds to high school and vocational college mathematics with an aim to develop systematic and disciplined learning and interaction skills.		
Contents:	Number systems Functions Trigonometry Vectors		

Determinants and matrices
Complex numbers
Introduction to a mathematics programme

Learning Strategies: Lectures and exercises, independent and group work.

Assessment: To be announced

Bibliography: Majaniemi, A., Algebra I
Majaniemi, A., Algebra II
Majaniemi, A., Geometria

(TUPM002) Mathematics 3

Credits: 6 cr Timing: 1st yr

Objective: In addition to developing calculation skills students will understand the main starting points and basic applications of differential and integral calculus.

Contents: Revision of basic algebra skills
Derivatives and growth rate of functions
The graph of a function
Extreme values
Indefinite and definite integrals
Area, volume and work

Learning Strategies: Lectures and exercises, independent and group work, use of a mathematics programme

Assessment: To be announced

Bibliography: Majaniemi, A., Matematiikka I

(TUPM003) Mathematics 4

Credits: 6 cr Timing: 2nd yr

Objective: students will gain mathematics skills used in modern data transfer and processing and data security.

Contents: Introduction to series
Fourier series
The Fourier transform
Classical probability
Random variables and distributions
Normal distribution
The central limit theorem

Learning Strategies: Lectures and exercises, independent and group work, use of mathematics programme

Assessment: To be announced

Bibliography: Majaniemi, A., Fourier, Laplace, ja Runge-Kutta-menetelmistä
Majaniemi, A., Matematiikka IV

(TUPF3Z) PHYSICS 15 cr**(TUPF001) Physics 1**

Credits: 6 cr Timing: 1st yr

Objective: This module will provide the necessary skills in physics for the other courses of the degree programme.

Contents: Physics quantity and unit system
Mechanics, electrostatics, DC circuits

Learning Strategies: Lectures and exercises

Assessment: To be announced

Bibliography: Inkinen, P., Tuohi, J., Momentti 1 ja 2, Insinöörifysiikka

(TUPF002) Physics 2

Credits: 6 cr Timing: 1st yr

Objective: This course builds on the knowledge provided in Physics 1 and provides a background in physical science for use in other courses of the degree programme.

Prerequisite: Physics 1

Contents: Mechanics, thermodynamics, electricity,
wave motion and acoustics

Learning Strategies: Lectures and exercises

Assessment: Interim tests

Bibliography: Inkinen, P., Tuohi, J., Momentti 1, Insinöörifysiikka
Inkinen, P., Manninen, R., Tuohi, J., Momentti 2, Insinöörifysiikka**(TUPF003) Physics, Laboratory Work**

Credits: 3 cr Timing: 2nd yr

Objective: Students will become conversant with basic physics through experimentation. The course also covers measurement technology and written reporting.

Contents: Topics covered during Physics 1 and 2

Learning Strategies: Completion of laboratory work and written reporting in small groups

Assessment: Completion of set assignments and reports for assessment (1 - 5)

Bibliography: Instructions provided by polytechnic
Inkinen, P., Tuohi, J., Momentti 1 ja 2,
Insinöörifysiikka
Inkinen, P., Manninen, R., Tuohi, J., Momentti 2, Insinöörifysiikka

(TUPK4Z) CHEMISTRY 3 cr**(TUPK001) Chemistry**

Credits: 3 cr Timing: 3st yr

Objective: This course revises and adds to high school chemistry. Students will gain knowledge of environmental chemistry and study the use of dangerous materials and poisons.

Contents: The periodic table, mol
 Chemical reactions
 Energy
 Acid-alkali theory
 pH
 Electrolysis
 Corrosion
 Environmental chemistry
 Dangerous materials and pollutants

Learning Strategies: Lectures and course work

Assessment: To be announced

Bibliography: Arvonen, H., Levonen, A., Ammattikorkeakoulun kemia
Handouts**COMPULSORY PROFESSIONAL STUDIES 61 cr****(TUAE0Z) ENGLISH LANGUAGE AND COMMUNICATION STUDIES 5 cr****(TUAE001) Intercultural and Business Skills 1**

Credits: 1.5 cr Timing: 3rd yr

Objective: This course develops information technology students' intercultural competence so that they have qualifications to communicate in English in international and multicultural working life contexts.

Contents: Concepts of culture and communication
 Variables used to compare cultures
 Cultural differences in communication
 The process of adapting to another culture

Learning Strategies: Contact teaching, assignments, independent work, pair and group work

Assessment: Active participation, project and its oral introduction (in assessment 50 %); written exam (in assessment 50 %)

Bibliography: Handouts

(TUAE002) Intercultural and Business Skills 2

Credits:	3.5 cr	Timing:	4th yr
Objective:	This course develops information technology students' intercultural competence so that they have qualifications to communicate in English in international and multicultural working life contexts.		
Contents:	Company, production and product presentations Telephone conversations Written business communication Meetings and negotiations		
Learning Strategies:	Contact teaching, assignments, independent work, pair and group work		
Assessment:	Active participation, oral assignments (in assessment 65 %) and written assignments (in assessment 35 %); written exam		
Bibliography:	Handouts		

(TUAT1Z) INFORMATION TECHNOLOGY 9 cr

(TUAT001) C Programming

Credits:	6 cr	Timing:	1st year
Objective:	To provide a foundation for the study of C programming and programming in practice. The course covers the basic concepts of programming and students will learn how to solve small-scale problems based on different set tasks and to create a solution using the C programming language. This course also introduces students to laboratory work.		
Prerequisite:	Data Processing, Basics		
Contents:	The basic concept of programming Problem solving and modular programming Data types, variables and operators Input and output functions The structure of a C programme: control structures, main programme and sub-programmes Pointers and character strings Table handling Records and file handling Programming environment Visual studio.Net		
Learning Strategies:	Lectures and supervised exercises and e-lessons		
Assessment:	Theory exam, computer test, assignment and coursework set during lessons and on the Internet		
Bibliography:	Silander Simo, Ohjelmointi Pro Training, Uusin painos Viope network environment		

(TUAT002) Computer Programming (C++)

Credits:	3 cr	Timing:	1st yr
Objective:	To extend and deepen the programming skills obtained during Programming, Basics using C++ programming language. Students must have prior knowledge of the basic		

concepts and structures in programming. This course covers the main structures of C++ and introduces students to the background and basic principles of object oriented techniques. This course serves as an introduction to device programming.

Prerequisite: C language

Contents: The principles of C++ programming
Problem solving and object oriented thinking and modularity
Data types, variables and operators
Input and output functions
The basic control structures of C++:
Main and sub-programmes
Table handling, pointers and character strings
Records and file handling

Learning Strategies: lectures and supervised exercises and e-lessons

Assessment: Theory exam, computer test, assignment and coursework and internet assignments

Bibliography: To be announced

(TUAU2Z) DATA SECURITY 9 cr

(TUAU001) Principles of Data Security 1

Credits: 4 cr Timing: 1 st yr

Objective: Students will have thorough knowledge of data security principles, threats and methods of ensuring data security.

Contents: Basic principles, targets of data security operations and threats to data security
Encryption
Digital signatures
Certification
Password security
Data security for browser users
Email data security
Local network data security

Learning Strategies: lectures, coursework, group work

Assessment: Exam and independent assignments

Bibliography: Järvinen Petteri (2006): Paranna Tietoturvaasi

(TUAU002) Principles of Data Security 2

Credits: 5 cr Timing: 1st yr

Objective: Students will gain an understanding of the most common attacks against data security and how to protect data security from such threats.

Prerequisite: Principles of data security 1

Contents: Expanding data security
Software data security
Methods of attack and protection

Learning Strategies: Lectures and assignments

Assessment: Exam and approved assignments

Bibliography: Lecture handouts

(TUAN3Z) ELECTRONICS 6 cr

(TUAN001) Electronics 1

Credits: 3 cr Timing: 1st yr

Objective: Students will be conversant with the basic electronic components and connections, as well as being able to apply the basic laws of electricity to make small scale connections.

Contents: Passive components and filters
Types of diodes, diode response curves and basic connections
Calculating bipolar and field-effect transistor operating points
An introduction to operation amplifiers
An introduction to computer aided simulation methods (Micro-Cap)
The basic structure of CMOS logic circuits

Learning Strategies: Lectures and exercises

Assessment: Interim exams

Bibliography: Silvonen, K., Tiilikainen, M., Helenius, K., Analogiaelektroniikka
Volotinen, V., Analoginen elektroniikka, Komponentit ja peruskytkennät
Salo, P., Sähkötekniikan perusoppi 4, elektroniikka 1
Salo, P., Sähkötekniikan perusoppi 5, elektroniikka 2
Salo, P., Analogista elektroniikkaa, Periaatteita ja sovellutuksia

(TUAN002) Electronics 2

Credits: 3 cr Timing: 2nd yr

Objective: This course provides students with knowledge of the operational principles of basic electronics connections and laws of electricity for application in small scale connections.

Prerequisite: Electronics 1

Contents: The operational solutions and features of the most common components
The operational principles and features of the most common electric connections
Sources of power
An introduction to electrical engineering design
An introduction to CAD

Learning Strategies: Lectures and assignments

Assessment: Exams and assignments

Bibliography: Silvonen, K., Tiilikainen, M., Helenius, K., Analogiaelektroniikka
Volotinen, V., Analoginen elektroniikka, Komponentit ja peruskytkennät
Salo, P., Sähkötekniikan perusoppi 4, elektroniikka 1
Salo, P., Sähkötekniikan perusoppi 5, elektroniikka 2

Salo, P., Analogista elektroniikkaa, Periaatteita ja sovellutuksia

(TUA4Z) COMPUTER ENGINEERING 12 cr

(TUA003) Data Security Seminar

Credits: 4 cr Timing: 4th yr

Objective: Special issues in data security discussed during seminar

Contents: Varies year to year, seminar and expert presentations on different areas of data security

Learning Strategies: Seminar and seminar presentations

Assessment: Participation in seminars, presentation

(TUA002) Computer Engineering 2

Credits: 8 cr Timing: 1st and 2nd yr

Objective: Students will be able to understand the structural parts and functioning of a microprocessor system as well as being able to plan a device based on a processor.

Prerequisite: Computer Engineering 1

Contents: Microprocessor engineering
- the functioning principles of microprocessors
- Planning and programming a microprocessor based device using Assembly and C-language

Learning Strategies: Lectures and assignments

Assessment: Interim exams

Bibliography: Rantala Pekka, Mikrotietokonetekniikka
Intel, MCS-51:n manuaalit

(TUA001) Computer Engineering 1

Credits: 4 cr Timing: 1st yr

Objective: Students will understand the principles of digital technology and components while being able to plan and analyse digital connections.

Contents: An introduction to digital engineering:
Number systems and Boolean algebra
The design and analysis of connections made using combinational circuits

Learning Strategies: Lectures and exercises

Assessment: Interim tests

Bibliography: Rantala Pekka, Digitaalitekniikka osa A

(TUAL5Z) TELECOMMUNICATIONS 8 cr**(TUAL001) Telecommunications 1**

Credits: 4 cr Timing: 2nd yr

Objective: Telecommunications 1

Contents: Students will gain an overall understanding of the history of telecommunications and telecommunications in the present day, the principles of telecommunications as well as getting to know the basic technology, techniques and theoretical background of telecommunications and telecommunications engineering.

Learning Strategies: Lectures and assignments

Assessment: Exam

Bibliography: K. Granlund: Tietoliikenne, E-material in course files, lectures handouts, work instructions, device and circuit based manuals and specifications

(TUAL002) Telecommunications 2

Credits: 4 cr Timing: 2nd yr

Objective: Students will understand networks and how connected devices and systems work and their data security.

Prerequisite: Telecommunications 1

Contents: Data networks, active and passive network devices, network engineering, LAN, WAN, wireless networks, Internet, data security and its requirements for data networks

Learning Strategies: Lectures and assignments

Assessment: Exam

Bibliography: Teaching handout, e-material

(TUAA6Z) PROFESSIONAL SUBJECTS, LABORATORY WORK 14 cr**(TUAA001) Computer Technology, Laboratory Work**

Credits: 6 cr Timing: 2nd yr

Objective: Students will be able to create simple programmes and applications using an 8051 microprocessor card.

Prerequisite: Computer Engineering 2

Contents: Practical applications and programming exercises using 8051 ANSI C and Assembler languages.

Learning Strategies: Small group teaching

Assessment: Approve lab exercises and reports
 Bibliography: 8051-manuals, ANSI C- ja Assembler-literature

(TUAA002) Electronics, Laboratory Work

Credits: 2 cr Timing: 2nd yr
 Objective: Students will learn how to use basic measurement equipment and to construct simple electronic connections.
 Prerequisite: Electronics 1 and 2
 Contents: Introduction to measuring devices and taking basic measurements
 Learning Strategies: Lab work in small groups
 Assessment: Labs, written reports and lab test (assessment 1 - 5)
 Bibliography: Electronics course material
 Components data info
 Measurement device manuals

(TUAA003) Communications, Laboratory Work

Credits: 4 cr Timing: 3rd yr
 Objective: This course deepens knowledge of the different areas of telecommunications technology through lab exercises.
 Prerequisite: Telecommunications 1 and 2
 Contents: Different lab based exercises involving the different areas of telecommunications engineering.
 Learning Strategies: Small group teaching
 Assessment: Approved lab exercises and reports

OPTIONAL PROFESSIONAL STUDIES

(TUVT0Z) DEVELOPMENT OF DATA SECURITY TECHNOLOGY/DEVELOPMENT OF SECURE DATA SYSTEMS 23 cr

(TUVT001) Object-oriented Software Development

Credits: 4 cr Timing: 2nd yr
 Objective: This course covers the object oriented software development process and related modelling methods and introduces students to the tools software used for software development. Data security is an integrated part of the software development process.

Contents: The stages and modelling of software development using UML
Data security standards and their application in software development
UML and data security
The requirements, modelling and design of data security with the aid of misuse cases.
Practical methods of ensuring data security

Learning Strategies: Lectures and group work

Assessment: Exam and assignments

Bibliography: To be announced

(TUVT002) Embedded Systems

Credits: 2 cr Timing: 3rd yr

Objective: This course provides comprehensive knowledge of embedded systems, applications, defining customer needs and demands and of the embedded systems development process.

Contents: The development process of an embedded system based on the customer's requirements to create a working product that is tested during different stages of its life cycle.

Learning Strategies: Small group teaching

Assessment: Labs and design assignments with written reports (assessment 1 - 5)

Bibliography: Circuit manuals
Koskinen, Mikrotietokonetekniikka

(TUVT003) Object-oriented Programming and Data Security

Credits: 5 cr Timing: 2nd yr

Objective: This course aims for the production of secure, high quality software using C++. It will deepen and extend students' skills in programming obtained during the C and C++ languages courses.

Prerequisite: C and C++ courses

Contents: What is secure programming?
The problems and principles of data secure programming
Data security as part of programming
Object oriented thinking and UML modelling
Case programmes as a programming support
The programming environment will be Visual Studio. NET

Learning Strategies: Lectures and supervised exercises and e lessons

Assessment: Theory exam, computer test, assignment and lesson and e exercises

Bibliography: To be announced

(TUVT004) Testing and Auditing

Credits:	4 cr	Timing:	3rd yr
Objective:	Students will know and be conversant with testing as part of data secure software development and programming.		
Prerequisite:	Object oriented software development and UML and Programming basics		
Contents:	Principles of testing and testing exercises Strategies and methods Planning and reporting Testing as part of data secure programming testing data security during planning The special features of embedded systems		
Learning Strategies:	Lectures and supervised exercises and e lessons		
Assessment:	Theory exam, assignment and lesson and e assignments		
Bibliography:	To be announced		

(TUVT005) Data Base System Data Security

Credits:	4 cr	Timing:	4th yr
Objective:	This course familiarisess students with data base system data security and development.		
Contents:	Basics of relational databases Use of databases in programming language Data security of data bases The programming environment will be Visual Studio.NET.		
Learning Strategies:	Lectures and group work		
Assessment:	Theory exam		
Bibliography:	To be announced		

(TUVT006) Data Security of Mobile Systems

Credits:	4 cr	Timing:	4th yr
Objective:	To study Symbian programming and to take into account data security during programming and to familiarise students with the data security of mobile devices.		
Contents:	An introduction to wireless communications An introduction to Symbian programming Data security of mobile devices		
Learning Strategies:	Lectures and supervised exercises and e-lessons		
Assessment:	Theory exam and assignment		
Bibliography:	To be announced		

(TUVL1Z) DATA SECURITY TECHNOLOGY/EQUIPMENT

AND COMMUNICATIONS SECURITY 25 cr**(TUVL001) Operating Systems**

Credits:	4 cr	Timing:	3rd yr
Objective:	Students will understand the different functions, meanings and weaknesses of different operating systems.		
Contents:	The structure of a computer system, low level programming, machine language and micro programming, exceptions, interruptions, DMA, monitor programmes, the different tasks of an operating system, the principles of different operating systems.		
Learning Strategies:	Lectures and exercises		
Assessment:	Exam		
Bibliography:	Lecture handouts, micro processor handouts, e-manterial		

(TUVL002) Hardware Security

Credits:	4 cr	Timing:	2nd yr
Objective:	Students will comprehend the significance of device based security as well as being able to audit it and to plan a secure environment.		
Contents:	Physical data security, lockout and physical access control, power cuts, fires, water damage and theft and protection against such threats, secure destruction of data.		
Learning Strategies:	Lectures and auditing exercises		
Assessment:	Exam and written auditing report		
Bibliography:	Teaching handout and e material		

(TUVL003) Communications Data Security

Credits:	5 cr	Timing:	3rd yr
Objective:	Students will be aware of possible threats to communications and they will know how to protect communications from such threats.		
Contents:	Different attack and disruption techniques DOS, "Social Engineering" and protecting communication against such threats.		
Learning Strategies:	Lectures and exercises		
Assessment:	Exam and assignment		
Bibliography:	Teaching handout, e material		

(TUVL004) Data Networks and Data Security

Credits:	4 cr	Timing:	2nd yr
Objective:	Students will possess in depth knowledge of network data security as well as the		

operating principles of routers and fire walls. They will be able to design a secure data network.

Prerequisite: Telecommunications 1 and 2, Computer Engineering 2

Contents: Advance studies in networks, routing, Access lists, operating principles of firewalls and their configuration, malicious programmes, anti-virus protection

Learning Strategies: Lectures and exercises

Assessment: Exam and written assignment

Bibliography: Teaching handout, e material

(TUVL005) Wireless Technology and Data Security

Credits: 4 cr Timing: 4th yr

Objective: Students will gain an in depth understanding of data security for wireless data systems and will know how to protect their weak points.

Prerequisite: Data Security of Mobile Systems

Contents: In depth operating principles and content of GSM and WLAN systems, disturbances in the radio path, multipath propagation and how to decrease existing problems

Learning Strategies: Lectures

Assessment: Exam

Bibliography: Teaching material, e material

(TUVL006) Data Security Seminar

Credits: 4 cr Timing: 4th yr

Objective: Special issues in data security discussed during seminar

Contents: Varies year to year, seminar and expert presentations on different areas of data security

Learning Strategies: Seminar and seminar presentations

Assessment: Participation in seminars, presentation

(VAPAAZ) FREE-CHOICE STUDIES 15 cr

Students can freely select 15 cr of studies that will support their professional development, from their own field/degree programme or from another degree programme in their own university of applied sciences, from another university of applied sciences or science university. Students will achieve wide-ranging business expertise.

(TRW007) Bygg Upp Din Svenska

Credits:	1.5 cr	Timing:	To be announced
Objective:	This course develops and strengthens Swedish skills acquired during earlier courses so that students will be able to cope with UAS level Swedish language studies in their own field of studies. The aim is also to develop language study skills.		
Prerequisite:	Proficiency test		
Contents:	Basic grammar and vocabulary. Activating speaking and writing skills as well as listening and reading comprehension.		
Learning Strategies:	Small groups		
Assessment:	Active participation 100 %, oral and written exercises, exam, evaluated on a scale of 0 - 5		
Bibliography:	Handout		

(TRW008) Build up Your English

Credits:	1.5 cr	Timing:	1st yr
Objective:	Students will develop and strengthen their language skills acquired during previous courses in order to be able to cope with their compulsory professional language studies. The aim is also to develop language learning skills.		
Prerequisite:	Proficiency test		
Contents:	Basic grammar and vocabulary Activation of speaking and writing skills as well as reading and listening comprehension.		
Learning Strategies:	Small group teaching		
Assessment:	Active participation 100 %, oral and written exercises, exam		
Bibliography:	handout		

(TUOO00Z) THESIS 15 cr

(TUOO001) Thesis

Credits:	15 cr	Timing:	4th yr
Objective:	The aim of the thesis is to demonstrate and develop the skills that students possess in applying their knowledge and know-how to professional studies and tasks requiring in their chosen field. The topic of the thesis is usually agreed beforehand with the client and is based on the requirements of working life to support students' professional development. The thesis provides a wide-ranging demonstration of students' knowledge and know-how.		
Contents:	Selecting a subject appropriate to working life Creating the necessary documents Acceptance processes Selecting the supervisor		

Thesis
 Presentation of thesis
 Maturity test

(TUHH0Z) PRACTICAL TRAINING 30 cr

(TUHH001) Practical Training

Credits: 30 cr Timing: Autumn of 3rd yr

Objective: The aim of the practical training period is to provide students with good post graduation employment opportunities and to familiarise students with working life. Students will gain knowledge of different job tasks, working procedures, devices and professional terminology related to their chosen specialism in a real working environment under supervision. The practical training period takes place during the spring semester of the third study year. Mr Eero Soininen is the practical training co-ordinator responsible for informing students of practical training issues together with the head of the degree programme.

Prerequisite: Students must have 135 cr before starting their practical training period.

Contents: A usually continuous approx five month training period (800 working hours) in working life.