

## **SCHOOL OF ENGINEERING / BACHELORS DEGREE IN ENGINEERING**

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

**Head of School:** Jari Kähkönen

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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
<b>Basic skills in mechanical engineering</b>	<ul style="list-style-type: none"> <li>• ability to use maths and physics to describe mechanical phenomena and to solve problems</li> <li>• knowledge of the most common components and machine parts used in mechanical engineering and how the most common machines work</li> <li>• knowledge of basic mechanical measurements</li> <li>• knowledge of principles of energy technology and use</li> </ul>
<b>Planning and design competence</b>	<ul style="list-style-type: none"> <li>• knowledge of basic technical documentation and use of 3D modelling in design and planning</li> <li>• knowledge of the most common structural materials and their features of use</li> <li>• understanding of the significance of standardisation in product planning and production</li> <li>• ability to take into account the whole life-cycle of the product during the planning stage</li> <li>• comprehension of the significance of group</li> </ul>

	work in product planning and the competence to work as a member of an international planning organisation
<b>Manufacturing technology competence</b>	<ul style="list-style-type: none"> <li>• knowledge of manufacturing engineering methods, equipment and opportunities</li> <li>• understanding of the principles of production systems and automation and its effect on product structure</li> <li>• knowledge of the principles of logistics</li> </ul>
<b>Machine safety competence</b>	<ul style="list-style-type: none"> <li>• knowledge of the demands in product planning resulting from mechanical directives and regulations</li> <li>• ability to plan safe and user-friendly devices and structures</li> </ul>
<b>Business competence</b>	<ul style="list-style-type: none"> <li>• knowledge of the requirements of profitable business operations</li> <li>• ability to carry out simple investment calculations</li> </ul>
<b>Mathematics and scientific competence</b>	<ul style="list-style-type: none"> <li>• ability to use mathematics and physics to solve problems</li> <li>• ability to work systematically and logically</li> <li>• knowledge of the effects of the laws of nature on the functioning of equipment and structures</li> </ul>
<b>Automation competence</b>	<ul style="list-style-type: none"> <li>• knowledge of the basic systems of machine automation, components and equipment</li> <li>• ability to plan and construct automated structures</li> </ul>
<b>Production competence</b>	<ul style="list-style-type: none"> <li>• knowledge of basic industrial production operations</li> <li>• ability to plan and control production</li> <li>• knowledge of the main production methods, equipment and systems for the manufacturing industry</li> </ul>

**THEMES FOR EACH YEAR OF STUDY:**

1<sup>st</sup> 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.

2<sup>nd</sup> 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.

3<sup>rd</sup> 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.

4<sup>th</sup> 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

<b>BASIC STUDIES</b>	<b>51 cr</b>
<b>GENERAL STUDIES</b>	<b>30 cr</b>
Mathematics	12 cr
Physics	12 cr
Industrial Chemistry	3 cr
Introduction to Data Processing	3 cr
<b>LANGUAGE AND COMMUNICATION STUDIES</b>	<b>9 cr</b>
Communication Skills in Finnish	3 cr
Text and Terminology	3 cr
Svenska för Maskin- och produktionsingenjörer	3 cr
<b>BUSINESS ADMINISTRATION</b>	<b>12 cr</b>
Introduction to Business Economics	3 cr
Corporate Law	3 cr
Leadership and Occupational Psychology	3 cr
Marketing and Customer Relationships	3 cr
<b>COMPULSORY PROFESSIONAL STUDIES</b>	<b>99 cr</b>
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
<b>OPTIONAL PROFESSIONAL STUDIES</b>	<b>30 cr</b>
Electronics Production	15 cr
Extractive Technology	15 cr
Machine Planning	15 cr
Maintenance	15 cr
Production Management	15 cr
Automation Technology	15 cr
<b>FREE-CHOICE STUDIES</b>	<b>15 cr</b>
<b>PRACTICAL TRAINING</b> (autumn of 4th yr)	<b>30 cr</b>
<b>THESIS</b>	<b>15 cr</b>

# COURSE DESCRIPTIONS FOR THE 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.

### (TKPY010) Algebra and Geometry

Credits: 6 cr                      Timing: 1st yr

Objective: To review and supplement the main principles of high school and vocational college mathematics

Contents: Sets of numbers and calculations  
Functions  
Trigonometry  
Vectors  
Determinants and matrixes  
Introduction to a mathematics programme

Learning Strategies: Lectures and exercises. Individual and group work

Assessment: To be announced

Bibliography: Majaniemi, A., Algebra I  
Majaniemi, A., Algebra II  
Majaniemi, A., Geometria  
Henttonen, J., Peltomäki, J., Uusitalo, S., Tekniikan matematiikka

### (TKPY011) Introduction to Differential and Integral Calculus

Credits: 3 cr                      Timing: 2nd yr

Objective: Students will gain an overview of the points of departure relating to differential and integral calculus and certain basic applications

Contents: Review of basic algebra calculations  
Derivate and function growth rate  
Examination of function graphs  
Extreme values  
The concept of integrals and surface area

Learning Strategies: Lectures and exercises. Individual and group work

Assessment: To be announced

Bibliography: Majaniemi, A., Matematiikka I  
Henttonen, J., Peltomäki, J., Uusitalo, S., Tekniikan matematiikka 2

### (TKPY012) Probability and Statistics



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:	Students will gain a proficiency in chemistry enabling them to understand chemical reactions and rules and chemical processes in industry.		
Contents:	Chemical elements and periodic table Quantity of material (mass) and concentration Chemical equations and energy Acids and alkalis and the PH values of their solutions Electrolysis as a method of producing and coating metals Corrosion and its prevention Dangerous materials and their safety regulations		
Learning Strategies:	Lectures and exercises		
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 UAS computers and their most common tools programmes and software for study purposes.		
Contents:	Computer hardware The UAS data system Use of networks Directory structure The basics of data processing Spreadsheet calculation and graphics		
Learning Strategies:	Small group work and exercises		
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

**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 simple parts and of the assembly of small constructions.

Contents: Standards and their significance  
 Lines and text  
 Projections and axonometry  
 Drafting  
 Cross sections  
 Dimensions and tolerances  
 Use of field specific symbols, schematic diagrams and special notations.

Learning Strategies: Lectures, exercises

Assessment: Exam, assignments and participation

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, Editia

Laakko, T., Tuotteen 3D-CAD -suunnittelu, WSOY  
Further reading list/material provided by lecturer

## **(TKAS005) Project/Laboratory Work, Design Technology**

Credits:	3 cr	Timing:	3rd yr
Objective:	Students will gain practical experience of planning and design and problems encountered during the design process while at the same time learning to apply previously acquired theoretical knowledge.		
Contents:	Practical research and/or design tasks linked to design and product development studies.		
Learning Strategies:	This course is accomplished by participating in the Product Development course (KBW025), delivered in English and where either 3 or 6 credits can be achieved.		
Assessment:	Participation in collaborative project and completing all agreed tasks therein		
Bibliography:	Students will search for their project/lab material using different sources of information.		

## **(TKAC0Z) PRODUCTION TECHNOLOGY 27 cr**

### **(TKAC012) Manufacturing Technology**

Credits:	4 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 - 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: Outinen: Statiikka I and II  
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

## **(TKAJ004) Labview**

Credits:	2 cr	Timing:	3rd yr
Objective:	Students will be proficient in LabVIEW programming language basics.		
Contents:	User interface, diagram window and tool palet Structures and loops Data types Table handling Character strings and clusters Variables Data processing		
Learning Strategies:	Lectures and exercises		
Assessment:	Submitted assignment		
Bibliography:	Handout		

## **(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, julakisu 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

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**

### **(TKVN006) NC Piece Work Planning**

Credits: 3 cr                      Timing: 3rd yr

Objective: Students will be able to work as supervisors or forepersons in a machine workshop, gaining the ability to plan NC piece tooling.

Prerequisite: Introduction to NC Technology

Contents: Designing NC pieces  
Securing NC pieces  
NC piece phasing  
New NC machines  
Group technology

Learning Strategies: Lectures, exercises

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  
CIM in practice  
Programming and using robots

Learning Strategies: Lectures, study visits and team work

Assessment: Exam (evaluation 1-5)(50 %) and assignment participation (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 and water 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: Intordution 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:	Laatutieto 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 to 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 toiminanohjaus  
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. Manufacturing and installation-oriented design		
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 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 compulsory 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:	Supervised exercises
Assessment:	Active participation 100 %, exam
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. Common professional studies provide wide-ranging basic knowledge of different areas of construction engineering. Optional studies provide specialist knowledge of production technology, facility management or timber construction.

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

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

## THEMES FOR EACH YEAR OF STUDY

1<sup>st</sup> 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.

2<sup>nd</sup> 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.

4<sup>th</sup> 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
Timber Construction	12 cr
Optional Project Work	6 cr

### FREE-CHOICE STUDIES 15 cr

### PRACTICAL TRAINING 30 cr

### THESIS 15 cr

# COURSE DESCRIPTIONS FOR THE DEGREE PROGRAMME IN CONSTRUCTION ENGINEERING

## BASIC STUDIES

### (TRPV0Z) LANGUAGE AND COMMUNICATION SKILLS 12 cr

#### (TRPV001) Communication Skills in Finnish

Credits:	3 cr	Timing:	1st yr
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: 2nd yr

Objective: Students will develop their oral and writing skills in Finland's second official language specifically to aid their own professional development.

Contents: Construction engineering terminology, vocabulary and communication situations

Learning Strategies: Supervised exercises

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

Bibliography: Handout

## **(TRPV006) Introduction to Data Processing**

Credits: 3 cr                      Timing: 1st yr

Objective: Students will be conversant with the basics of data processing and data security, and know how to use the university's computers and peripheral equipment, and the most common tools programmes in their studies.

Contents: Introduction to data processing  
Microcomputer equipment and peripheral devices  
Windows XP  
Internet and email  
Word processing with MS Word  
Spreadsheet calculation with MS Excel  
Presentation graphics with MS PowerPoint

Learning Strategies: Contact and online teaching

Assessment: Exam and assignments

Bibliography: Reading list/material provided by lecturer

## **(TRPB2Z) BUSINESS STUDIES 11 cr**

The contents of this module are the same for all the schools at Kajaani UAS.

**(TRPB001) Introduction to Business Economics**

Credits: 3 cr Timing: 1st yr

Objective: Students will be conversant with basic business functions and have a general overview of business planning.

Contents: Basic concepts of business  
 Internal and external entrepreneurship  
 Business processes and operational environment  
 Business financing  
 Monitoring business profitability  
 Profit margin and investment calculation  
 Business planning

Learning Strategies: Lectures and exercises

Assessment: Exam and written business plan

Bibliography: Handout

**(TRPB002) Leadership and Interpersonal Skills**

Credits: 5 cr Timing: 4th yr

Objective: Students will understand the importance of leadership in terms of achieving targets within an organisation. This course also covers typical forms of team/group work within the students' own school and solving customer service problems.

Contents: Work psychology  
 Human resource management  
 Professional ethics  
 Occupational health and safety  
 Challenging customer service situations from a psychological point of view  
 Group and team work within construction engineering and facilities management  
 An introduction to meeting and negotiating skills

Learning Strategies: Lectures, exercises, group work

Assessment: Participation in group work and study visits, exercises and exam

Bibliography: Kauppinen A., Nummi J., Savola T., Hänninen M., Tekniikan viestintä Handouts

**(TRPB004) Marketing Project Work**

Credits: 3 cr Timing: 2nd yr

Objective: Students will understand customer needs as being the driving force of business and will be able to commodify such needs to create business.

Contents: Selecting a target group  
 Segmentation  
 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.

### **(TRPM004) Algebra and Geometry**

Credits: 6 cr                      Timing: 1st yr

Objective: This course partially reviews and supplements the basics of high school and vocational college mathematics, encouraging a disciplined and determined approach to learning and the development of interaction skills

Contents: Number series and calculations  
Functions  
Trigonometry  
Vectors  
Determinants and matrixes  
Introduction to a mathematics programme

Learning Strategies: Lectures and exercises. Individual and group work

Assessment: To be announced

Bibliography: Majaniemi, A., Algebra I  
Majaniemi, A., Algebra II  
Majaniemi, A., Geometria  
Henttonen, J., Peltomäki, J., Uusitalo, S., Tekniikan matematiikka 1

### **(TRPM005) Differential and Integral Calculus**

Credits: 6 cr                      Timing: 1st yr

Objective: In addition to calculation skills students will understand the points of departure of differential and integral calculus and be able to apply them in engineering

Contents: Review of basic algebra calculation skills  
Derivate and function growth rate  
Examination of a function graph  
Extreme values  
Undetermined and definite integral  
Surface area, volume and work  
Applications in engineering

Learning Strategies: Lectures and exercises. Individual and group work. Use of mathematics programme

Assessment: To be announced

Bibliography: Majaniemi, A., Matematiikka I  
Henttonen, J., Peltomäki, J., Uusitalo, S., Tekniikan matematiikka 2

## **(TRPM006) Probability and Statistics**

Credits: 3 cr                      Timing: 2nd yr

Objective: The aim is to introduce students to statistical thinking

Contents: Probability calculation  
Basic statistical concepts

Learning Strategies: Lectures and exercises. Individual and group work

Assessment: To be announced

Bibliography: Majaniemi, A., Matematiikka IV  
Henttonen, J., Peltomäki, J., Uusitalo, S., Tekniikan matematiikka 2

## **(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 yr

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 Insinöörifysiikka , Otava

### **(TRPF002) Physics 2**

Credits: 5 cr                      Timing: 1st yr

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

**(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

## **(TRA05Z) BUSINESS ECONOMICS AND LAW 6 cr**

### **(TRA0003) 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

### **(TRA0004) 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 yr
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 acoustic planning.		
Prerequisite:	Building Materials		
Contents:	Building frame parts sorted according to building parts Different frameworks and their functions Loads on the building frame Fire safety and sound insulation of buildings The construction principles of wood, concrete and steel framed buildings Population shelters (emergency shelters)		
Learning Strategies:	lectures, exercises 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. The course assignment is to create drawings of a detached family house for building permission purposes.		
Learning Strategies:	Lectures and exercises		
Assessment:	Sufficient participation and approved assignment		
Bibliography:	Lecture handout Illikainen, K., AutoCAD 2006		

**(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: Handouts Kankainen, 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: Knowledge of the Building and Construction Trade

Contents: The principles of project financial management  
 Cost planning, quantity calculation and monitoring costs  
 Property life cycle client and production quality

Learning Strategies: Lectures, assignments

Assessment: Exam and exercises

Bibliography: Nissinen Sampsa., Koskenvesa Anssi. Pientalon kustannukset. Rakennustieto Oy.  
 ISBN 951-682-763-2.  
 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 on the construction site.

Contents: Quantity survey for a real building project.

Learning Strategies: Supervised project

Assessment: Approved project work

Bibliography: Building project planned by students. Other literature to be announced.

## **(TRAT3Z) PRODUCTION TECHNOLOGY 12 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

## **(TRAT009) Occupational Safety in Construction and Facility Management**

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will understand the significance of occupational safety in facility management and building production. The course provides proficiency in building site safety inspections, safety notices and official regulations. Students will be aware of the responsibilities and importance of the site manager in building site safety promotion.		
Prerequisite:	none		
Contents:	Occupational safety in facilities management and during different construction phases. Building site inspections and notices. Official regulations and work requiring official authorisation. The duties and responsibilities of the employer in terms of work safety. How to act in an emergency First Aid I course		
Learning Strategies:	Lectures, group work and exercises		
Assessment:	Exam and approved accomplishment of First Aid I		
Bibliography:	Aitomaa, K. Luoto, T. Marjamäki, M. Niskanen, T. Patrikainen, H. Päiväranta, K. Rakennustöiden turvallisuusmääräykset selityksineen. 2007. ISBN 978-952-468-117-9		

## **(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		

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, dimensioning 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  
Eurocode 5: Puurakenteiden mitoitus  
RIL205-2007: Puurakenteiden suunnitteluohje

## **(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, dimension and plan reinforced concrete structures.

Prerequisite:	Statics The strength of Materials
Contents:	An introduction to planning and dimensioning reinforced concrete and masonry structures The dimensioning of reinforced concrete beam and column structures The design and dimensions of reinforced concrete tile and wall structures
Learning Strategies:	Lectures, calculation exercises and assignment
Assessment:	Exam and exercises
Bibliography:	Handouts Eurocode 2: Teräsbetonirakenteiden suunnittelu BY60-2007: Suunnitteluohje EC2 Leskelä: BY 201 Betonirakenteiden suunnittelu ja mitoitus 2008

## **(TRAE006) Concrete Structures, Laboratory Work**

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 lab 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, Betonitekniikan oppikirja 2004		

## **(TRAE005) Foundations**

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

## **(TRAM9Z) RENOVATION TECHNOLOGY 24 cr**

### **(TRAM009) Mould and Damp Damages**

Credits: 3 cr                      Timing: 1st yr

Objective: This course provides students with an overview of microbiological damage in buildings, how it is caused and methods of repair.

Contents: Properties of microbes, microbe species and where they can be found.  
Problems with dampness, mould and decay in buildings.  
Principles of repairing damage caused by microbes  
Prevention of microbe damage in the construction planning and building stages

Learning Strategies: Lectures, av teaching and group assignments

Assessment: Exam, approved assignments

Bibliography: Study handout

### **(TRAM002) Renovation Technology, Basics**

Credits: 3 cr                      Timing: 2nd yr

Objective: The course provides basic information on facility condition and maintenance in terms of the structure, building part or features of the building for the purposes of future renovation.

Contents: Concepts and general significance to the national economy  
Recent style and material history  
Healthy building and problem materials  
Typical material damage and damage mechanisms  
Typical structural damage and damage mechanisms  
Possibilities of renovation

Learning Strategies: Lectures, av teaching and group work

Assessment: Exam and approved assignments

Bibliography: Kerrostalot 1880-2000  
Kerrostalot 1880-1940  
Kerrostalot 1940-1960  
Kerrostalot 1960-1975  
Asbesti asuinkerrostaloissa  
Lecture handouts  
RT-kortisto

### **(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 able to produce alternative renovation plans including a selection of materials for elevation renovations. 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.		
Prerequisite:	Introduction to Renovation Building Condition Assessments and Surveys		
Contents:	Renovation methods and renovation planning for concrete elevations Life cycle calculations Renovation work energy use calculations Renovation work specifications		
Learning Strategies:	Lectures and exercises		
Assessment:	Exam and assignments		
Bibliography:	Vakavastivaurioituneen betonijulkisivun korjauksen talous		

Lecture handouts  
Rt kortisto

## **(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:	Introduction to Renovation Building and Renovation Planning Mould and Moisture Damage Condition Surveys and Inspections		
Contents:	A technical renovation building plan for a real property including an estimate of costs and profit on investment based on life-cycle calculations.		
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
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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		

## **(TRVT1Z) PRODUCTION TECHNOLOGY 12 cr**

Students will gain in depth knowledge of production technology and control methods.

### **(TRVT001) Production Planning and Control**

Credits:	3 cr	Timing:	3rd - 4th yr
Objective:	Students will gain an overview of building scheme implementation production planning and supervision methods.		
Contents:	Work timing and supervision Schedules (types and levels) Combining schedules, work and contract work periods Work phasing and cycles Schedule monitoring and control Production information sources		
Learning Strategies:	lectures and exercises		
Assessment:	exam		

Contents:

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

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		

**(TYW063) Safety at Work and Fire Safety Passport Course**

Credits:	1 cr	Timing:	2nd - 4th yr
Objective:	Students will understand the significance of occupational and fire safety and fire/accident prevention in the form of preparation in construction and facilities management.		
Prerequisite:	No previous knowledge required. It is recommended that students have completed the Safety in Construction and Facility Management		
Contents:	Construction industry occupational safety card/certificate training Working with fire/fire safety card/certificate training		
Learning Strategies:	Intensive course		
Assessment:	Lectures and exercises. Exam.		
Bibliography:	Handouts		

**(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 and control devices. During their studies students will carry out a product project in small groups using the versatile laboratory environments available on campus, ensuring a practical, hands-on approach.

## The competences covered in the Information Technology Degree Programme

Information Technology Degree Programme	Description of range of competence
<b>Competence in mathematics and natural sciences</b>	<ul style="list-style-type: none"> <li>• able to use a mathematical and logical approach and way of thinking in technical problem solving</li> <li>• ability to use mathematical principles, methods and tools</li> <li>• awareness of important physical properties of applications and the principles of sustainable development</li> </ul>
<b>Hardware competence</b>	<ul style="list-style-type: none"> <li>• Is conversant with the functioning and development environments of different vehicle information systems</li> <li>• Is proficient in electrical engineering measurements</li> <li>• Understands the electronics design and production process</li> <li>• Knows the most important electronic components, how they work and basic connections</li> <li>• Has basic IT skills</li> </ul>
<b>Software competence</b>	<ul style="list-style-type: none"> <li>• proficiency in programming technology; comprehension of programming logic, knowledge of the most common algorithms, information structures and tools</li> <li>• ability to interpret programming language and to use programming to solve problems</li> <li>• knows object-oriented design and programming basics</li> <li>• ability to participate in software projects in a client and company oriented manner</li> <li>• competence in device-oriented programming basics</li> <li>• knows the basics of data communication application planning and programming</li> </ul>

<b>Information technology design competence</b>	<ul style="list-style-type: none"> <li>• possesses knowledge of the theoretical foundations of vehicle information systems</li> <li>• 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</li> <li>• ability to participate in disciplined product development work independently and as a member of a team</li> </ul>
<b>Electrical measuring competence</b>	<ul style="list-style-type: none"> <li>• comprehension of the general structure of a measurement system</li> <li>• knowledge of measuring systems of basic electrical magnitudes</li> <li>• comprehension of the statistical nature of measurements and questions relating to their reliability</li> <li>• knowledge of disturbances in measuring</li> </ul>
<b>Measuring systems competence</b>	<ul style="list-style-type: none"> <li>• knowledge of the sensors used to measure the most common quantities</li> <li>• knowledge of optical measuring methods and the required components</li> <li>• ability to create measurement systems using graphical programming environments</li> </ul>
<b>Signal processing competence</b>	<ul style="list-style-type: none"> <li>• Will know the basic principles related to signals</li> <li>• Will know the basic editing methods for analogue signals</li> <li>• Will know how to convert different signals</li> <li>• Will know how to use signal processing to produce digital filters</li> <li>• Will be able to use signal processing for digital image manipulation</li> </ul>
<b>Applied electronics competence</b>	<ul style="list-style-type: none"> <li>• Will be able to design, test and document electronic applications based on microcontrollers, for demanding conditions</li> <li>• Will be conversant with electronics testing methods</li> <li>• will be conversant with basic information transfer methods</li> </ul>
<b>Product development competence</b>	<ul style="list-style-type: none"> <li>• proficient in independent disciplined product development work and as a member of a team</li> <li>• will understand client-oriented product development</li> <li>• will be conversant with the different stages of product development and will understand the</li> </ul>

	<p>significance of project planning and documentation</p> <ul style="list-style-type: none"> <li>• will be conversant with product and product development quality control methods</li> </ul>
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## **THEMES FOR EACH YEAR OF STUDY**

### **1<sup>st</sup> 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.

### **2<sup>nd</sup> 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.

### **4<sup>th</sup> 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** **63 cr**

### **COMMUNICATION SKILLS** **14 cr**

Finnish Language and Communication 1	3 cr
Finnish Language and Communication 2	2 cr
Text and Terminology 1	1.5 cr
Text and Terminology 2	1,5 cr
Svenska för Fordonsingenjörer	3 cr
Introduction to Data Processing	3 cr

### **PRODUCT DEVELOPMENT** **13 cr**

Introduction to Vehicle Data Systems	1 cr
Introduction to Product Development Project Planning	3 cr
Introduction to Project Economics	3 cr
Introduction to Product Development Legislation	3 cr
Project Leadership	3 cr

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

Mathematics	18 cr
Physics	15 cr
Chemistry	3 cr

### **COMPULSORY PROFESSIONAL STUDIES** **76 cr**

English Language and Communication Skills	5 cr
Programming	12 cr
Electronics	16 cr
Computer Technology	12 cr
Telecommunications Technology	14 cr
Professional Subjects, Laboratory Work	17 cr

### **VEHICLE DATA SYSTEMS** **41 cr**

Common studies	25 cr
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### **OPTIONAL PROFESSIONAL STUDIES**

Measurement Electronics Design	16 cr
Software Engineering	16 cr

### **FREE-CHOICE STUDIES** **15 cr**

### **PRACTICAL TRAINING** **30 cr**

### **THESIS** **15 cr**

# COURSE DESCRIPTIONS FOR THE DEGREE PROGRAMME IN INFORMATION TECHNOLOGY

## BASIC STUDIES

### (TTPV1Z) LANGUAGE AND COMMUNICATION SKILLS 14 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) Introduction to team work, negotiation situations and meetings		
Learning Strategies:	Independent work, group work, supplementary lectures		
Assessment:	Participation in group work, assignments, exam and portfolio		
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

## **(TTPV013) Svenska för fordonsingenjörer**

Credits: 3 cr                      Timing: 3rd yr

Objective: Students will develop their oral and writing skills in Finland's second official language for use in their chosen professional field.

Contents: Vehicle technology central vocabulary and language use situations

Learning Strategies: Supervised exercises

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

Bibliography: Study handout

## **(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: Introduction to data processing

Computer hardware and peripheral devices  
 Windows XP  
 Internet and email  
 Word processing with MS Word  
 Spreadsheet accounting with MS Excel  
 presentation graphics with PowerPoint

Learning Strategies: Contact and online teaching

Assessment: Exam and assignments

Bibliography: Reading list/material provided by lecturer

## **(TTPK0Z) PRODUCT DEVELOPMENT 13 cr**

### **(TTPK001) Introduction to Vehicle Information Systems**

Credits: 1 cr                      Timing: 1st yr

Objective: Students will gain an overview of how vehicles work and of vehicle information systems on a practical level.

Contents: Overview of vehicle engineering  
 Route technology device solutions  
 Introduction to companies in the area  
 Practical exercises - how does a vehicle work?

Learning Strategies: Contact teaching and independent work

Assessment: Participation in group work and assignments

Bibliography: Lecture handouts  
 Online material

### **(TTPK002) The Basics of Project Finance**

Credits: 3 cr                      Timing: 1st yr

Objective: Students will understand the concept of project finance and the importance of cost control in project work. Students will be proficient in product development procedure and be able to apply this knowledge in their own product development project.

Prerequisite: Introduction to Product Development Project

Contents: Project cost control  
 Effective time management  
 Sourcing management  
 Product development procedure  
 Customer oriented product development  
 Determining customer needs and standards  
 Commodification of the project

Learning Strategies: Lectures and exercises

Assessment: Exam and compilation of standards and project plan update

Bibliography: Pelin, R., Projektihallinnan käsikirja  
A Guide to the Project Management Body of Knowledge  
Lecture handouts

### **(TTPK003) The Basics of Product Development Project**

Credits: 3 cr                      Timing: 1st yr

Objective: Students will be proficient in the concepts of project work, and its operational model as well as being able to compile a project plan. Students will be conversant with the embedded system product development process.

Prerequisite: Introduction to Vehicle Information Systems

Contents: From idea to project  
Organisation and start-up  
Project planning  
Project time and resource management  
Ending a project  
Embedded system product development process

Learning Strategies: Lectures, assignments

Assessment: Exam, exercises and compilation of project plan

Bibliography: Pelin, R., Projektihallinnan käsikirja  
A Guide to the Project Management Body of Knowledge  
Lecture handouts

### **(TTPK004) Product Development Legislation**

Credits: 3 cr                      Timing: 3rd yr

Objective: Students will be aware of the general tenets and effects of contract and intellectual property rights and legislation in product development.

Contents: Legislation  
Contracts and their use  
Employment contract, working time and annual holidays  
Commercial technology and cooperation agreements/contracts  
Intellectual property rights (IPR) in business

Learning Strategies: Lectures and assignments

Assessment: Exam and portfolio

Bibliography: To be announced

### **(TTPK005) Project Leadership**

Credits: 3 cr                      Timing: 4th yr

Objective: Students will deepen their knowledge of project-based work, being proficient in project leadership with the ability to develop project-based activities.

Prerequisite: Introduction to project Finance

Contents:	A project as a form of leadership Interaction and working as a team in a project Project quality control Project risk management Developing company project management Professional ethics
Learning Strategies:	Lectures, exercises
Assessment:	Report and seminar presentation
Bibliography:	Pelin, R., Projektihallinnan käsikirja A Guide to the Project Management Body of Knowledge Lecture handouts

## **STUDIES IN MATHEMATICS AND SCIENCE 36 cr**

This module provides the mathematical skills required in engineering subjects.

### **(TTPM2Z) MATHEMATICS 18 cr**

#### **(TTPM004) Algebra and Geometry**

Credits:	6 cr	Timing:	1st yr
Objective:	To partly review and add to high school and vocational college mathematics, with the adoption of disciplined and determined working methods and to develop interaction skills.		
Contents:	Character strings and calculations Functions Trigonometry Vectors Determinants and matrixes Complex numbers Introduction to a mathematics programme		
Learning Strategies:	Lectures and exercises. Individual and group work		
Assessment:	To be announced		
Bibliography:	Majaniemi, A., Algebra I Majaniemi, A., Algebra II Majaniemi, A., Geometria Henttonen, J., Peltomäki, J., Uusitalo, S., Tekniikan matematiikka 1		

#### **(TTPM005) Differential and Integral Calculus**

Credits:	6 cr	Timing:	2nd yr
Objective:	In addition to possessing calculation skills students will understand the points of departure of differential and integral calculus, being able to apply them in engineering.		
Contents:	Review of basic algebra calculations Derivative and function growth rate Examination of function graphs		

Extreme values  
Indefinite and definite integral  
Surface area, volume and work  
Applications in engineering

Learning Strategies: Lectures and exercises. Individual and group work. Use of mathematics programme

Assessment: To be announced

Bibliography: Majaniemi, A., Matematiikka I  
Henttonen, J., Peltomäki, J., Uusitalo, S., Tekniikan matematiikka 2

## **(TTPM006) Mathematics for Information Technology**

Credits: 6 cr                      Timing: 2nd yr

Objective: Students will supplement and deepen their mathematical analysis skills acquired during previous courses for the special purposes of modern information transfer and processing purposes.

Contents: Selected parts from the following topics:  
Differential equations  
Laplace transformation  
Power series  
Fourier's series and transformation  
Numeric methods  
Probability and statistics

Learning Strategies: Lectures and exercises. Individual and group work. Use of mathematics programme

Assessment: To be announced

Bibliography: Majaniemi, A., Matematiikka II  
Majaniemi, A., Matematiikka IV  
Majaniemi, A., Sarjaoppia.  
Majaniemi, A., Fourier, Laplace ja Runge-Kutta-menetelmistä  
Henttonen, J., Peltomäki, J., Uusitalo, S., Tekniikan matematiikka 2

## **(TTPF3Z) PHYSICS 15 cr**

### **(TTPF004) Physics 1**

Credits: 7 cr                      Timing: 1st yr

Objective: Students will gain the necessary physics skills and knowledge required in engineering.

Contents: Physics magnitude and unit system  
Motion and the theory of dynamics  
Work, power and energy  
Momentum  
Circular and rotating motion  
Fluids and gases  
Thermology

Learning Strategies: Lectures and exercises

Assessment: Interim tests

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

## **(TTPF005) Physics 2**

Credits: 5 cr                      Timing: 2nd yr

Objective: Students will gain the skills and knowledge in Physics required in the other engineering courses.

Contents: Electrostatics  
Magnetic field  
Electromagnetic induction  
Vibrations, mechanical wave motion  
Electrical vibrations  
Optics, photometry  
Quantum physics

Learning Strategies: Lectures and exercises

Assessment: Interim tests

Bibliography: 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: 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  
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

## 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

**(TTAO00Z) PROGRAMMING 12 cr****(TTAO001) Introduction to Programming**

Credits: 4 cr Timing: 1st yr

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 computer engineering 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  
 Introduction to embedded systems  
 Programming environment Visual studio.Net

Learning Strategies: Lectures, supervised exercises, online studies and use of teaching card

Assessment: Theory exam, computer test, assignment, class work and online exercises for submission

Bibliography: Material provided by lecturer and other literature to be announced

**(TTAO002) C++ Programming**

Credits: 4 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 of 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-ptogrammes  
 Table handling, pointers and character strings  
 Records and file handling  
 Object-oriented thinking and introduction to UML modelling

Learning Strategies: lectures and supervised exercises and online studies

Assessment: Theory exam and assignment

Bibliography: To be announced

### **(TTAO003) Object Oriented Software Design**

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

Objective: Students will be proficient in the basic theory concerning object-oriented software design and UML modelling, having an opportunity to test their acquired knowledge in vehicle data system development work.

Contents: Software development according to the following process:  
analysis and defining of standards  
from design models to implementation  
UML charts

Learning Strategies: Lectures and supervised exercises

Assessment: Exam, exercises and assignment

Bibliography: Literature and software instructions of use to be announced

### **(TTAE0Z) ELECTRONICS 16 cr**

#### **(TTAE003) Circuit Analysis**

Credits: 6 cr                      Timing: 1st yr

Objective: Students will know the basic magnitudes of electrical circuits and be able to apply basic laws to examine the properties of direct and alternating current circuits. Students will be proficient in understanding the interactions between electrical magnitudes and will learn to recognise how they behave in electrical circuits and in vehicle electronics connections.

Contents: Direct current, Ohm's law, Kirchhoff's laws, Power  
Current circuit solution methods, basic law method, loop method, node method, bridge connections  
Introduction to circuit simulation programmes  
Induction phenomenon, counter-inductive effect  
Alternating quantities, indicator diagram, impedance  
Understanding alternating current circuits  
Mutual induction in alternating current circuits  
Resonance circuits  
Passive filters

Learning Strategies: Lectures and small group teaching/exercises

Assessment: To be announced

Bibliography: Tarkka, P., Määtänen, K., Hietalahti, L., Piirianalyysi 1 ja 2  
Aura, L., Tonteri, A., Sähkömiehen käsikirja

#### **(TTAE004) Analogue Electronics 1**

Credits: 6 cr                      Timing: 1st yr

Objective: Students will be conversant with the basic electronic components and connections

involved in analogue electronics, being able to apply the basic laws of electronics to 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 and basic connections  
Basic connections of operation amplifiers  
An introduction to computer aided simulation methods (Micro-Cap)  
The basic structure of CMOS logic circuits

**Learning Strategies:** Lectures, exercises and demonstrations

**Assessment:** Interim exams

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

## **(TTAE005) Analogue Electronics 2**

**Credits:** 4 cr **Timing:** 2nd yr

**Objective:** Students will know the functioning principles of basic electronics connections and will be able to plan electronics appropriate for use in vehicles.

**Prerequisite:** Analogue Electronics 1

**Contents:** The functioning principles and most common components of basic connections, function-related solutions and features  
Power source engineering  
Thermal planning  
The basics of electronics design  
The basics of computer aided design

**Learning Strategies:** Lectures and exercises

**Assessment:** Interim tests and assignments

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

## **(TTAD4Z) COMPUTER TECHNOLOGY 12 cr**

Students will be competent in planning devices based on microprocessor technology.

## **(TTAD003) Digital Engineering**

**Credits:** 6 cr **Timing:** 1st yr

**Objective:** Students will learn to understand the basics of digital engineering and components

and will be proficient in designing and analysing digital connections.

Contents: Basics of Digital Engineering:  
number systems and Boolean algebra  
designing and analysing connections used in combinational and sequential logic circuits

Learning Strategies: Lectures and exercises

Assessment: Interim tests

Bibliography: Rantala Pekka, Digitaalitekniikka  
Piirikohtaiset manuaalit

## **(TTAD004) Microprocessor Engineering**

Credits: 6 cr Timing: 2nd yr

Objective: Students will learn to understand the structural parts and functioning principles of a microprocessor system while being able to design a processor based device for use in vehicles.

Prerequisite: Digital Engineering

Contents: Introduction to microprocessors and the functioning of the central peripheral circuits.  
Designing microprocessor based devices.  
The programming of the microprocessors will be done using either assembly or C language.

Learning Strategies: Lectures and exercises

Assessment: Interim tests

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

## **(TTAL0Z) TELECOMMUNICATIONS 14 cr**

### **(TTAL003) Basics of Telecommunications Engineering**

Credits: 6 cr Timing: 2nd yr

Objective: Students will gain a general overview of different telecommunications systems, how they work and their technical limitations

Contents: Concepts, organisations and standards  
Signal, noise; basics of information theory and encryption.  
Structures of data communications systems  
Basics of sound and image transfer technology  
Basics of wireless systems  
Basics of information networks and routes

Learning Strategies: Lectures and written assignments

Assessment: Exam

Bibliography: Lecture handout

## **(TTAL004) Basics of EMC**

Credits: 3 cr                      Timing: 4th yr

Objective: Students will understand the basics of EMC and be able to protect vehicle devices against large fields of interference and transients.

Prerequisite: Telecommunications Engineering Telecommunications Laboratory Work

Contents: Basics of transport leads and EM wave motion and progression. Basic structures of antennas.  
E and M fields  
Conducted and radiated interference and how to measure such interference  
How interference becomes connected  
Protection against connections

Learning Strategies: Lectures and laboratory work

Assessment: Exam. Approved laboratory assignments

Bibliography: Lecture handouts

## **(TTAL005) Basics of Signal Processing**

Credits: 5 cr                      Timing: 3rd yr

Objective: Students will be conversant with signals and basic methods of signal processing while learning to use them in practice.

Contents: Describing signals  
Complex numbers  
Processing continuous time signals  
Linear systems  
Processing discrete time signals  
Signal processing applications

Learning Strategies: Lectures and exercises Introduction to signal processing software

Assessment: Interim tests

Bibliography: Study handout

## **(TTAC0Z) PROFESSIONAL SUBJECTS, LABORATORY WORK 17 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 Digital Engineering Theory

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)

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

### **(TTAC007) Analogue Electronics Laboratory Work**

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

Objective: Students will be able to carry out measurements on basic analogue electronic components and vehicle sensors, as well as building up connections and measuring their basic features using standard measurement equipment. Students will be proficient in planning, building, measuring and reporting on connection configurations consisting of several functions.

Prerequisite: Introduction to Laboratory Work Analogue Electronics 1

Contents: Planning, creating, measuring and written report of configurations

Learning Strategies: Small group teaching

Assessment: Lab work, report reports and exam (assessment 1 - 5)

Bibliography: Analogue electronics lecture handouts and literature

### **(TTAC008) Microprocessor Engineering Laboratory Work**

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

Objective: Students will learn to plan a processor based board and to use programming tools.

Prerequisite: Digital Technology, Introduction to Laboratory Work

Contents: Introduction to device oriented programming tools and vehicle sensors.  
 The assignments include planning, constructing, programming and testing a processor based board.

Learning Strategies: Small group teaching

Assessment: Lab work, written reports and exam

Bibliography: Piiri- ja anturikohtaiset manuaalit  
 Rantala Pekka, Mikrotietokonetekniikka  
 Intel, MCS-51:n manuaalit  
 (circuit and sensor manuals)

### **(TTAC009) Communications Laboratory Work**

Credits:	2 cr	Timing:	2nd yr
Objective:	To deepen students' understanding of communications equipment and systems and short range communications devices.		
Prerequisite:	Communications Technology (during course)		
Contents:	Laboratory work Different areas of communications engineering.		
Learning Strategies:	Small group teaching through laboratory work		
Assessment:	Approved lab reports		

### **(TTAC010) Basics of Circuit Board Design**

Credits:	2 cr	Timing:	2nd yr
Objective:	Students will learn to design a circuit board		
Contents:	Creation of circuit configurations using design programme and creation of boards using this schema. Introduction to component library manipulation, creating new components, elimination of disturbances, and the dimensioning of different types of pieces.		
Learning Strategies:	Lectures and exercises		
Assessment:	Course test and final assignment		

## **OPTIONAL PROFESSIONAL STUDIES**

Students will select one of the following modules. For further information on these modules please consult your study supervisor and lecturers.

### **(TTVA3Z) VEHICLE DATA SYSTEMS/SHARED COURSES 25 cr**

#### **(TTVA001) Basics of Measurement Technology**

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will be proficient in basic electronic measurements and the associated fault and interference factors.		
Contents:	Measuring scales, measurement errors SI system, measurement standards, calibration General digital measurement device, oscilloscopes Interferences associated with measuring The most common sensors Automation of measuring		
Learning Strategies:	Lectures and exercises		
Assessment:	Interim tests		
Bibliography:	Aumala, O., Mittaustekniikan perusteet Lecture handout		

**(TTVA002) Information Networks and Buses**

Credits:	2 cr	Timing:	4th yr
Objective:	Students will understand the topology, functioning principles and their limitations of different information carriers.		
Prerequisite:	Telecommunications		
Contents:	The most significant information networks and their frameworks. Ethernet. TCP/IP and its applications. The main vehicle information carriers. CAN		
Learning Strategies:	Lectures and exercises Small group teaching		
Assessment:	Exam, approved assignments		
Bibliography:	Lecture handouts		

**(TTVA003) Introduction to Testing**

Credits:	2 cr	Timing:	2nd yr
Objective:	Students will adopt the basic principles of testing embedded systems.		
Contents:	The aim of testing. Testing products at different stages of their life-cycle		
Learning Strategies:	Lectures and exercises		
Assessment:	Exam and assignment		
Bibliography:	To be announced		

**(TTVA004) Embedded Systems Programming and Tools**

Credits:	2 cr	Timing:	2nd - 3rd yr
Objective:	Students will be proficient in the basic programming of embedded devices and the special features of such programming, while being able to use simulator, debugger and UML software.		
Contents:	Programming tools, debuggers and simulators. Code documentation and version management		
Learning Strategies:	Lectures and supervised exercises		
Assessment:	Exam, exercises and assignment		
Bibliography:	To be announced		

**(TTVA005) Systems-on-Chip (SoC) Programming (VHDL)**

Credits:	4 cr	Timing:	3rd - 4th yr
Objective:	Students will adopt the principles of planning and creating a FPGA device		

Contents: Planning methods and tools  
ModelSim software for model creation using VHDL language and simulating and testing functions

Learning Strategies: Lectures and supervised exercises

Assessment: Exam, exercises and assignment

Bibliography: To be announced

## **(TTVA006) Product Development Laboratory Work/1**

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

Objective: Students will be able to build an embedded device on a prepared developer platform.

Prerequisite: Introduction to vehicle Information Systems Introduction to Product Development Project Planning

Contents: Introduction to device-oriented programming tools:  
1. LabVIEW programming environment  
2. Embedded system developer platforms.

Learning Strategies: Small group teaching

Assessment: Lab work, assignments and written reports

Bibliography: Circuit and sensor manuals  
Lecture handouts

## **(TTVA007) Product Development Laboratory Work/2**

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

Objective: Students will be able to transfer solutions developed using the developer platform to their own products and further develop the equipment. Students will plan and create prototypes of their own products

Prerequisite: Product Development Laboratories (Own product project)

Contents: Creation of prototype of own product  
Development of device software, electronics and mechanical parts if required

Learning Strategies: Small group teaching

Assessment: Laboratory work, exercises and written reports

Bibliography: Circuit and sensor manuals  
Lecture handouts

## **(TTVA008) Product Development Laboratory Work/3**

Credits: 4 cr                      Timing: 4th yr

Objective: Students will put the finishing touches to production versions of their products created from the prototypes.

Prerequisite:	Product Development Laboratory Work/ Lab Work 2 (Own product project)
Contents:	Embedded system product development, documentation and testing
Learning Strategies:	Small group teaching
Assessment:	Lab work, written reports. Seminar presentation
Bibliography:	Circuit and sensor manuals. Standards

## **(TTVO00Z) VEHICLE DATA SYSTEMS/SOFTWARE ENGINEERING 16 cr**

### **(TTVO001) Windows Programming**

Credits:	3 cr	Timing:	3rd - 4th yr
Objective:	Students will be proficient in the basics of Windows programming and hardware handling.		
Prerequisite:	Real-Time Operating Systems		
Contents:	Windows programming with Visual Studio Using information networks Hardware handling in Windows		
Learning Strategies:	Lectures and supervised exercises		
Assessment:	Exam, exercises and assignment		
Bibliography:	To be announced		

### **(TTVO002) Realtime Operating Systems**

Credits:	4 cr	Timing:	3rd - 4th yr
Objective:	Students will be able to design, test and make real-time systems according to real-time standards using operating systems.		
Contents:	Real-time operating systems		
Learning Strategies:	Lectures and supervised exercises		
Assessment:	Exam, exercises and assignment		
Bibliography:	To be announced		

### **(TTVO003) Telecommunications Programming**

Credits:	3 cr	Timing:	3rd - 4th yr
Objective:	Students will be proficient in the basic concepts of designing and making telecommunications applications.		

Prerequisite:	Embedded device Programming and Tools
Contents:	Protocol design and implementation
Learning Strategies:	Lectures and supervised exercises
Assessment:	Exam, exercises and assignment
Bibliography:	To be announced

## **(TTVO004) Data Structures and Algorithms**

Credits:	3 cr	Timing:	2nd yr
Objective:	Students will possess proficiency in the use and application of central data structures and algorithms, in understanding the basic concept of algorithm analysis and in planning and analysing algorithms. The programmes presented during the course have been created using C or a pseudo language.		
Prerequisite:	C language		
Contents:	The most important data structures and their processing algorithms Stacks, strings and linkaged lists Trees and networks Search and sort methods		
Learning Strategies:	Lectures, supervised and independent exercises		
Assessment:	Exam and assignment		
Bibliography:	To be announced		

## **(TTVO005) Smart Systems**

Credits:	3 cr	Timing:	3rd - 4th yr
Objective:	Students will understand the functioning of systems based on artificial intelligence and the architecture used to create them.		
Prerequisite:	Data Structures and Algorithms		
Contents:	Introduction to artificial intelligence Route finder agents and navigation A system that learns		
Learning Strategies:	Lectures and supervised exercises		
Assessment:	Exam, exercises and assignment		
Bibliography:	To be announced		

## **(TTVM0Z) VEHICLE DATA SYSTEMS/MEASUREMENT TECHNOLOGY DESIGN 16 cr**

### **(TTVM001) Planning Testing and Fault Diagnosis**

Credits:	2 cr	Timing:	3rd yr
Objective:	Students will be proficient in the main testing and fault diagnosis methods used for embedded systems and in applying these methods.		
Contents:	Testing plan Fault diagnosis plan		
Learning Strategies:	Lectures and exercises		
Assessment:	Exam and assignment		
Bibliography:	To be announced		

## **(TTVM002) Planning EMC and Environmental Testing**

Credits:	2 cr	Timing:	4th yr
Objective:	Students will be proficient in the basic principles of EMC and environmental testing of embedded systems and able to compile the appropriate testing plans.		
Contents:	EMC testing and environmental testing methods. EMC test plan and test implementation Environmental test plan and test implementation		
Learning Strategies:	Lectures and assignments		
Assessment:	Exam and assignments		
Bibliography:	To be announced		

## **(TTVM003) Microcontroller System Design**

Credits:	4 cr	Timing:	3rd and 4th yr
Objective:	Students will be proficient in designing a vehicle microprocessor based system product		
Prerequisite:	Analogue Electronics 1 and 2 Digital Technology Microprocessor Technology		
Contents:	Awareness of EMC requirements in all stages of device design Multilayer printed board design Thermal planning Reliability technology Legislation pertaining to electrical devices (e.g. EMC, LV; RoHS, WEEE, EuP) Using simulators and existing simulated models in design Power feed planning		
Learning Strategies:	Lectures and exercises		
Assessment:	Interim tests and assignments		
Bibliography:	Lecture handouts Study material from Analogue Electronics and Microprocessor Technology		

## **(TTVM004) Sensor and Interface Electronics**

Credits:	4 cr	Timing:	3rd yr
Objective:	Students will be conversant with the most common sensors and will learn to design the connection electronics required in their use.		
Contents:	The basic features of sensors Measuring mechanical quantities, temperature, pressure and humidity Measuring flow speed Measuring luminosity Micro-sensors Connecting electronics required in sensors		
Learning Strategies:	Lectures and exercises		
Assessment:	Interim tests		

### **(TTVM005) LabVIEW Programming and Applications**

Credits:	4 cr	Timing:	4th yr
Objective:	Students will know the basic structures of the LabVIEW programming language and will be able to use this language when creating measurement applications.		
Contents:	Basic structures of the LabVIEW language Applications in data logger boards, bus connected measurement devices and real-time systems Applications in digital sensors		
Learning Strategies:	Lectures and supervised exercises, group work		
Assessment:	Exercises and assignments		
Bibliography:	LabVIEW Basics, Hands-On Course Study handout		

### **(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 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 compulsory 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: Supervised exercises

Assessment: Active participation 100 %, exam

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: 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 expertise in their chosen field. The topic of the thesis is usually agreed beforehand with the commissioning party 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 from industry and commerce  
Creating the necessary documents  
Acceptance processes  
Selecting the supervisor  
Thesis  
Presentation of thesis  
Maturity test

Assessment: Independent study, participation in supervision process

## **(TTHH0Z) PRACTICAL TRAINING 30 cr**

### **(TTHH001) Practical Training**

Credits:	30 cr	Timing:	Spring semester 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.		
Prerequisite:	Students must have 112 cr before starting their practical training period.		
Contents:	A usually continuous approx five month training period (800 working hours) in working life		