Seinäjoen Ammattikorkeakoulu Oy

AE21 Bachelor of Engineering, Automation Engineering

STUDY OBJECTIVES
Automation engineering studies at SeAMK are designed to meet the future requirements of industry. In addition to traditional automation engineering capabilities, students get involved with computer science and programming. SeAMK School of Technology is known for the research and development in the field of Industrial Internet and Digital Manufacturing, which are also included in our education.

The studies include common studies for all SeAMK students regarding international working and communication skills, entrepreneurship, and research project skills. The common studies at the School of Technology provide students with necessary basic skills of English, Swedish, mathematics and physics. Professional studies contain basic automation engineering and computer science courses, after which it is possible to focus on various modules to deepen one's knowledge. These modules contain, for example, information technology, business studies, and industrial internet. The degree will be finalized with two practical training periods and a thesis – all of which are typically carried out as real life assignments for local companies.

Sustainable development and environmental values are playing an increasingly important role in today's industry.
Automation technology and digitalization enable the creation of increasingly energy-efficient solutions through optimization and artificial intelligence.

LANGUAGE INFORMATION
The degree program is taught completely in English.

STUDY CONTENTS
During the first year the studies will cover predominantly the common studies of SeAMK and the School of Technology focusing on building students' abilities to study and work in an international and entrepreneurial environment, but there will also be some basic level professional studies to ensure students get the flavor of automation engineering as soon as possible.
The second year will continue with some common studies, while adding the amount of more professional studies, including the first professional modules. Students will also start to work on their first project studies. Starting from the second year it is possible to choose some elective courses like production simulation or computer aided manufacturing.
The third year will deepen the professional studies to ensure students are ready for their first practical training that will take place at the end of the third year. At this stage students are predominantly concentrating on professional studies utilizing laboratories and doing assignments given by local companies within the courses.
The fourth year finalizes the remainder of the professional modules, lets students to build their career opportunities during the second practical training and closes the studies with the thesis. Quite often the practical training converts naturally into a thesis workplace, ensuring the researching of modern-day industrial challenges with full support from both the company and our university of applied sciences.

CHOOSING A MAIN SUBJECT OF FIELD OF SPECIALIZATION
All students study the core courses in automation engineering and computer science. Modules within the degree program include Production automation, Design of electrical systems, Process

automation, Industrial internet, Information technology and Electronics. On top of the module structure, elective professional studies are available.

THESIS
The aim of the Bachelor's thesis is that students are able to apply the theoretical knowledge they have acquired during their studies in their own research. The thesis is ideally commissioned by a company or organization, often the one in which the practical training took place. During the thesis process, students learn problem-solving, project work, scientific thinking, independent information retrieval, and reporting research results. The thesis process also allows students to be creative, and to experiment and use innovative applications.

PEDAGOGICAL APPROACH
Teaching in the Degree Programme in Automation Engineering emphasises hands-on learning. This means that we combine theoretical information with practical skills for the working world in modern technology laboratories. Students experience great moments of insight doing a diverse range of assignments in our laboratories. The equipment and the software in our laboratories is the same used in the working world. This allows students to routinely solve practical problems and acquire the readiness they need to work in the field. Moreover, designing, automating and using machines and devices with a team is fun.

In addition to skills in problem solving, the working world requires that employees are able to work with others and commit themselves to life-long learning. For this reason, teaching involves much group work and working in pairs. There are also visits by experts in the field, various assignments, projects, visits to various companies and trade fairs, as well as practical training in authentic working environments.

OCCUPATIONAL PROFILES
Jobs for professionals possessing numerous areas of expertise do not rest with just one employer. Our diverse training in the fields of automation, electricity and IT opens up new job opportunities in a world that ever-increasingly depends on technology. For this reason, the job situation for automation engineers is excellent on both the national and international levels. Job titles include designer, technical expert, production manager, sales manager, purchasing manager, etc. Graduates may also work in teaching and as independent entrepreneurs.

CAREER OPPORTUNITIES
A degree in automation engineering offers a lot of career opportunities . Our students have found various careers in the field of production, project management, quality, sales, research and development, supply chain management, and many have even found their career within education or as an entrepreneur. SeAMK is known for its entrepreneurial approach to studies, and our university of applied sciences offers great platforms for future business owners.

code	name	sum
AE21	**Bachelor of Engineering, Automation Engineering**	**240-255**
AE21-1001	Basic Studies Common to all in SeAMK	20
AE21-1002	**Building Competence**	**10**
XX00CG96	**Studying at a University of Applied Sciences**	**2**
XX00CG97	**Career planning and internationalisation**	**2**
YPOE3A3	**Communication Skills**	**3**
YPOE4A3	**ICT Skills**	**3**

AE21-1003	**Business and Entrepreneurship Competence**	**5**
XX00BE93	**Business and Entrepreneurship**	**3**
XX00BE94	**SeAMK Innovation Week**	**2**
AE21-1004	**Research and Project Work Skills**	**5**
YPOE1C2	**Introduction to Research and Development**	**2**
YPOE2C3	**Introduction to Project Work**	**3**
AE21-1005	BASIC STUDIES FOR ENGINEERING STUDENTS	35-44
AE21-1006	**Mathematics**	**14**
AE00CM42	**Algebra and Geometry**	**4**
AE00CM43	**Vectors and Matrices**	**3**
AE00CM44	**Differential and Integral Calculus**	**3**
AE00CM45	**Automation Technology Mathematics**	**4**
AE21-1007	**Physics**	**12**
AE00CM46	**Mechanics**	**3**
AE00CM47	**Electrical and Thermal Physics**	**3**
AE00CM49	**Wave Motion and Modern Physics**	**3**
AE00CM48	**Physics Laboratory Works**	**3**
AE21-1022	**Language Studies**	**9-18**
AE21-1025	**For All Students**	**6**
AE00CW60	Working Life English	3
AE00CW65	Professional English	3
AE21-1023	**For Non Finnish students**	**12**
AE00CW66	Finnish 1	3
AE00CW68	Finnish 2	3
AE00CW70	Finnish 3	3
AE00CW76	Finnish 4	3
AE21-1024	**For Finnish students**	**3**
AE00CW78	Ruotsi	3
VIRKARUKI	Julkisyhteisöjen henkilöstön ruotsin kielen taito, kirjallinen	0
VIRKARUSU	Julkisyhteisöjen henkilöstön ruotsin kielen taito, suullinen	0
AE21-1008	COMMON PROFESSIONAL STUDIES	130-136
AE21-1009	**Basics of Professional Studies**	**32**
AE00CM50	**Basics of Automation**	**3**
AE00CM51	**Sensor Technology**	**3**
AE00CM52	**Programmable Logic Controllers**	**3**
AE00CM53	**Electrical Engineering**	**4**
AE00CM54	**Electrical Safety and Standards**	**3**
AE00CM55	**Data Communications and Security**	**4**
AE00CM56	**Micro Computer Technology**	**3**
AE00CM57	**Basics of Programming 1**	**3**
AE00CM58	**Basics of Digital Technology**	**3**

AE00CM59	**Basics of Electronics**	**3**
AE21-1010	**Professional Studies Modules**	**98-104**
AE21-1011	**Production automation**	**19**
AE00CM84	Machine Automation 1	4
AE00CM85	Laboratory Assignments in Automation 1	4
AE00CM86	Robotics	4
AE00CM60	Production Management	4
AE00CM87	3D-CAD	3
AE21-1012	**Design of Electrical System**	**12**
AE00CM61	Design of Electrical and Automation System	4
AE00CM62	Laboratory Assignments in Control Systems	3
AE00CM63	Safety in Electrical Installation	2
AE00CM64	Electric Drives	3
AE21-1018	**Process Automation**	**11**
AE00CM65	Measuring Technology and Instrumentation	3
AE00CM66	Control Engineering	3
AE00CM67	Hydraulics and Pneumatics	2
AE00CM68	Components of Control Systems	3
AE21-1013	**Industrial Internet of Things**	**15**
AE00CM69	Databases	3
AE00CM70	Network Programming	3
AE00CM71	Basics of Industrial Internet of Things	3
AE00CM72	Cloud Computing	3
AE00CM73	Introduction to Artificial Intelligence	3
AE21-1015	**Electronics**	**10**
AE00CM81	Advanced Electronics	3
AE00CM82	Laboratory Assignments in Electronics	3
AE00CM83	Embedded Systems	4
AE21-1014	**Information Technology**	**23**
AE00CM74	Data Structures and Algorithms	4
AE00CM75	Virtual Environments	3
AE00CM76	Software Engineering	3
AE00CM77	Client-side Programming	3
AE00CM78	Server-side Programming	3
AE00CM79	Object-oriented Programming	4
AE00CM80	User Interface Design	3
AE21-1020	**Elective Professional Studies**	**8-14**
AE00CM91	C++ Programming	3
AE00CM92	Digital Signal Processing	3
AE00CM93	Machine Automation 2	4
AE00CM94	Laboratory Assignments in Automation 2	4

AE21-1017	PRACTICAL TRAINING	30
AE00CM88	**Practical Training 1**	**15**
AE00CM89	**Practical Training 2**	**15**
AE21-1016	BACHELOR'S THESIS	15
AE00CM95	**Thesis**	**15**
AE21-1019	ELECTIVE STUDIES	10
AE21-1026	**Other Elective Studies**	**0-10**
AE21-1027	**Multi-Field Project Studies**	**0-10**

AE21 Bachelor of Engineering, Automation Engineering: 255 op

AE21-1001 Basic Studies Common to all in SeAMK: 20 op

AE21-1002 Building Competence: 10 op

XX00CG96 Studying at a University of Applied Sciences: 2 op

Osaamistavoitteet
Students are able to
- function in a university of applied sciences
- develop their learning, studying and job seeking skills
- use efficiently different learning environments
- learn about their own field of study and employment opportunities in the field
- identify their individual opportunities for internationalisation

Sisältö
- structure of studies and different ways of conducting studies
- study orientation and Seinäjoki University of Applied Sciences as a work community
- statutes regulating higher education studies, regulations an rules of Seinäjoki University of Applied Sciences
- student union activities
- library services of Seinäjoki University of Applied Sciences
- developing learning and study skills
- social benefits for students and welfare services at Seinäjoki University of Applies Sciences
- career planning and job seeking skills
- relevance of internationalisation skills
- opportunities for further studies

Esitietovaatimukset
The student and the study counsellor go through other recommended studies when planning the student's personal curriculum.

Arviointikriteerit
Hyväksytty/hylätty

Pass: The student participates in the classes of the course and shows the knowledge and skills listed in the learning outcomes in class and/or by completing the required course assignments.
Fail: The student does not reach the learning outcomes of the course and is not able to show required knowledge and skills.

XX00CG97 Career planning and internationalisation: 2 op

Osaamistavoitteet
Students are able to
- plan their studies in accordance with their own career plans
- develop their job seeking skills in different ways
- identify their own career opportunities
- anticipate the changing needs of working life
- identify the effects of multiculturalism and globalisation on working life and interaction
- function in an international operational environment and make use of international networks
- plan their personal internationalisation in studies and working life

Sisältö
rules of working life and working life skills
- anticipating the needs of future working life
- career planning and job seeking skills
- goal-oriented planning of studies from the viewpoint of the student's own career plans
- personal internationalisation planning
- opportunities of study and training abroad
- international operational environment and multiculturalism
- international networks

Esitietovaatimukset
Course: Studying in an University of Applied Sciences

Arviointikriteerit
Hyväksytty/hylätty

Pass: The student participates in the classes of the course and shows the knowledge and skills listed in the learning outcomes in class and/or by completing the required course assignments.

Fail: The student does not reach the learning outcomes of the course and is not able to show required knowledge and skills

YPOE3A3 Communication Skills: 3 op

Osaamistavoitteet
Opiskelija osaa
- toimia tarkoituksenmukaisesti erilaisissa esiintymis- ja ryhmäviestintätilanteissa
- analysoida ja arvioida viestintätaitoja osana ammatillista kehittymistä.
- soveltaa SeAMKin kirjallisten töiden ohjeita tehtävissään.

Sisältö
- Viestintätyylin analysointi
- Esiintymistaito ja vuorovaikutus (palvelutilanteissa)
- Ryhmäviestintätaito (keskustelutaito, palautteen antaminen ja vastaanottaminen, toimintatavat, kokoustekniikka, asiakirjastandardi, pöytäkirjat, muistiot)
- Kirjallisten töiden raportointiohjeet (lähdeviittaustekniikka, referointi, kielenhuolto, mallipohja, Urkund)

Esitietovaatimukset
Edeltäviä opintoja ei tarvita

Arviointikriteerit
Tyydyttävä (1-2)

- Tyydyttävä (2-1):
Opiskelija osaa viestiä lähettäjälähtöisesti: hän ei osaa ottaa tavoitetta, vastaanottajaa tai tilannetta huomioon riittävästi. Tekstin rakenne on hajanainen ja epälooginen ja argumentointi on yksipuolista ja niukkaa. Havainnollistaminen on suppeaa ja epätarkoituksenmukaista. Opiskelija osaa arvioida omaa viestintäänsä vain viestin lähettäjän näkökulmasta.

Hyvä (3-4)

- Hyvä (4-3):
Opiskelija osaa viestinnässään ottaa osittain huomioon tavoitteen, tilanteen ja vastaanottajan. Osaa ylläpitää viestinnän vuorovaikutusta. Tunnistaa jossain määrin viestinnän kulttuurisidonnaisen luonteen. Tekstin rakenne on pääosin selkeää ja johdonmukaista ja argumen-tointi on monipuolista ja uskottavaa. Havainnollistaminen on tarkoituksenmukaista. Opiskelija osaa arvioida omaa viestintäänsä joiltakin osin ja osittain realistisesti.

Kiitettävä (5)

- Kiitettävä (5):
Opiskelija osaa viestinnässään ottaa erinomaisesti ja vakuuttavasti huomioon tavoitteen, tilanteen ja vastaanottajan, hän osaa toimia vastuullisesti ja sovittujen toimintatapojen mukaisesti. Viestinnän vuorovaikutus on erittäin taitavaa. Osaa tunnistaa viestinnän kulttuurisidonnaisen luonteen. Tekstin rakenne noudattaa tekstilajille ominaista rakennetta, teksti on loogista, selkeää ja sidosteista ja argumentointi on monipuolista ja eri näkökulmia huomioon ottavaa ja vakuuttavaa. Havainnollistaminen on tarkoituksenmukaista, tehokasta ja harkittua. Opiskelija osaa arvioida omaa viestintäänsä monipuolisesti ja realistisesti tavoitteen, tarkoituksen, vastaanottajan ja oman ammattialansa kannalta.

YPOE4A3 ICT Skills: 3 op

Osaamistavoitteet
- Opiskelija osaa käyttää käytössä olevia toimisto-ohjelmia, erilaisia verkkopalveluita ja verk-ko-oppimisympäristöä.
- Opiskelija osaa soveltaa tietoteknisiä perustaitoja uusissa laite- ja ohjelmistoympäristöissä.

Sisältö
- Johdatus toimisto-ohjelmiin
- Tekstinkäsittely
- kirjallisten töiden ohjeen mukaiset asetukset
- asiakirjastandardi
- Taulukkolaskenta
- laskentamallit
- kaaviot
- Esitysgrafiikka
- esityksen sisältö ja rakenne
- esityksen asetukset
- Verkkopalvelujen hyödyntäminen
- pilvipalvelut
- verkkoneuvottelu työvälineenä

Esitietovaatimukset

Edeltäviä opintoja ei tarvita

Arviointikriteerit
Tyydyttävä (1-2)

Opiskelija tunnistaa yleisimpien toimisto-ohjelmien ja verkkopalveluiden käyttömahdollisuuksia. Opiskelija hallitsee toimisto-ohjelmien yksinkertaisen peruskäytön.

Hyvä (3-4)

Opiskelija tunnistaa toimisto-ohjelmien ja verkkopalveluiden käyttömahdollisuuksia ja ymmär-tää niiden toimintaperiaatteet ja käyttömahdollisuudet henkilökohtaisen työskentelyn apuväli-neinä. Opiskelija osaa käyttää toimisto-ohjelmia erilaisissa käyttötilanteissa.

Kiitettävä (5)

Opiskelija tunnistaa toimisto-ohjelmien ja verkkopalveluiden käyttömahdollisuuksia ja ymmär-tää niiden toimintaperiaatteet. Opiskelija osaa itsenäisesti ja monipuolisesti soveltaa toimisto-ohjelmia ja verkkopalveluita erilaisissa käyttötilanteissa.

AE21-1003 Business and Entrepreneurship Competence: 5 op

XX00BE93 Business and Entrepreneurship: 3 op

Osaamistavoitteet
The student can
- describe the meaning and role of business activities in the society and in his/her field
- explain how entrepreneurship manifests on individual and organisational level
- describe entrepreneurial capabilities and assess his/her own entrepreneurial capabilities
- describe prerequisites of profitable business
- examine analytically the future outlook of business opportunities in his/her field

Sisältö
- business as part of society and the global environment
- entrepreneurship as pattern of action and as business activities
- basic concepts of business, business logic
- business as a part of a career in one's own field

Esitietovaatimukset
None.

Arviointikriteerit
Hyväksytty/hylätty

- Active participation and all assignments accepted. Learning outcomes must be achieved for acceptance.

XX00BE94 SeAMK Innovation Week: 2 op

Osaamistavoitteet
1. Understanding the user-centric problem-solving method and its usability in development tasks
2. Analysing the development task
3. Understanding the customer problem

4. Defining the development task
5. Concepting
6. Getting customer feedback
7. Group work skills

Sisältö

For day programmes the course is a one-week intensive course. The students will not take part in other SeAMK courses during it. During the SeAMK Innovation week, the students will solve real working life problems in multidisciplinary student teams by means of the design thinking method. In accordance with the method, the students will focus on both customer and business perspectives. The Innovation Week results in a tried-and-tested solution concept.
For students in multimodal study programmes, an online course is arranged.

Esitietovaatimukset
None.

Arviointikriteerit
Hyväksytty/hylätty

A personal learning assignment and group development assignment

AE21-1004 Research and Project Work Skills: 5 op

YPOE1C2 Introduction to Research and Development: 2 op

Osaamistavoitteet
Opiskelija osaa
- tunnistaa tieteellisen ja arkiajattelun eroja
- määritellä tutkimuksellisia lähestymistapoja ja tutkimuksen peruskäsitteitä
- esitellä tutkimusprosessin ja raportoinnin vaiheet (rakenne)
- selittää kriittisen ajattelun merkityksen tutkivassa ja kehittävässä työotteessa
- antaa esimerkkejä tutkimusetiikan merkityksestä

Sisältö
- tieteellinen ajattelu ja arkiajattelu
- yleinen tutkimusetiikka
- keskeisiä tutkimusmenetelmiä
- tutkimuksen peruskäsitteet ja rakenne
- tutkimusprosessin ja - raportin vaiheet
- tutkiva ja kehittävä työote

Esitietovaatimukset
Aikaisempia opintoja ei tarvita

Arviointikriteerit
Hyväksytty/hylätty

- Hyväksytty/hylätty
- Hyväksytty: Opiskelija osoittaa osaamistavoitteissa esitetyn osaamisensa suorittamalla opintojaksoon kuuluvat tehtävät hyväksytysti.
- Hylätty: Opiskelija ei saavuta opintojakson osaamistavoitteita eikä pysty osoittamaan osaamistaan niissä

YPOE2C3 Introduction to Project Work: 3 op

Osaamistavoitteet
Opiskelija osaa
- selittää projektityyppisen työskentelyn luonteen sekä sen, milloin projektityöskentelymalli on tarpeellinen
- esitellä perustiedot ja ?valmiudet, joiden perusteella hän voi osallistua projektityöhön sekä projektien suunnitteluun.
- selittää projektiin liittyvät käsitteet, projektisuunnitelman sisällön, projektin aikasuunnitte-lun ja projektin ohjaamisen (elinkaari).
- esitellä projektisyklin eri vaiheisiin liittyvät tehtävät.

Sisältö
- projektitoiminnan käsitteet ja toimintatavat
- projektin vaiheet ja prosessi
- projektisuunnitelma (aika-, resurssi- ja kustannussuunnittelu)
- projektiorganisaatio ja sidosryhmät
- projektin muutokset, riskit ja ongelmat
- projektiviestintä ja raportointi
- projektin päättäminen

Esitietovaatimukset
Aikaisempia opintoja ei tarvita

Arviointikriteerit
Tyydyttävä (1-2)

The student can name and can define the central concepts which describe Project and Project management. Student can define basic skills required for working as part of Project team. Student can explain different phases of the project cycle.

Hyvä (3-4)

The student can explain the central concepts which describe Project and Project management. Student can explain well different phases of the project cycle and can define skills required for working as part of Project team. Student has basic Project work skills.

Kiitettävä (5)

The student can name and define very well the central concepts of Project and Project management. Student can explain very well different phases of the project cycle and can define skills required for working as part of Project team. Student has Basic Project work skills.

AE21-1005 BASIC STUDIES FOR ENGINEERING STUDENTS: 44 op

AE21-1006 Mathematics: 14 op

AE00CM42 Algebra and Geometry: 4 op

Osaamistavoitteet
Students will be competent in using the mathematical methods described in the course contents to solve practical mathematical problems.

Sisältö
- Basic algebra
- Basic trigonometry
- Analytic geometry
- Trigonometric functions
- Exponential and logarithm functions

Arviointikriteerit
Tyydyttävä (1-2)

satisfactory (1-2): The student knows and understands to a satisfactory extent the basic concepts and methods of algebra and geometry, and is able to apply them to usual problems.

Hyvä (3-4)

good (3-4): The student is familiar with the concepts and methods of algebra and geometry, and is able to apply them to different types of problems. The student is able to combine the accumulated knowledge and skills with previous experiences in the subject.

Kiitettävä (5)

excellent (5):): The student is familiar with the concepts and methods of algebra and geometry, and is able to apply them to a variety of different problems. The student has demonstrated creativity and innovation, and is able to find new meanings when applying what they have learned

AE00CM43 Vectors and Matrices: 3 op

Osaamistavoitteet
Students will be competent in using the mathematical methods described in the course contents to solve practical mathematical problems.

Sisältö
Vectors in plane and space
Matrix algebra
Linear system of equations
Rotations and coordinate changes

Arviointikriteerit
Tyydyttävä (1-2)

satisfactory (1-2): The student knows and understands to a satisfactory extent the basic concepts and methods of vectors and matrices, and is able to apply them to usual problems.

Hyvä (3-4)

good (3-4): The student is familiar with the concepts and methods of vectors and matrices, and is able to apply them to different types of problems. The student is able to combine the accumulated knowledge and skills with previous experiences in the subject.

Kiitettävä (5)

excellent (5):): The student is familiar with the concepts and methods of vectors and matrices, and is able to apply them to a variety of different problems. The student has demonstrated creativity and innovation, and is able to find new meanings when applying what they have learned

AE00CM44 Differential and Integral Calculus: 3 op

Osaamistavoitteet
Students will be competent in using the mathematical methods described in the course contents to solve practical mathematical problems.

Sisältö
Derivative, interpretation as slope,
geometric and physical applications
Integral, interpretation as area,
geometric and physical applications
Differential equations

Esitietovaatimukset
Algebra and geometry, Vectors and matrices

Arviointikriteerit
Tyydyttävä (1-2)

satisfactory (1-2): The student knows and understands to a satisfactory extent the basic concepts and methods of differential and integral calculus, and is able to apply them to usual problems.

Hyvä (3-4)

good (3-4): The student is familiar with the concepts and methods of differential and integral calculus, and is able to apply them to different types of problems. The student is able to combine the accumulated knowledge and skills with previous experiences in the subject.

Kiitettävä (5)

excellent (5):): The student is familiar with the concepts and methods of differential and integral calculus, and is able to apply them to a variety of different problems. The student has demonstrated creativity and innovation, and is able to find new meanings when applying what they have learned

AE00CM45 Automation Technology Mathematics: 4 op

Osaamistavoitteet
Students will be competent in using the mathematical methods described in the course contents to solve practical mathematical problems.

Sisältö
Laplace transform
Fourier transform
Probability and statistics
Data analysis

Esitietovaatimukset
Algebra and geometry, Vectors and matrices, Differential and integral calculus

Arviointikriteerit
Tyydyttävä (1-2)

satisfactory (1-2): The student knows and understands to a satisfactory extent the basic concepts and methods described in the course contents, and is able to apply them to usual problems.

Hyvä (3-4)

good (3-4): The student is familiar with the concepts and methods described in the course contents, and is able to apply them to different types of problems. The student is able to combine the accumulated knowledge and skills with previous experiences in the subject.

Kiitettävä (5)

excellent (5): The student is familiar with the concepts and methods described in the course contents, and is able to apply them to a variety of different problems. The student has demonstrated creativity and innovation, and is able to find new meanings when applying what they have learned.

AE21-1007 Physics: 12 op

AE00CM46 Mechanics: 3 op

Osaamistavoitteet
Upon completion of the course, student will
- be able to utilize the necessary concepts and units that are used in modeling mechanical phenomena
- be able to build and solve physical models that describe different mechanical phenomena
- be able to interpret a physical model as an approximate description of the real world phenomenon
- be able to analyze the motion of solid bodies and fluids, and to understand the empirical nature of the physical science
- be able to evaluate his/her skills on mechanics and apply his/her expertise in the subsequent advanced studies

Sisältö
- Kinematics
- Newton's laws
- Work, power, energy, impulse
- Linear momentum
- Rotary movement
- Mechanics of solids and fluid

Esitietovaatimukset
No previous studies are required

Arviointikriteerit
Tyydyttävä (1-2)

Satisfactory (1 ... 2): The student knows and understands to a satisfactory extent the mechanical basic concepts and methods, and is able to apply them to usual problems.

Hyvä (3-4)

Good (3 ... 4): The student is familiar with the concepts and methods of mechanics, and is able to apply them to different types of problems. The student is able to combine the accumulated knowledge and skills with previous experiences in the subject.

Kiitettävä (5)

Excellent (5): The student is familiar with the concepts and methods of mechanics, and is able to apply them to a variety of different problems. The student has demonstrated creativity and

innovation, and is able to find new meanings when applying what they have learned.

AE00CM47 Electrical and Thermal Physics: 3 op

Osaamistavoitteet
Upon completion of the course, student will
- be able to utilize the necessary concepts and units that are used in modeling thermal and electrical phenomena
- be able to analyze the thermodynamic properties of materials and solid bodies with equilibrium models
- be able to interpret thermal and electrical laws as approximate empirical descriptions
- is able to analyze electrostatic interactions between electric fields and charged particles
- be able to solve even complicated DC circuits
- be able to identify electricity production and transmission processes, such as the use of three-phase power, transformer, generator and induction motor operation
- be able to evaluate his/her skills on thermal and electrical physics and apply his/her expertise in the subsequent advanced studies

Sisältö
- Basics of thermal physics
- Electrostatics
- Direct current
- Alternating current
- Basics of magnetism

Esitietovaatimukset
Mechanics

Arviointikriteerit
Tyydyttävä (1-2)

Satisfactory (1 ... 2): The student knows and understands to a satisfactory extent the basic concepts and methods of both electricity and thermal physics. The student is able to apply electricity and thermal physics to usual problems.

Hyvä (3-4)

Good (3 ... 4): The student is familiar with the concepts and methods of electricity and thermal physics, and is able to apply them to different types of problems. The student is able to combine the accumulated knowledge and skills with previous experiences in the subject.

Kiitettävä (5)

Excellent (5): The student is familiar with the concepts and methods of electricity and thermal physics, and is able to apply them to a variety of different problems. The student has demonstrated creativity and innovation, and is able to find new meanings when applying what they have learned.

AE00CM49 Wave Motion and Modern Physics: 3 op

Osaamistavoitteet
Students will possess basic knowledge of the physics associated with technology in the areas described in the course contents, and the readiness they will need to acquire advanced knowledge in technology in their further studies and the working world. They will be competent in solving various

problems in physics using models (magnitude equations) and presenting their results appropriately.

Sisältö
- Harmonic oscillation
- Wave motion
- Sound
- Optics
- Quantum physics
- Atom- and nuclear physics

Esitietovaatimukset
No previous studies are required. Basic knowledge about mechanics and electromagnetism is strongly recommended.

Arviointikriteerit
Tyydyttävä (1-2)

(1 ... 2): The student knows and understands to a satisfactory extent the basic concepts and methods of wave and modern physics, and is able to apply them to usual problems. The student is aware of the limitations of classical physics, and identifies the status of the modern physics in the world view.

Hyvä (3-4)

(3 ... 4): The student is familiar with the concepts and methods of both wave and modern physics, and is able to apply them to different types of problems. The student is able to combine the accumulated knowledge and skills with previous experiences in the subject.

Kiitettävä (5)

(5): The student is familiar with the concepts and methods of wave and modern physics, and is able to apply them to a variety of different problems. The student has demonstrated creativity and innovation, and is able to find new meanings when applying what they have learned.

AE00CM48 Physics Laboratory Works: 3 op

Osaamistavoitteet
Upon completion of the course, student will
- be able to use the common tools and methods used in the research of technology
- be able to identify restrictions of the basic experimental research tools
- become familiar with the experimental data acquisition and are able to make controlled measurements
- be able to process results and to evaluate measurement methods and reliability of the results
- be able to analyze results with computer-assisted mathematical tools
- be able to form a scientific report based on the received measurements and their analysis by using a word processing program
- be able to build the relationship between theoretical knowledge and practical knowledge of physics
- be able to evaluate his/her skills and apply his/her expertise in the subsequent advanced studies and real problems at work

Sisältö
Laboratory experiments from different areas of physics and engieering

Esitietovaatimukset
Mechanics and Electrical and thermal physics or similar knowledge and skills

Arviointikriteerit
Tyydyttävä (1-2)

Satisfactory (1 ... 2): The student is able to make basic measurements in accordance with working instructions and work safely in the laboratory. The student is able to deal with measurement results and to present the results graphically using computer-aided tools. The student is able to assess the reliability of the measurements according to instructions. The student is able to present a short technical report of the results of the measurements.

Hyvä (3-4)

Good (3 ... 4): The student is able to make different types of measurements in accordance with work instructions and work independently in the laboratory. The student is able to deal with the measurement results, and present the results graphically using computer-aided tools. The student is able to assess the reliability of measurements using different types of error estimation methods. The student is able to present the results in a logical and clear technical report.

Kiitettävä (5)

Excellent (5): The student works independently in the laboratory, and is able to make measurements based on instructions and develop the measurement methods. The student is able to evaluate the results using a wide range of computer-assisted tools, make reliable error estimates and draw conclusions from the results and error estimates. The student is able to present the results and conclusions in a logical and clear technical report.

AE21-1022 Language Studies: 18 op

AE21-1025 For All Students: 6 op

AE00CW60 Working Life English: 3 op

Osaamistavoitteet
The students can describe their own education both orally and in writing.
The students are familiar with the job application process and the related vocabulary.
The students recognize the different levels of formality and are able to use formal style in professional communication.
The students can communicate politely and professionally both on the phone and when writing emails.
The students are familiar with the vocabulary related to meetings and negotiations.
The students are able to give presentations on field related topics.
The students know the most central vocabulary of their field of education and are able to use it both orally and in writing

Sisältö
- effective communication
- customer contacts
- presentations
- field-related terminology
- education and work
- meetings and negotiations

Lisätiedot

Prerequisite: English studies at an upper secondary school or corresponding knowledge gained otherwise.

Arviointikriteerit
Tyydyttävä (1-2)

There are lots of major errors in the student's written expression and problems with the fluency of text. Their text is simple but coherent and intelligible. There are lots of mistakes and mispronunciations in the student's oral expression and the pronunciation differs from that of the target language. Despite the problems, the message is mainly intelligible. If the text is read directly from written notes or slides, the maximum grade is 1 to 2. The students masters the basic vocabulary and key grammatical structures in a limited way.

Hyvä (3-4)

There are some minor errors in the student's written expression, but the message is still conveyed without problems. Their text is fluent and consistent, as well as written using basic structures correctly. There are some mispronunciations and grammatical errors in the student's oral expression, but they do not disturb the conveying of the message. Good, fluent basic language skills, presented relatively spontaneously, yet based to some extent on notes. Hesitation slows down the student's speech. The students masters the basic vocabulary and field-specific vocabulary quite well. The student uses key grammatical structures quite faultlessly.

Kiitettävä (5)

The student's written expression is faultless, very fluent, and the student pays attention to stylistic matters required by professional-life communication situations. They also use complex syntactic structures in their text. There are no mistakes in oral expression; the student's pronunciation is authentic and their speed of speech is appropriate. Overall, their speech is spontaneous, fluent narration, which the listener can easily follow. The student reacts in an adequate way in interactive situations. The students masters a large vocabulary and uses grammatical structures fluently and in a varied way.

AE00CW65 Professional English: 3 op

Osaamistavoitteet
• Students can describe technical devices, its use and features.
• Students can tell about companies.
• Students can write business letters.
• Students are able to summarize texts both orally and in writing.
• Students understand demanding, field-related texts and terminology.
• Students are able to use formal vocabulary both orally and in writing.

Sisältö
- Reading and writing field-related texts
- Writing summaries and reports
- Using formal style
- Writing business letters
- Describing technical devices
- Telling about field related companies

Lisätiedot

Prerequisite: English studies at an upper secondary school or corresponding knowledge gained otherwise.

Arviointikriteerit
Tyydyttävä (1-2)

There are lots of major errors in the student's written expression and problems with the fluency of text. Their text is simple but coherent and intelligible.
There are lots of mistakes and mispronunciations in the student's oral expression and the pronunciation differs from that of the target language. Despite the problems, the message is mainly intelligible. If the text is read directly from written notes or slides, the maximum grade is 1 to 2.
The students masters the basic vocabulary and key grammatical structures in a limited way.

Hyvä (3-4)

There are some minor errors in the student's written expression, but the message is still conveyed without problems. Their text is fluent and consistent, as well as written using basic structures correctly.
There are some mispronunciations and grammatical errors in the student's oral expression, but they do not disturb the conveying of the message. Good, fluent basic language skills, presented relatively spontaneously, yet based to some extent on notes. Hesitation slows down the student's speech.
The students masters the basic vocabulary and field-specific vocabulary quite well. The student uses key grammatical structures quite faultlessly.

Kiitettävä (5)

The student's written expression is faultless, very fluent, and the student pays attention to stylistic matters required by professional-life communication situations. They also use complex syntactic structures in their text.
There are no mistakes in oral expression; the student's pronunciation is authentic and their speed of speech is appropriate. Overall, their speech is spontaneous, fluent narration, which the listener can easily follow. The student reacts in an adequate way in interactive situations.
The students masters a large vocabulary and uses grammatical structures fluently and in a varied way.

AE21-1023 For Non Finnish students: 12 op

AE00CW66 Finnish 1: 3 op

Osaamistavoitteet
Students know some basic vocabulary, grammar and phrases of the Finnish language. After the course, they are able to tell and write about themselves using simple expressions and to communicate in simple everyday situations. Furthermore, students are acquainted with Finland as a country and also have a better understanding of the Finnish way of life.

Sisältö
This course provides students with an introduction to Finland and the Finnish language and culture:
- greetings, basic phrases, numbers
- introducing and telling about oneself (name, address, age, country, nationality, language skills), family and housing
- some expressions of time (weekdays, months, seasons, telling time)
- weather

- basic vocabulary (e.g. numbers, time, family, home, weather)
- simple everyday situations, e.g. telling about oneself, shopping and asking prices (Level A1)
- grammar, e.g. personal pronouns, possessive construction, verb conjugation, question and negative sentence, partitive case, genitive, local cases, consonant gradation
- main features of the spoken language
- basic information about Finland and Finnish culture.

Esitietovaatimukset
No prerequisites

Arviointikriteerit
Tyydyttävä (1-2)

The student knows some vocabulary and polite phrases learnt during the course. He can use simple constructions but mistakes can impede comprehension. The student can communicate in some everyday situations when helped. Other languages strongly influence the pronunciation. The student can tell only a few main facts about the country and its culture.

Hyvä (3-4)

The student knows the most of the vocabulary and polite phrases learnt during the course. He can use simple constructions almost without mistakes. He manages independently in most everyday situations. The pronunciation is mainly understandable. The student knows detailed facts widely - although some false information might appear - and is therefore relatively well acquainted with the country and its culture.

Kiitettävä (5)

The student knows the vocabulary and polite phrases learnt during the course. He can use simple constructions making hardly any mistakes. He manages independently and fluently in everyday situations. The pronunciation is close to that of a native speaker. The student knows precise and detailed facts and is well acquainted with the country and its culture.

AE00CW68 Finnish 2: 3 op

Osaamistavoitteet
Students are more confident in using Finnish. After the course, they are able to tell and write about their daily life by using simple expressions and to communicate in everyday situations, such as ordering food and drinks at a restaurant or telling about their daily lives and travelling. They extend their knowledge of the basic vocabulary, grammar and typical structures of the Finnish language. They are further acquainted with the Finnish way of life.

Sisältö
Students are able to communicate in simple everyday situations e.g.:
- ordering food and drinks in restaurant
- telling about their daily lives and hobbies
- asking the way, telling about places and explaining directions in daily life
- travelling (Level A1)
- grammar e.g. verb conjugation, partitive case, more about consonant gradation, some typical sentence types.

Esitietovaatimukset
Finnish 1

Arviointikriteerit

Tyydyttävä (1-2)

The student knows some vocabulary learnt during the course. He can use simple sentences but mistakes can impede comprehension. He can communicate in some everyday situations when helped. He understands slow and clearly articulated speech to some extent and he recognizes the topic of written texts and understands some words and expressions in them. The student is able to write short and simple texts, but mistakes impede comprehension. Other languages strongly influence the pronunciation.

Hyvä (3-4)

The student knows the most of the vocabulary learnt during the course. He can use simple sentences making a few mistakes. He manages independently in the most everyday situations, mistakes do not impede comprehension. He understands most of the normal speed speech and the content of written texts. He is able to write mainly understandable texts while still making some mistakes. The pronunciation is mainly understandable.

Kiitettävä (5)

The student knows the vocabulary learnt during the course. He can use simple sentences making hardly any mistakes. He manages independently and fluently in everyday situations. He understands normal speed speech and the content of written texts and he can write understandable texts, which may contain minor mistakes.The pronunciation is close to that of a native speaker.

AE00CW70 Finnish 3: 3 op

Osaamistavoitteet
Students are more confident in using Finnish. After the course, they are able to tell and write about their daily life by using simple expressions and to communicate in everyday situations, such as telling about their daily life at work and running errands in a bank, post office and hotel. They are acquainted with the Finnish enterprises and working life.

Sisältö
Students are able to communicate in everyday situations, e.g.:
- telling about daily life, holiday and travelling
- telling about work and professions
- running errands in bank, post office and hotel
- seeking a job (Level A1)
- telling the basic information of an enterprise in Finnish.
- grammar e.g. the most common noun types, object, more about the consonant gradation and the use of the local cases

Esitietovaatimukset
Finnish 1 and Finnish 2

Arviointikriteerit
Tyydyttävä (1-2)

The student knows some vocabulary learnt during the course. He can use simple sentences but mistakes can impede comprehension. He can communicate in some everyday situations when helped. He understands slow and clearly articulated speech to some extent and he recognizes the topic of written texts and understands some words and expressions in them. The student is able to write short and simple texts, but mistakes impede comprehension. Other languages strongly influence the pronunciation. The student can tell only a few main facts about Finnish enterprises.

Hyvä (3-4)

The student knows the most of the vocabulary learnt during the course. He can use simple sentences making a few mistakes. He manages independently in most of the everyday situations, mistakes do not impede comprehension. He understands most of the normal speed speech and the content of written texts. He is able to write mainly understandable texts while still making some mistakes. The pronunciation is mainly understandable. The student knows detailed facts widely about Finnish enterprises - although some false information might appear.

Kiitettävä (5)

The student knows the vocabulary learnt during the course. He can use simple sentences making hardly any mistakes. He manages independently and fluently in everyday situations. He understands normal speed speech and the content of written texts and he can write understandable texts, which may contain minor mistakes.The pronunciation is close to that of a native speaker. The student knows precise and detailed facts about Finnish enterprises.

AE00CW76 Finnish 4: 3 op

Osaamistavoitteet
Students are more confident in using Finnish in everyday situations. After the course, they are able to tell and write about their daily life by using typical expressions in Finnish and to communicate in everyday situations, such as telling about their daily life, work, health and running errands. They are able to give a short presentation in Finnish.

Sisältö
Students are able to communicate in everyday situations, e.g.:
- telling about daily life and leisure time
- telling about business and work
- telling about health and running errands in a health care center (Level A1 - A2)
- grammar e.g. past tense, more noun and sentence types, plural

Esitietovaatimukset
Finnish 1, Finnish 2, Finnish 3

Arviointikriteerit
Tyydyttävä (1-2)

The student knows some vocabulary learnt during the course. He can use simple sentences but mistakes can impede comprehension. He can communicate in some everyday situations when helped. He understands slow and clearly articulated speech to some extent and he recognizes the topic of written texts and understands some words and expressions in them. The student is able to write short and simple texts, but mistakes impede comprehension. Other languages strongly influence the pronunciation.

Hyvä (3-4)

The student knows the most of the vocabulary learnt during the course. He can use simple sentences making a few mistakes. He manages independently in most of the everyday situations, mistakes do not impede comprehension. He understands most of the normal speed speech and the content of written texts. He is able to write mainly understandable texts while still making some mistakes. The pronunciation is mainly understandable.

Kiitettävä (5)

The student knows the vocabulary learnt during the course. He can use simple sentences making hardly any mistakes. He manages independently and fluently in everyday situations. He understands normal speed speech and the content of written texts and he can write understandable texts, which may contain minor mistakes. The pronunciation is close to that of a native speaker.

AE21-1024 For Finnish students: 3 op

AE00CW78 Ruotsi: 3 op

Osaamistavoitteet
Learning Outcomes
The students can communicate in Swedish both orally and in writing in working life situations. They are able to discuss field related topics in Swedish. They are able to develop their expertise using literature as well as other sources in Swedish.

Students:
can tell about themselves, their education and work experience
can write a cv and a job application and can handle job interviews
can write work relevant messages (e.g. e-mails) and manages work related telephone conversations, company presentations and other spoken communication situations
can use polite phrases
know the basic terminology of the field

Sisältö
Contents
Telling about oneself and one´s studies
Job application, cv, job interview
Polite phrases and small talk
Basic written messages and spoken work life communication (e.g. company presentations, e-mails)
texts on field specific topics

Esitietovaatimukset
No previous studies are required.

Arviointikriteerit
Tyydyttävä (1-2)

There are lots of major errors in the student's written expression and problems with the fluency of text . Their text is simple but coherent and intelligible.
There are lots of mistakes and mispronunciations in the student's oral expression and the pronunciation differs from that of the target language. Despite the problems, the message is mainly intelligible. If the text is read directly from written notes or slides, the maximum grade is 1 to 2.
The students masters the basic vocabulary and key grammatical structures in a limited way.

Hyvä (3-4)

There are some minor errors in the student's written expression, but the message is still conveyed without problems. Their text is fluent and consistent, as well as written using basic structures correctly.
There are some mispronunciations and grammatical errors in the student's oral expression, but they do not disturb the conveying of the message. Good, fluent basic language skills, presented relatively

spontaneously, yet based to some extent on notes. Hesitation slows down the student's speech. The students masters the basic vocabulary and field-specific vocabulary quite well. The student uses key grammatical structures quite faultlessly.

Kiitettävä (5)

The student's written expression is faultless, very fluent, and the student pays attention to stylistic matters required by professional-life communication situations. They also use complex syntactic structures in their text.
There are no mistakes in oral expression; the student's pronunciation is authentic and their speed of speech is appropriate. Overall, their speech is spontaneous, fluent narration, which the listener can easily follow. The student reacts in an adequate way in interactive situations.
The students masters a large vocabulary and uses grammatical structures fluently and in a varied way.

VIRKARUKI Julkisyhteisöjen henkilöstön ruotsin kielen taito, kirjallinen: 0 op

VIRKARUSU Julkisyhteisöjen henkilöstön ruotsin kielen taito, suullinen: 0 op

AE21-1008 COMMON PROFESSIONAL STUDIES: 136 op

AE21-1009 Basics of Professional Studies: 32 op

AE00CM50 Basics of Automation: 3 op

Osaamistavoitteet
Students will be able to differentiate between various automation systems and identify the components used in them. They will understand how automation systems works. Students will be knowledgeable of the structure, function and connections of relays and PLC drivers and the more common types of sensors and actuators. They will learn the idea behind the logic needed in automation technology.

Sisältö
- Development of automation and automation technology
- What is automation?
- Control and regulation, control systems for automation, sensors, actuators, programmable logics, components for a control system
- Common connections for sensors and actuators into programmable logics
- Practice making connections in the lab
- Familiarisation with various automation control system.

Esitietovaatimukset
No previous studies are required.

Arviointikriteerit
Tyydyttävä (1-2)

Student know the basics and terminology, but he/she have shortcomings in applying the key things. However, student can satisfactorily implement the basic controls of automation circuits.

Hyvä (3-4)

Student know the basic components of automation technology and know how to make holistically justified choices between them. He/She understand very different connections of automation circuits. Student know how to use the programming environment so well that you can make a working application and modify existing larger programs according to good practices.
He/She know how to use tools to monitor and simulate a program well and are able to locate simple faults in the system.

Kiitettävä (5)

Student manage key issues and are able to apply them creatively from system entities to the field device level. You can make a critical comparison between solution options.

AE00CM51 Sensor Technology: 3 op

Osaamistavoitteet
Students will learn about the basic sensors used in machine automation. They will understand how sensors work, their electrical and mechanical properties and performance characteristics. They will be competent in selecting appropriate sensors for solving problems with detection and measuring. They will be able to make electrical connections for sensors and connect them to control units and fieldbuses.

Sisältö
- Basics in sensor technology
- Protection classes
- On-off sensors
- Sensors that detect presence
- Sensors that measure magnitudes
- Detection techniques
- Measuring movement
- Computer vision
- Connecting sensors and practice making measurements in the lab

Esitietovaatimukset
No previous studies are required.

Arviointikriteerit
Tyydyttävä (1-2)

The student knows and commands the basic operation of sensors and the concepts - in the one to be been satisfied with numbers. He is able to solve faults in the basic sensors and is able to replace with the similar sensor of the one which had been damaged.

Hyvä (3-4)

The student knows well the basic concepts which are related to the sensors and their operating principles. He is able to adapt his knowledge in the solving of problems of different types and either in place of the one which had been damaged or to a new target the sensor which is suitable for choosing.

Kiitettävä (5)

The student knows the concepts and operating principles of different sensors well. In addition to the basic sensors, he is able to choose special sensors also to different applications and environments.

AE00CM52 Programmable Logic Controllers: 3 op

Osaamistavoitteet

Student knows the role of the Programmable Logic Controller (PLC) in machine automation, control systems and process industries. Student can develop sequence-based PLC programs, which control simple automatic machines. Student understands how the sequence logic is implemented utilizing the theory of finite state machines. Student can develop PLC programs with Function Block Diagram (FBD) and Structured Text (ST) programming languages. Student can design simple user interfaces for industrial automation applications.

Sisältö

- Stucture of PLC devices and programming environment
- Programming with FBD and ST programming languages
- Sequence-based programming and finite state machines
- Function blocks
- Designing and programming a user interface

Esitietovaatimukset

- Basics of programming
- Basics of industrial automation

Arviointikriteerit
Tyydyttävä (1-2)

Student knows the role of the Programmable Logic Controller (PLC) in machine automation, control systems and process industries. Student can develop sequence-based PLC programs, which control simple automatic machines. Student can develop PLC programs with Function Block Diagram (FBD) programming language.

Hyvä (3-4)

Student knows the role of the Programmable Logic Controller (PLC) in machine automation, control systems and process industries. Student can develop sequence-based PLC programs, which control simple automatic machines. Student understands how the sequence logic is implemented utilizing the theory of finite state machines. Student can develop PLC programs with Function Block Diagram (FBD) programming language. Student can design simple user interfaces for industrial automation applications.

Kiitettävä (5)

Student knows the role of the Programmable Logic Controller (PLC) in machine automation, control systems and process industries. Student can develop sequence-based PLC programs, which control automatic machines. Student understands how the sequence logic is implemented utilizing the theory of finite state machines. Student can develop PLC programs with Function Block Diagram (FBD) and Structured Text (ST) programming languages. Student can design user interfaces for industrial automation applications.

AE00CM53 Electrical Engineering: 4 op

Osaamistavoitteet

After completion of the course, students will understand the factors influencing electric properties and know how to explain them. They will able to mathematically solve basic problems associated with direct current circuits and alternating current circuits.

Sisältö
- Electodynamics
- DC and AC circuits calculations. (Kirchoff current and voltage law)
- Electrical circuit measurement in theory
- Three-phase systems

Esitietovaatimukset
Electrical and thermal physics

Arviointikriteerit
Tyydyttävä (1-2)

Student is able to use quantities and units of electrostatics. Student is able to analyze the accuracy of the results obtained and solve simple problems which resemble exemplary problems given during the course.

Hyvä (3-4)

In addition to previous, student is also able to utilize the basic laws of electrostatics and justify the solutions.

Kiitettävä (5)

Student has a comprehensive understanding of the basic laws in electrostatics, the interrelations between the laws and utilization of them in problem-solving. Student is fluent in analyzing problems and justifying the solutions.

AE00CM54 Electrical Safety and Standards: 3 op

Osaamistavoitteet
Student can explain what electrical work can skilled person do. He can search and apply valid regulations of electrical safety. He can do electrical installations safely. In addition he can do the right things when electrocution happens. He can do the initial inspection of the electrical installations and the technical documentation.

Sisältö
- The law of electrical safety
- Protection against electric shock
- Safety of electrical work
- Circumstances of electrical installations and degrees of protection
- First aid in accident
- Measurements of verification

Esitietovaatimukset
No previous studies are required

Arviointikriteerit
Tyydyttävä (1-2)

The student knows and understands of Electrical safety and standards to a satisfactory extent and is able to apply them to usual problems

Hyvä (3-4)

The student is familiar with the concepts and methods of Electrical safety and standards , and is able

to apply them to different types of problems

Kiitettävä (5)

The student is familiar with the concepts and methods of Electrical safety and standards, and is able to apply them to a variety of different problems. The student has demonstrated creativity and innovation, and is able to find new meanings when applying what they have learned

AE00CM55 Data Communications and Security: 4 op

Osaamistavoitteet
The student masters TCP / IP communication and a whole range of different communication connections and their properties, concepts and different relationships. He understands the principles behind IP addresses and subnets, TCP / IP protocols and how they work. The student learns the basics of computer networks and threats and how to protect against them.

Sisältö
Students will become familiar with data communications protocols and how they work. They will understand the principles of data transfer and data communications systems.
-TCP / IP Security
- Security Protocols
- Network Security
- Firewalls and IDS -
- Malware

Esitietovaatimukset
No previous studies are required.

Arviointikriteerit
Tyydyttävä (1-2)

1 - 2 The student knows and understands to a satisfactory extent telecommunications and security concepts and methods.

Hyvä (3-4)

3 - 4 The student is familiar with the concepts and methods of telecommunications and security , and is able to apply them to different types of problems.

Kiitettävä (5)

5 The student is familiar with the concepts and methods of telecommunications , and is able to apply them to a variety of different problems. Students are able to commendable rate issues and know how to apply them.

AE00CM56 Micro Computer Technology: 3 op

Osaamistavoitteet
Upon completion of the course, students will be competent in assembling computers from parts and installing an operating system and other necessary applications in it. They will be able to perform the initial start-up of a computer and carry out the processes needed to maintenance computers and expand their functionality.

Sisältö

- Structure of the more common peripheral devices for computers and how they function
- PC structure, processors, and connections
- RAM/ROM memory
- Magnetic and optic memory
- SSD Hard Drives
- Monitors, voice cards, scanners and printers

Esitietovaatimukset
No previous studies are required.

Arviointikriteerit
Tyydyttävä (1-2)

1-2 The student knows the basics of computer structure.

Hyvä (3-4)

3-4 The student is well versed in the basic concepts and methods of computer technology. He is able to apply to solve problems.

Kiitettävä (5)

5 The student is admirably familiar with the concepts and methods related to computer technology. He is able to apply them in a variety of ways to solve different types of issues and problems.

AE00CM57 Basics of Programming 1: 3 op

Osaamistavoitteet
Students will have command of the basic structures of programming and structural programme design. They can design, code, document and test small-scale programmes with a console user interface.

Sisältö
Basics language structures: types, statements, input/output, selection, looping, branching, methods.

Esitietovaatimukset
No previous studies are required.

Arviointikriteerit
Tyydyttävä (1-2)

The student knows and understands to a satisfactory extent the basic programming structures and is able to apply them to usual programming problems.

Hyvä (3-4)

The student is familiar with the basic programming structures and is able to apply them to programming problems.

Kiitettävä (5)

The student is able to plan independently, implement and utilise various programming structures in his programming exercises.

AE00CM58 Basics of Digital Technology: 3 op

Osaamistavoitteet
Students will be able to process digital data and use it to solve logical problems and design and program logical circuits. Students will be able to utilize the modern semiconductor technology.

Sisältö
Digital data, logic gates, boolean algebra, reducing methods, flip-flops, registers, counters, number systems, memory circuit technology, programmable logic circuits.

Esitietovaatimukset
No previous studies are required

Arviointikriteerit
Tyydyttävä (1-2)

Student master number systems and know how to make number system transformations using examples.
You will be able to analyze simple digital technology problems and design solutions based on examples.

Hyvä (3-4)

Student master number systems and know how to make demanding number system conversions. You master the basics of logical design and Boolean algebra and know how to simplify expressions. You know the basics of combination logic. You will be able to analyze digital technology problems and design creative solutions.

Kiitettävä (5)

Student master number systems and can do demanding number system conversions. You master the Boolean algebra and can simplify expressions. You master logical design, combinatorial logic and sequence logic and are able to apply knowledge in technical design. You will be able to independently analyze demanding problems and design creative solutions

AE00CM59 Basics of Electronics: 3 op

Osaamistavoitteet
Upon completion of the course, students will be knowledgeable of basic electronic components and will make simple connections for filters and amplifiers. They will calculate and measure how the connections function and the properties of components.

Sisältö
General properties of active and passive components, independent semi-conductors, operational amplifiers and optical components. Common connections, test and measurement connections, analysing connections. Writing relevant reports.

Esitietovaatimukset
No previous studies are required

Arviointikriteerit
Tyydyttävä (1-2)

The student has satisfactory knowledge of the theory of basic electronic components and is able to satisfactorily design and implement basic circuits according to a specific specification.

Hyvä (3-4)

The student has a commendable command of the theory of electronic components and is commendably able to design and implement circuits according to a specific specification. The work is innovative.

Kiitettävä (5)

The student has excellent knowledge of the theory of electronic components and is excellent at designing and implementing circuits according to a specific specification. You will be able to independently analyze and develop functions.

AE21-1010 Professional Studies Modules: 104 op

AE21-1011 Production automation: 19 op

AE00CM84 Machine Automation 1: 4 op

Osaamistavoitteet
Students will be competent in analysing the structures and functions of the control systems used in machine automation systems. They will be able to utilise the IEC standardised programming tools and to develop reliable and energy efficient control software and a user interface for a materials handling device.

Sisältö
- Structural programming (sequence)
- Function block programming
- Standard functions (timers, calculators, comparisons and other commonly used functions)
- Analogue signals
- Recipes
- User interfaces.

Students will engage in hands-on learning of pneumatically and electrically controlled actuators for automation systems using programmable logic and touch screens.

Esitietovaatimukset
- Basics of automation
- Programmable logic controllers

Arviointikriteerit
Tyydyttävä (1-2)

The student knows and masters satisfactorily the basics of using the IEC standard programming tool. He is able to make a functional and safe logic program for a simple automation device using ready-made models.

Hyvä (3-4)

The student knows well the basic concepts which are related to the machine automation and the standard programming methods. He is able to adapt and use ready-made function blocks to solve various problems. The student can test the operation of the automation program and can track possible mistakes which endanger safety by using simulation.

Kiitettävä (5)

The student can create and debug independently a clear structured standard logic program. He can make, test and adapt own function blocks to different applications without forgetting safety.
The student understands the function of the programmable devices which are used in the machine automation and can locate and repair errors by using different simulation and diagnostics tools.

AE00CM85 Laboratory Assignments in Automation 1: 4 op

Osaamistavoitteet
Students will be competent in configuring and programming control systems (PLC) associated with the automation of bulk goods. They will create automation applications for complex process modules utilizing and testing the knowledge and skills they have learned during their studies. In the implementations, the aim is to make the equipment controls as energy efficient as possible.

Sisältö
Students complete exercises in the laboratory using a diverse range of automation devices. The software and devices are those that are commonly used in industry, and therefore students are able to apply the experience they have obtained in the laboratory directly to situations in industry. The devices students use include Siemens and Omron programmable logic controllers, touch-screens, PC monitoring stations, industrial terminals, and RFID (radio frequency identification) sensors. Students also gain experience in using electric motors and pneumatic cylinders.

Esitietovaatimukset
Machine Automation 1

Arviointikriteerit
Tyydyttävä (1-2)

The student can make the configuration of the programmable logic according to a given instruction. He can program and test the basic functions of the controlled PLC device. The student is able to act and solve oncoming basic problems together with the members of the group.

Hyvä (3-4)

In addition to a satisfactory level, the student is able to independently apply, program and test special functions of logics. In addition, he will be able to work with the team to ensure and insist that the programs are safe to use.

Kiitettävä (5)

The student knows how to work together with a group in an effective and systematic way. In addition to device configuration, he is able to find and fix various hardware and programming errors. Together with the team, he ensures that the team results in a reliable, secure, and well-documented program.

AE00CM86 Robotics: 4 op

Osaamistavoitteet
Students will learn about various types of robots and examine robots and how to use them in factory automation and other areas where robots are needed. The will know the structure, features and coordinate systems of robots as well as the periphery devices used in robotics. Students will be competent in handling and programming industrial robots on- and offline. The course provides fundamental knowledge of robotics and an ability to design and select equipment for the automatic handling of products.

Sisältö

Robots types, Industrial robots: mechanical structure, control systems, features, coordinate systems and periphery devices, Handling an ABB industrial robot and basic online programming. Handling a Yaskawa welding robot and programming in offline. Handling and programming Fanuc industrial robot using machine vision system. Working with collaborative robots in assembly tasks based on force sensing.

Arviointikriteerit
Tyydyttävä (1-2)

Rating 1-2 Students master the learning outcomes satisfactorily. Student has completed laboratory exercises and passed theory- and practical programming exams

Hyvä (3-4)

Rating 3-4 Students master the learning outcomes well. Students can apply lecture- and laboratory experiments in exam.

Kiitettävä (5)

Rating 5 Students master the learning outcomes to be commended. Students can apply lecture- and laboratory experiments in exam by showing deeper understanding of industrial robotics.

AE00CM60 Production Management: 4 op

Osaamistavoitteet
Upon completion of the course, students will
be familiar with the concepts associated with production management and the problematic, can be used by production management for future assignments.

Sisältö
Supply-Chain management and ERP,
Production management,
Sales and Operations management,
Master Production Scheduling,
Manufacturing Resource Planning,
Inventory Management,
Introduction to production management system

Arviointikriteerit
Tyydyttävä (1-2)

Satisfactory (1-2) The student knows the basics.

Hyvä (3-4)

Good (3-4): The student masters well the principles of the ERP and operations management.

Kiitettävä (5)

Excellent (5): The student can utilize the learned skills in the exercises, exam and in the demo Enterprise.

AE00CM87 3D-CAD: 3 op

Osaamistavoitteet

Students will learn to create 3D part models, sheet metal models, sub-assembly and assembly models. They will also learn to create assembly and component drawings by using CAD software. They will also learn basic knowledge of the theory of technical drawing and understand the symbols used in mechanical drawing.

Sisältö

-Theory of technical drawing
-3D modelling and general theory of modelling systems
-3D modelling of products and assembly models
-Drawing planes and sheet metal designing
-Diagrams and their standardised symbols

Esitietovaatimukset

No previous studies are required

Arviointikriteerit
Tyydyttävä (1-2)

Satisfactory (2-1)
Students are familiar with the standard machine drawing symbols and be able to model 3D workpieces.

Hyvä (3-4)

Students are able to model the 3D workpieces, create drawings and small assemblies.

Kiitettävä (5)

Students can do a demanding product design.

AE21-1012 Design of Electrical System: 12 op

AE00CM61 Design of Electrical and Automation System: 4 op

Osaamistavoitteet

Students will acquire the ability to interpret drawings in the fields of electrical and automation engineering. They will be competent in using CAD programmes for electrical and automation designing, and they will understand their features and areas where the programmes can be used. Upon completion of the course, students will possess the readiness they need to make simple, field-related drawings using CAD and to choose appropriate ways to present their work.

Sisältö

Basic knowledge of drawings for electrical and automation engineering:
- Command of symbols and drawing techniques
- Ways to use computers in designing
- Practice in designing and drawing general, field-related diagrams
- Functions of the CAD system

Esitietovaatimukset

Electrical engineering
Components of control systems

Arviointikriteerit

Tyydyttävä (1-2)

The student knows and understands to a satisfactory extent the basic concepts of electrical CAD software, and is able to draw basic level main circuits, control circuits and panel layouts and apply them to basic level design of electrical and automation system.

Hyvä (3-4)

The student is familiar with the concepts of electrical CAD software, and is able to draw different types of main circuits, control circuits and panel layouts and is able to apply them to to different types design of electrical and automation system.

Kiitettävä (5)

The student is familiar with the concepts and methods of electrical CAD software, and is able to apply them well to a variety of different types design of electrical and automation system.

AE00CM62 Laboratory Assignments in Control Systems: 3 op

Osaamistavoitteet
Students will learn about the basic connections involved in electrical and automation engineering. They will be competent in constructing an automation system, and they will gain insight into the regulations and technical aspects of installing electrical instruments.

Sisältö
During the course, students will construct a small-scale automation system. The automation systems involve mechanics, programmable logic controllers, and various sensors, actuators and motor output. Students will design and programme a functioning system.

Esitietovaatimukset
Components of control systems

Arviointikriteerit
Hyväksytty/hylätty

The student is able to self-implement small-scale electrical switching, as well as its control, based on the plan they have made. In addition, students must be familiar with the basic workings of the control systems components used. Competence is measured by exam and practical practice.

AE00CM63 Safety in Electrical Installation: 2 op

Osaamistavoitteet
Students will understand the qualifications required for working with electricity and acquire the knowledge and skills needed to work safely with electricity, abiding by the installationa dn standards recommended by manufacturers. Students will comply with the principles of electrical safety, which include the right attitude, responsibility, the right tools and safe working methods.

Sisältö
- Electrical Safety Act and Decree
- Electrical Safety Standard SFS 6002
- Electrical installations/SFS 6002 series
- Familiarisation with lab work involving electricity
- Checklists and forms for electrical safety

- Working conditions and protective gear
- First-aid

Esitietovaatimukset
Electrical safety (2cr)

Arviointikriteerit
Hyväksytty/hylätty

The student describes the basic challenges of electrical work safety and is able to apply electrical safety requirements in normal situations. The student must also pass the exam successfully.

AE00CM64 Electric Drives: 3 op

Osaamistavoitteet
Students will learn about the basic principles of electric motors, the functions of direct current motors (DC motors) and alternating current motors (AC motors). Adjustable drives and control system engineering are also discussed. The aim of the course is to give students a general idea of electric motors as an integral part of automation engineering. Upon completion of the course, students will know how to choose the correct electrical drives and connect them to an electrical network.

Sisältö
- Basic principles of electric motors
- Direct current motors (DC motors)
- Cage induction motors
- Frequency converters
- Servo-motors
- Servo-controls
- Stepping motors and their controls

Lab work: Connecting motors and motor controls
- Testing
- Measuring

Arviointikriteerit
Tyydyttävä (1-2)

The student knows and understands to a satisfactory extent the electric drives concepts and methods, and is able to apply them to usual problems.

Hyvä (3-4)

The student is familiar with the concepts and methods of electric drives, and is able to apply them to different types of problems. The student is able to combine the accumulated knowledge and skills with previous experiences in the subject.

Kiitettävä (5)

The student is familiar with the concepts and methods of electric drives and is able to apply them to a variety of different problems. The student has demonstrated creativity and innovation, and is able to find new meanings when applying what they have learned.

AE21-1018 Process Automation: 11 op

AE00CM65 Measuring Technology and Instrumentation: 3 op

Osaamistavoitteet
Students will be competent in making basic measurements safely and correctly. They will be able to determine and locate possible faults by interpreting the measuring results. The student is able to tune the equipment to operate energy efficiently based on the measurement results obtained. They will take into account the impact of external interferences on measurement results. Students will learn about the characteristics of computer-based measuring devices and their possible uses in different applications.

Students will understand industrial processes, instrumentation diagram drawings and possess the eadiness they need to design industrial control and adjustment systems. Students will be competent in using the more common methods of measurement used in industry and be capable of planning, measuring and installing instruments for industrial processes. They will also be competent in selecting measurement and control instruments and plan the installation, purchase and startup of them.

Sisältö
Mittaus:
Types of electricity and how to measure them ** Instruments for measuring electricity (multimeters, oscilloscopes, RLC meters, analyzers, installation testers, PC meters) ** Measurements (currency, voltage, resistence, frequency) ** Measurement accuracy and factors contributing to disturbances ** Troubleshooting systems ** Measurements in the lab.

Instru:
- Basic concepts of industrial instrumentation
- Principles of instrumentation and measurement technology
- Dimensioning adjustment valves
- Common industrial measurements
- Instrument installation and field engineering for industrial processes
- Instrumentation diagrams and documents
- Maintenance documents and how to make them

Esitietovaatimukset
Electrical engineering
Automation technology basic courses

Arviointikriteerit
Tyydyttävä (1-2)

Mittaus:
The student knows the measuring methods of basic quantities and can carry out the multimeter and the oscilloscope safely using, the practical measurings. Furthermore, he knows let one to calibrate analogy based and digital based measure transmitters according to the instruction.
Instru:
The student knows the measuring methods of basic quantities and the selection criteria of the sensor types. He can place the sensors according to the instruction and can connect the sensors and regulating units. Furthermore, he can read the PI schemes and can locate the devices from the processes according to the code.

Hyvä (3-4)

Mittaus:

In addition to the previous, the student knows the methods of the troubleshooting. Both one can know the modern measuring devices and their use. He can make the measurings of the automation according to the instruction using PC based measurement systems.
Instru:
In addition to the previous, the student knows the operating principles of modern regulating units and can locate using the information within reach of the fault and indicators. Furthermore, he knows when making the safe operation methods.

Kiitettävä (5)

Mittaus:
The student can search for independently, it is not chosen and adapt, the measuring devices and applications to the different measurings of the automation. He can measure the condition of the measuring devices which are used in the processes and if necessary, command the tuning and calibration of them. Furthermore, he knows the standard placements of measuring devices.
Instru:
The student can dimension independently and can choose the correct measuring devices and regulating units to the basic processes of the automation and can search for information about the special measurement equipment and can apply the knowledge got by it. Furthermore, he can make changes in the PI schemes and in the PI circuit diagrams.
In addition to the matters well above, the student is familiar with the function of the control circuits which are used in the instrumentation and can dimension the different valves and pumps using dimensioning programs on the market.

AE00CM66 Control Engineering: 3 op

Osaamistavoitteet
Students will master the basics of control technology and be able to apply the control theory to practical control systems. Students will learn to design control systems for different purposes. They will also be able to tune control systems.

Sisältö
- Basics of control technology
- Transfer function
- Controller blocks in time domains
- Control loop tuning
- Structure and the types of controllers
- Designing a control systems

Esitietovaatimukset
Sensor Technology
Automation Technology Mathematics

Arviointikriteerit
Tyydyttävä (1-2)

The student knows the basics of control technology and can identify the terms used.

Hyvä (3-4)

The student masters well principles of control system design and tuning.

Kiitettävä (5)

The student can utilize learned skills in demanding projects.

AE00CM67 Hydraulics and Pneumatics: 2 op

Osaamistavoitteet
Students will learn about the controls and actuators used in hydraulic and pneumatic systems. They will be competent in designing and creating hydraulic and pneumatic systems. They are capable of the design of the system and selection of the components.

Sisältö
Hydraulic pumps, hydraulic valves, hydraulic actuators, types of compressors, valve types, pneumatic timers and logic valves, control systems for pneumatic circuits, principles of designing a pneumatic system.

Arviointikriteerit
Tyydyttävä (1-2)

The student knows the basics of hydraulics and pneumatics.

Hyvä (3-4)

The student can design pneumatic/hydraulic systems similar to the exercises.

Kiitettävä (5)

The student can design pneumatic/hydraulic systems by the given requirements of the system functionality.

AE00CM68 Components of Control Systems: 3 op

Osaamistavoitteet
Students will be competent in selecting and using electrical components of control systems. They will also be able to size the components of control system.

Sisältö
Components of control systems, sizing and selection.

Esitietovaatimukset
Electrical and Thermal Physics
Electrical Engineering

Arviointikriteerit
Tyydyttävä (1-2)

Student knows basic components of control systems.

Hyvä (3-4)

Student knows basics components of control systems. Student can select and size components.

Kiitettävä (5)

Student knows the contents of the course well and can apply their knowledge to demanding projects.

AE21-1013 Industrial Internet of Things: 15 op

AE00CM69 Databases: 3 op

Osaamistavoitteet
The student understands the concept of database and database management system. Student knows how database is designed and how information is analyzed and modeled. Student can transform entity-relationship model to a relational model, and the to relation database. Student knows the SQL programming language and can make queries and other operations to database, also from other programs. Student knows the basics of NoSQL databases.

Sisältö
- Concepts of databases and database management systems
- Relational databases
- Conceptual modelling
- ER (Entity-Relationship) modelling
- SQL (Structured Query Language)
- Basics of NoSQL databases

Esitietovaatimukset
- Basics of programming

Arviointikriteerit
Tyydyttävä (1-2)

The student understands the concept of database. Student knows how database is designed and how information is modeled. Student knows the basics of SQL programming language and can make queries and other operations to database.

Hyvä (3-4)

The student understands the concept of database and database management system. Student knows how database is designed and how information is analyzed and modeled. Student can transform entity-relationship model to a relational model, and the to relation database. Student knows the SQL programming language and can make queries and other operations to database. Student knows the basics of NoSQL databases.

Kiitettävä (5)

The student understands the concept of database and database management system. Student knows how database is designed and how information is analyzed and modeled. Student can transform entity-relationship model to a relational model, and the to relation database. Student masters the SQL programming language and can make queries and other operations to database, also from other programs. Student can develop applications, which use NoSQL databases.

AE00CM70 Network Programming: 3 op

Osaamistavoitteet
Student can develop client-server applications. Student can develop concurrent and distributed applications with different techniques and programming languages. Student can develop simple web-based applications and utilize REST API's.

Sisältö

- Client-server model
- Socket programming
- HTTP protocol
- Concurrent programs
- Threads and synchronization
- Web-based applications and REST API
- MQTT

Esitietovaatimukset
- Object-oriented programming

Arviointikriteerit
Tyydyttävä (1-2)

Student can develop simple client-server applications.

Hyvä (3-4)

Student can develop client-server applications. Student can develop concurrent and distributed applications with different techniques and programming languages. Student can develop simple web-based applications and utilize REST API's.

Kiitettävä (5)

Student can develop client-server applications. Student can develop concurrent and distributed applications with different techniques and programming languages. Student can develop simple web-based applications and utilize REST API's.

AE00CM71 Basics of Industrial Internet of Things: 3 op

Osaamistavoitteet
Student knows how the development in Industrial Internet of Things (IIoT) affects to the manufacturing industry and to its products and services.
Student can utilize IoT platforms and cloud services. Student can develop application, which collects data from automatic machines and industrial processes and sends that data to IoT services.

Sisältö
Student knows how the development in Industrial Internet of Things (IIoT) affects to the manufacturing industry and to its products and services.
Student can utilize IoT platforms and cloud services. Student can develop application, which collects data from automatic machines and industrial processes and sends that data to IoT services.

Arviointikriteerit
Tyydyttävä (1-2)

Student knows how the development in Industrial Internet of Things (IIoT) affects to the manufacturing industry and to its products and services. Student can utilize IoT platforms.

Hyvä (3-4)

Student knows how the development in Industrial Internet of Things (IIoT) affects to the manufacturing industry and to its products and services.
Student can utilize IoT platforms and cloud services. Student can develop application, which collects data from automatic machines and industrial processes and sends that data to IoT services.

Kiitettävä (5)

Student knows how the development in Industrial Internet of Things (IIoT) affects to the manufacturing industry and to its products and services.
Student can utilize IoT platforms and cloud services. Student can develop application, which collects data from automatic machines and industrial processes and sends that data to IoT services. Student can develop web-based applications which displays and stores the process data.

AE00CM72 Cloud Computing: 3 op

Osaamistavoitteet
The student knows the concepts related to cloud services and their purposes of use. The student knows the interfaces and functionalities of the cloud services introduced during the course. Student can make applications which send data to the cloud services in question.

Sisältö
Service models of cloud services:
-Software as a Service (SaaS)
-Platform as a Service (PaaS)
-Infrastructure as a Service (IaaS)

Getting acquainted with different cloud services e.g.:
-Microsoft Azure
-Siemens MindSphere
-Wapice IoT-Ticket

Practical exercises on the cloud services mentioned above are included in the course.

Arviointikriteerit
Tyydyttävä (1-2)

Student has satisfactory knowledge of the basics of cloud services. Student can make a simple application which sends data to some cloud service introduced during the course.

Hyvä (3-4)

The student has good knowledge of the basics of cloud services. The student is able to apply the gained knowledge and to utilize already existing code examples in order to make applications which communicate with cloud services.

Kiitettävä (5)

The student has excellent knowledge of the basics of cloud services. The student can create independently applications that communicate with different cloud services and also test them and search for possible mistakes in them.

AE00CM73 Introduction to Artificial Intelligence: 3 op

Osaamistavoitteet
Students will be competent in using the mathematical methods described in the course contents to solve practical mathematical problems.

Sisältö

Minimization by gradient descent
Linear regression
Logistic regression
Neural networks

Esitietovaatimukset
Algebra and geometry, Vectors and matrices, Differential and integral calculus, Automation technology mathematics

Arviointikriteerit
Tyydyttävä (1-2)

satisfactory (1-2): The student knows and understands to a satisfactory extent the basic concepts and methods discussed in the course, and is able to apply them to usual problems.

Hyvä (3-4)

good (3-4): The student is familiar with the concepts and methods discussed in the course, and is able to apply them to different types of problems. The student is able to combine the accumulated knowledge and skills with previous experiences in the subject.

Kiitettävä (5)

excellent (5): The student is familiar with the concepts and methods discussed in the course, and is able to apply them to a variety of different problems. The student has demonstrated creativity and innovation, and is able to find new meanings when applying what they have learned

AE21-1015 Electronics: 10 op

AE00CM81 Advanced Electronics: 3 op

Osaamistavoitteet
Students will understand the construction of electronic devices and will get acquainted with the designing limitations and definations. The students will also learn to understand the safety, EMC and material demands of electronic devices. Students will understand power supply requirements, life time demands and integration of digital and aanlog electronics.

Sisältö
Theoretical basics of electronics and practical design of electronic equipment and devices

Esitietovaatimukset
Basics of electronics

Arviointikriteerit
Tyydyttävä (1-2)

The student knows the principles of electronics design. Can select components for simple circuits and implement the circuit.
Knows how to document electronics

Hyvä (3-4)

The student is able to design and implement electronics with simple circuits. Can also look for faults in circuits.
Good documentation of electronics

Kiitettävä (5)

The student knows the contents of the course well and can apply their knowledge in practice.
The student is able to design and implement complex electronics circuits. Can document a well-manufactured electronic device.
Excellent documentation of electronics

AE00CM82 Laboratory Assignments in Electronics: 3 op

Osaamistavoitteet
Upon completion of the course, students will be able to use measuring devices and software.
Students will apply measuring devices and sensors, handle and verify collected signals. They will be able to develop and design various measuring equipment and methods.

Sisältö
- Various sensor circuits: temperature, moisture, light, force, etc.
- Signal amplifiers
- Measuring methods
- Sensor module connections
- Analyzing measurements
- Post-processing with an appropriate software

Esitietovaatimukset
Basics of electronics

Arviointikriteerit
Tyydyttävä (1-2)

The student will do the job of the course assignments successfully. Laboratory work is documented.
The student is very sufficiently familiar with subjects.

Hyvä (3-4)

The student will do the job of the course assignments well. Laboratory work is well documented. The student is very familiar with subjects.

Kiitettävä (5)

The student will do the job of the course assignments perfectly. The student is very well familiar with subjects. Laboratory work is
excellent documented. Independently studies the operation of the components

AE00CM83 Embedded Systems: 4 op

Osaamistavoitteet
Upon completion of the course, students will verify the basic structures and function of micro-controllers and will realize a defined embedded system using a micro-controller. Additionally, students will be able to adapt hardware-oriented programming in C language to embedded systems. Students will solve various applications and exercises using hardware-oriented programming. Students will be able to develop a program and electronics for a small embedded system.

Sisältö
- Hardware-oriented C language and Assembly language

- Development environment; installation, usage and maintenance
- C compiler, simulator and hardware measurement
- 8-bit or 32-bit micro-controller and peripheral devices

Esitietovaatimukset
Basics of Programming 1

Arviointikriteerit
Tyydyttävä (1-2)

The student will do the job of the course assignments successfully. The student is familiar with general features of embedded system. The student knows the simple circuits and the basics of embedded system software

Hyvä (3-4)

The student will do the job of the course assignments well.
The student is able to design and implement embedded system circuits and embedded system software. Knows the documentation of the embedded system.
The student is familiar with embedded system and is able to utilize basic features.

Kiitettävä (5)

The student will do the job of the course assignments perfectly. The student is able to design and implement the connections and embedded system software of an extensive and complicated embedded system.
The student is familiar with embedded system and is able to utilize most of features.

AE21-1014 Information Technology: 23 op

AE00CM74 Data Structures and Algorithms: 4 op

Osaamistavoitteet
Student can implement fundamental data structures and algorithms and compare their properties. Student can use different data structures, such as lists, sets, dictionaries, trees and hashing, and algorithms associated to them. Student can develop applications, which utilizes different kind of data structures and algorithms efficiently.

Sisältö
- Lists, stack, queue
- Dictionaries
- Trees
- Sorting
- Searching
- Hashing
- Principles of algorithm analysis
- Collection classes of C#, Java or C++

Arviointikriteerit
Tyydyttävä (1-2)

Student can implement fundamental data structures and algorithms. Student can use lists and dictionaries, and algorithms associated to them.

Hyvä (3-4)

Student can implement fundamental data structures and algorithms and compare their properties. Student can use different data structures, such as lists, sets, dictionaries, trees and hashing, and algorithms associated to them. Student can develop applications, which utilizes different kind of data structures and algorithms.

Kiitettävä (5)

Student can implement fundamental data structures and algorithms and compare their properties. Student can use different data structures, such as lists, sets, dictionaries, trees and hashing, and algorithms associated to them. Student can develop applications, which utilizes different kind of data structures and algorithms efficiently. Student can analyze the running time of the algorithms.

AE00CM75 Virtual Environments: 3 op

Osaamistavoitteet
Students are able to design, deploy, and maintain a variety of virtualized server environments.

Sisältö
The course installs virtualized server environments using VmWare, Microsoft and Linux virtualization methods, for example.
- VmWare
- Citrix XenServer
- KVM (Kernel Based Virtual Machine)
- PROXMOX VE

Esitietovaatimukset
No prior information requirements.

Arviointikriteerit
Tyydyttävä (1-2)

1-2 Students are able to rate the basics.

Hyvä (3-4)

3-4 Students are able to rate the key issues

Kiitettävä (5)

5 Students are able to commendable rate issues and know how to apply them.

AE00CM76 Software Engineering: 3 op

Osaamistavoitteet
Student is familiar with the basic knowledge of the software process. Student knows the different types of software project documentation. Student learns to use software development tools and methods.

Sisältö
Software life cycle models, agile methods, UML-modelling, requirements specification, testing and version control.

Esitietovaatimukset

No previous studies are required.

Arviointikriteerit
Tyydyttävä (1-2)

Student recognizes UML-models, testing plans and other types of software project documentation. Student knows how to create repository for version control.

Hyvä (3-4)

Student can write a program from UML-model and is able test program with help of testing plan. Student is also able to write other types of software project documentation. Student is able to keep project's files updated with version control system.

Kiitettävä (5)

Student can design and apply UML-models, testing plans and other types of software documentation for software project. Student is able to fork another student's projects with version control system.

AE00CM77 Client-side Programming: 3 op

Osaamistavoitteet
The student knows how to build client-side single-page and multipage web-applications. Student can develop interactive functionality to HTML pages using modern technologies.

Sisältö
Basics:
- HTML
- CSS
- Javascript

Tools and frameworks:
- npm as a build tool
- React
- Webpack
- Redux

Practical exercises

Arviointikriteerit
Tyydyttävä (1-2)

The student knows the basic terms and technologies used in client-side programming.

Hyvä (3-4)

The student masters well the principles of client-side programming and is able to apply them to different exercises.

Kiitettävä (5)

The student masters well the principles of client-side programming and is able to adopt new client-side technolgies on his own. He is also able to apply them to even the most demanding cases.

AE00CM78 Server-side Programming: 3 op

Osaamistavoitteet
Student knows the fundamentals of web applications. Student can develop web-based applications, which utilize REST APIs. Student can program the server side of the application with JavaScript and Node.js. Student can use relational and NoSQL databases for storing the application's data. User can develop tests for the server program.

Sisältö
- Fundamentals of web applications
- HTTP, REST API
- JavaScript, TypeScript
- Programming server with Node.js and Express
- Testing server programs
- User administration

Arviointikriteerit
Tyydyttävä (1-2)

Student knows the fundamentals of web applications. Student can develop simple web-based applications with Node.js.

Hyvä (3-4)

Student knows the fundamentals of web applications. Student can develop web-based applications, which utilize REST APIs. Student can program the server side of the application with JavaScript and Node.js. Student can use relational or NoSQL databases for storing the application's data.

Kiitettävä (5)

Student knows the fundamentals of web applications. Student can develop web-based applications, which utilize REST APIs. Student can program the server side of the application with JavaScript and Node.js. Student can use relational and NoSQL databases for storing the application's data. User can develop tests for the server program.

AE00CM79 Object-oriented Programming: 4 op

Osaamistavoitteet
Students will learn how to apply object-oriented paradigms and how to develop object-oriented PLC and PC software

Sisältö
Class, object, encapsulation, inheritance, polymorphism, programming language syntax and object-oriented programming in automation applications

Esitietovaatimukset
Basics of Programming 1

Arviointikriteerit
Tyydyttävä (1-2)

Satisfactory (1-2): The student knows basics
The student recognizes the concepts and theory of object-oriented programming. The student is able to design, document and implement simple object-oriented structures.

Hyvä (3-4)

Good (3-4): The student masters well principles of object oriented paradigms in PLC and PC programming.
The student masters the concepts and theory of object-oriented programming. The student is able to design, document and implement demanding classroom structures. The student knows the object-oriented programming language and is able to use it to implement programs that implement practical needs.

Kiitettävä (5)

Excellent (5): The student can utilize learned skills in demanding projects,
The student knows the concepts and theory of object-oriented programming. The student is able to design, document and implement demanding classroom structures. The student has a comprehensive knowledge of object-oriented programming language and is able to implement programs that implement practical needs in a versatile way with the help of object-oriented programming.

AE00CM80 User Interface Design: 3 op

Osaamistavoitteet
Students will learn how to evaluate different user interfaces and how to identify user groups. They will also learn how to design a user interface according to human-centred design processes and the principles of the sustainable development, and how to create a user interface using SCADA software.

Sisältö
Evaluating user interfaces, identifying users, designing user interfaces, visually designing user interfaces, cognition and SCADA software.

Arviointikriteerit
Tyydyttävä (1-2)

The student knows and commands the basic structure of the user interfaces in the one to be been satisfied with numbers and can tell its opinion on the function of the user interface. Furthermore, he can make the user interface according to the basic rules.

Hyvä (3-4)

The student knows well the basic concepts which are related to the user interface, the rules and the structure of the functioning user interface. He can create the user interface to the different applications using known programming tools.

Kiitettävä (5)

The student knows the rules which are well used in the planning of the user interface and can make user interfaces to the different applications and environments which are in accordance with the rules. Furthermore, he is able to adapt in the solving of questions and problems from many sides of different types the matters learned by him.

AE21-1020 Elective Professional Studies: 14 op

AE00CM91 C++ Programming: 3 op

Osaamistavoitteet
Upon completion of the course the student can create C++ applications into micro controller based platform, create function libraries and user interfaces.

Sisältö
The features of the embedded platform and microcontroller, programming of measures and controls, user interface with microcontroller platform, user interface by remote, memory usage, multitasking principle and realization.

Esitietovaatimukset
Basics of programming.

Arviointikriteerit
Tyydyttävä (1-2)

The student knows the basics of C++ programming language.

Hyvä (3-4)

The student masters the principles of device depending programming with C++ programming language.

Kiitettävä (5)

The student can develop versatile applications self-directed.

AE00CM92 Digital Signal Processing: 3 op

Osaamistavoitteet
Students will be competent in command of the analysis, processing and data transmission of digital signals

Sisältö
- Signal frequencies, filtering, and modulation
- Digital processing of a sound frequency signal
- Applications for signal processing: adaptive filtering, modification of sampling frequencies, compression of sound signals
- Brief discussion of speech processing, image processing and image coding

Arviointikriteerit
Tyydyttävä (1-2)

satisfactory (1-2): The student knows and understands to a satisfactory extent the basic concepts and methods of digital signal processing, and is able to apply them to usual problems.

Hyvä (3-4)

good (3-4): The student is familiar with the concepts and methods of digital signal processing, and is able to apply them to different types of problems. The student is able to combine the accumulated knowledge and skills with previous experiences in the subject.

Kiitettävä (5)

excellent (5):): The student is familiar with the concepts and methods of digital signal processing,

and is able to apply them to a variety of different problems. The student has demonstrated creativity and innovation, and is able to find new meanings when applying what they have learned

AE00CM93 Machine Automation 2: 4 op

Osaamistavoitteet
Students will learn how to create multi-axis motion control systems using frequency converters, AC motors, servo-drives and servo-motors. They will also learn to create data transfer solutions for various types of motion control systems using fieldbuses.

Sisältö
Controlling a goods processing station using programmable logic, servo-drive and servo-motor, PLC, frequency converters and AC motors, multi-axis motion control using a PC-based controller, signals and data transmission solutions commonly used in motion control instruments

Esitietovaatimukset
Machine Automation 1

Arviointikriteerit
Tyydyttävä (1-2)

The student knows the basics of motion control.

Hyvä (3-4)

The student masters well principles of multi-axis motion control and fieldbus communication.

Kiitettävä (5)

The student can utilize learned skills in demanding multi-axis motion control projects.

AE00CM94 Laboratory Assignments in Automation 2: 4 op

Osaamistavoitteet
Students will be able to configure and programme discrete automation control systems (PLC). Students will learn how to develop a multi-axis motion control system using frequency converters, cage induction motors, servo-drives and servo-motors. They will be competent in constructing various data transfer solutions needed for motion control in automation systems using fieldbuses.

Sisältö
Students will practise how to programme and configure the control for a goods-processing station using programmable logic, a servo-drive and a servo-motor, as well as a frequency converter and cage induction motor. Students will also programme a multi-axis, PC-based motion controller and they will also practice configuring different fieldbus systems.

Arviointikriteerit
Hyväksytty/hylätty

Approved written reports of laboratory exercises.

AE21-1017 PRACTICAL TRAINING: 30 op

AE00CM88 Practical Training 1: 15 op

Osaamistavoitteet
The aims of practical training are as follows:

- Students learn to work in the working world as a member of a work community.
- Students learn to apply the knowledge and skills they have learned at the university to practical work.
- Students gain experience in the technical implementations and favourable practices characteristic of their chosen field.
- Students learn about various work methods and phases.
- Students gain experience in carrying out operations economically and responsibly.
- Students develop their social skills and langauge skills.
- Students' ability to withstand pressure and uncertainty increases.
- Students practice their skills in management.

Sisältö
Practical training is an integral part of studying at the university of applied sciences, and it is a degree requirement. Practical training is not only working, but it is learning while working and applying that which has been learned while studying at the university. Practical training teaches students how to survive in life after the university. It also provides students with the opportunity to gain important contacts with employers and their representatives.

Students are responsible for obtaining an internship and making a contract with the employer. In this way, the practical training also teaches students the process of applying for a job. During their training, students should discuss possible topics or projects for their final thesis.

Arviointikriteerit
Hyväksytty/hylätty

the student completes 2.5 months (or 400h) of training in a company or community.

AE00CM89 Practical Training 2: 15 op

Osaamistavoitteet
The aims of practical training are as follows:

- Students learn to work in the working world as a member of a work community.
- Students learn to apply the knowledge and skills they have learned at the university to practical work.
- Students gain experience in the technical implementations and favourable practices characteristic of their chosen field.
- Students learn about various work methods and phases.
- Students gain experience in carrying out operations economically and responsibly.
- Students develop their social skills and langauge skills.
- Students' ability to withstand pressure and uncertainty increases.
- Students practice their skills in management.

Sisältö
Practical training is an integral part of studying at the university of applied sciences, and it is a degree requirement. Practical training is not only working, but it is learning while working and applying that which has been learned while studying at the university. Practical training teaches students how to survive in life after the university. It also provides students with the opportunity to

gain important contacts with employers and their representatives.

Students are responsible for obtaining an internship and making a contract with the employer. In this way, the practical training also teaches students the process of applying for a job. During their training, students should discuss possible topics or projects for their final thesis.

Arviointikriteerit
Hyväksytty/hylätty

The student completes 2.5 months (or 400h) of training in a company or community. Student also return a report for training

AE21-1016 BACHELOR'S THESIS: 15 op

AE00CM95 Thesis: 15 op

Osaamistavoitteet
As a rule, students write their final thesis during their fourth year of studies. Students should choose their thesis topic as early as possible, during their internship completed in the autumn of their fourth year of studies at the latest.

Students do their thesis as an independent project in design, development, or as a survey. The thesis may also be a part of a more extensive research or development project. The purpose of the thesis is to give students an opportunity to show their competence in independently utilising theoretical information to solve a practical problem.

With few exceptions, students usually do their thesis for an enterprise. This gives students an excellent opportunity to pave their way into the working world and the services of the enterprise for which they have written their thesis.

Sisältö
More detailed information about evaluation: Seinäjoki UAS's Instructions for Writing a Thesis.

Esitietovaatimukset
More detailed information about evaluation: Seinäjoki UAS's Instructions for Writing a Thesis.

Lisätiedot
More detailed information about evaluation: Seinäjoki UAS's Instructions for Writing a Thesis.

Arviointikriteerit
Tyydyttävä (1-2)

More detailed information about evaluation: Seinäjoki UAS's Instructions for Writing a Thesis.

Hyvä (3-4)

More detailed information about evaluation: Seinäjoki UAS's Instructions for Writing a Thesis.

Kiitettävä (5)

More detailed information about evaluation: Seinäjoki UAS's Instructions for Writing a Thesis.

AE21-1019 ELECTIVE STUDIES: 10 op

AE21-1026 Other Elective Studies: 10 op

AE21-1027 Multi-Field Project Studies: 10 op