Häme University of Applied Sciences

Degree Programme in Electrical and Automation Engineering

Bachelors of Engineering specialising in Electrical and Automation Engineering have the competence required for designing electrification and automation for buildings and industrial production equipment. They are able to make use of their education in applying electrical and automation engineering to different application areas, such as lighting, traffic and lift control as well as robotics.

The Degree Programme in Electrical and Automation Engineering is focused on electrical engineering, the automation of production machines and equipment, production facility maintenance, distributed energy production applications and smart controls. The degree programme makes use of the possibilities of new technology in a practical learning process that contains plenty of doing things by oneself.

The Degree Programme in Electrical and Automation Engineering is a Finnish-language programme that runs concurrently with work, enabling graduates to apply for an electrical work supervisor qualification in accordance with the Electrical Safety Act.

The full-time Degree Programme in Electrical and Automation Engineering, which runs in both English and Finnish, is oriented towards using automation engineering in new application areas. New, efficient and inexpensive IT devices especially are an avenue for interesting opportunities in automation engineering.

Electrical and automation engineers typically work in high technology companies as planners and specialists, and with enough experience, in supervisory roles as well. Their work is most often done in multidisciplinary teams of specialists in an international environment.

DIFFERENCES BETWEEN WORK-CONCURRENT EDUCATION AND FULL-TIME EDUCATION

The English and Finnish-language Degree Programme in Electrical and Automation Engineering is focused on automation engineering, whereas the work-concurrent programme is focused on electrical engineering. This is reflected in the work-concurrent programme as a minimum 45 cr electrical engineering module.

The content definition of the electrical engineering module complies with the following Finland's national regulations on qualification requirements:

- KTMp 516 (http://www.edilex.fi/tukes/fi/lainsaadanto/19960516?toc=1)
- Sections 12-14 Requirements for Qualification

The electrical engineering modules must comply with the following Finland's national regulations on education requirements:

- SETI (http://www.seti.fi/index.php?k=18796)

The Finnish and English-language full-time programmes contain 30 cr of automation engineering content and, respectively, the work-concurrent Finnish language programme contains 30 cr of
EMPLOYMENT AFTER GRADUATION

Bachelors of Engineering in Electrical and Automation Engineering typically work in planning and specialist tasks. These tasks are available in, for example, production facilities, planning and consultancy firms as well as equipment and software sales companies.

Planning tasks often consist of projects that focus on, for example, planning and implementing the electrification and automatic control of production equipment and processes. Electrifying residential and production buildings as well as building automation are also typical tasks in the work of a Planning Engineer, as well as tasks relating to work machines, traffic guidance systems and the electricity supply.

Sales and marketing tasks often include mapping the customer’s needs, guiding them in questions that relate to electrical and automation engineering, and the sales and marketing of suitable systems. Their work is often project sales that can include multiple, international companies operating in various fields. Training customers to use their new product can also be included in their tasks.

Maintenance tasks include tasks that relate to the electrical and automation engineering of production equipment and processes. They ensure a factory’s or production equipment's uninterrupted operation for a predetermined period. Tasks include, for example, mapping the failure rate of a piece of production equipment as well as the definition of tasks during planned maintenance outages.

Success in these tasks requires, in addition to technical competence, an active attitude, team-work skills, travel readiness, multicultural competence, a customer-first way of thinking and public speaking skills as well as a minimum of good written and oral skills in English.

Graduates of the work-concurrent Degree Programme in Electrical and Automation Engineering are able to apply for an electrical work supervisor’s qualification in accordance with the Finnish Electrical Safety Act.

COMPETENCE AND STUDY PATHS

Professional competence of a Bachelor of Engineering in Electrical and Automation Engineering consists of several areas. The following is a brief description of said areas.

Basic competence in Electrical and Automation Engineering includes metrology, electrical and automation field-related information and software technology, mathematical methods, physics and electronics.

Design competence includes design processes, methods and tools, simulation methods, equipment and component dimensioning and selection, documentation, application of standards, quality systems and lifecycle approaches.

Electrical and equipment safety competence includes the core laws, regulations and standards that govern electrical and equipment safety.

Business administration and industrial management competence includes project operations, people
management, entrepreneurship, marketing and maintenance.

Application competence includes electrical and electric power systems, building automation, process automation, production automation and general application of technology in new application areas.

Process, equipment and system competence includes the most important electric power production methods and equipment, the most common production processes and machines, the sensors, transmitters and devices used in said processes and devices, as well as control and adjustment systems.

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**BEAU16A-1022 CORE COMPETENCE: 150 op**

**BEAU16A-1000 Fundamentals of Automation Engineering: 15 op**

**Objectives**
This module introduces the study environment and the structure of studies. The module establishes a base for the core concepts of engineering: mathematics, physics and the direct-current circuits of theoretical electrical engineering. Additionally, there is an introduction to automation engineering and logic programming.

The module develops communication skills especially during the engineering project related to the field of automation. Completing the module provides students with the knowledge of the core concepts of automation engineering and the ability to work as a member of a project team. Student can use CAD software.

Module includes first aid and occupational safety training, and introduction to laboratory work.

**EA00BH03 Fundamentals of Automation Engineering and Logic Programming: 5 op**

**Objectives**
Fundamentals of Automation Engineering, 15 cr

This module introduces the study environment and the structure of studies. The module establishes a base for the core concepts of engineering: mathematics, physics and the direct-current circuits of
Theoretical electrical engineering. Additionally, there is an introduction to automation engineering and logic programming.

The module develops communication skills especially during the engineering project related to the field of automation. Completing the module provides students with the knowledge of the core concepts of automation engineering and the ability to work as a member of a project team. Students can use CAD software.

Module includes first aid and occupational safety training, and introduction to laboratory work.

**Content**
This is a part of the module Fundamentals of Automation Engineering.

**EA00BG97 Working English 1: 1.5 op**

**Content**
This is a part of module Fundamentals of Automation Engineering.

**EA00BG98 Mathematics 1: 2 op**

**Content**
This is a part of the module Fundamentals of Automation Engineering.

**EA00BG99 Physics 1: 2 op**

**Content**
This is a part of the module Fundamentals of Automation Engineering.

**EA00BH00 Theoretical Electrical Engineering - DC: 2 op**

**Content**
This is a part of the module Fundamentals of Automation Engineering.

**EA00BH01 Study Skills and Introduction to Work Safety: 0.5 op**

**Content**
This is a part of the module Fundamentals of Automation Engineering.

**EA00BH02 Engineering Project and CAD: 2 op**

**Content**
This is a part of the module Fundamentals of Automation Engineering.

**BEAU16A-1001 Practical Automation Applications: 15 op**

**Objectives**
The module applies the knowledge and skills of the previous module to laboratory work while continuing to introduce the basics of engineering: mathematics, physics and the alternating current circuits of theoretical electrical engineering. Students also learn to use innovation methods for solving engineering problems.

Completing the engineering project provides students with the skills to present and document an engineering project in English. Completing the module provides them with the ability to implement and document small applications in automation engineering.

**EA00BH08 Automation Engineering Laboratory Works: 4.5 op**

**Objectives**
Practical Automation Applications, 15 cr

The module applies the knowledge and skills of the previous module to laboratory work while continuing to introduce the basics of engineering: mathematics, physics and the alternating current circuits of theoretical electrical engineering. Students also learn to use innovation methods for solving engineering problems.

Completing the engineering project provides students with the skills to present and document an engineering project in English. Completing the module provides them with the ability to implement and document small applications in automation engineering.

**Content**
This is a part of the module Practical Automation Applications.

**EA00BC25 Practical Finnish 1: 1.5 op**

**Content**
This is a part of the module Practical Automation Applications.

**EA00BC27 Opiskeluviestintä: 1.5 op**

**Content**
This is a part of the module Practical Automation Applications.

**EA00BH04 Mathematics 2: 2 op**

**Content**
This is a part of the module Practical Automation Applications.

**EA00BH05 Physics 2: 2 op**

**Content**
This is a part of the module Practical Automation Applications.
**EA00BH06 Theoretical Electrical Engineering - AC: 3 op**

**Content**
This is a part of the module Practical Automation Applications.

**EA00BH07 Engineering Project and Innovation: 2 op**

**Content**
This is a part of the module Practical Automation Applications.

**BEAU16A-1002 ICT in Automation: 15 op**

**Objectives**
The module explores the applications of logic programming, telecommunications, mathematics and physics in automation design and implementation. Completing the module provides students with knowledge of the operating principles of programmable logic, the ability to program the equipment in use, and a command of the principles of modular programming.

Students gain the mathematics and physics skills integral to automation engineering. Students are aware of the core operating principles of telecommunication systems relating to automation engineering and have an understanding of information security as a part of the system.

**EA00BH12 Logic Programming, Programming Languages and Human Machine Interface: 6 op**

**Objectives**

ICT in Automation, 15 cr

The module explores the applications of logic programming, telecommunications, mathematics and physics in automation design and implementation. Completing the module provides students with knowledge of the operating principles of programmable logic, the ability to program the equipment in use, and a command of the principles of modular programming.

Students gain the mathematics and physics skills integral to automation engineering. Students are aware of the core operating principles of telecommunication systems relating to automation engineering and have an understanding of information security as a part of the system.

**Content**
This is a part of the module ICT in Automation.

**EA00BH09 Mathematics 3: 2 op**

**Content**
This is a part of the module ICT in Automation.

**EA00BH10 Physics 3: 2 op**
**Content**
This is a part of the module ICT in Automation.

**EA00BH11 Telecommunications and Information Security: 5 op**

**Content**
This is a part of the module ICT in Automation.

**BEAU16A-1003 Applied Metrology: 15 op**

**Objectives**
The module explores the metrology theory and methods required in automation engineering as well as the analogue and digital components and applications of electronics. Students learn to apply the mathematical methods used in automation and metrology.

Completing the module gives students the ability to apply the core measurement methods of automation and to evaluate the correctness of the results. They are able to design and implement measurements and understand the importance of calibration.

Students are able to communicate in English, both verbally and in writing, in working environments and tasks of the field of automation. They are able to design and implement a technical report in both Finnish and English.

**EA00BH18 Metrology: 4 op**

**Objectives**
Applied Metrology, 15 cr

The module explores the metrology theory and methods required in automation engineering as well as the analogue and digital components and applications of electronics. Students learn to apply the mathematical methods used in automation and metrology.

Completing the module gives students the ability to apply the core measurement methods of automation and to evaluate the correctness of the results. They are able to design and implement measurements and understand the importance of calibration.

Students are able to communicate in English, both verbally and in writing, in working environments and tasks of the field of automation. They are able to design and implement a technical report in both Finnish and English.

**Content**
This is a part of the module Applied Metrology.

**EA00BH14 Practical Finnish 2: 1.5 op**

**Content**
This is a part of the module Applied Metrology.
EA00BH15 Asiantuntijaviestintä 1: 1.5 op

Content
This is a part of the module Applied Metrology.

EA00BH16 Working English 2: 1.5 op

Content
This is a part of the module Applied Metrology.

EA00BH17 Mathematics 4: 2 op

Content
This is a part of the module Applied Metrology.

EA00BH19 Metrology Laboratory Works: 3 op

Content
This is a part of the module Applied Metrology.

EA00BH20 Electronics: 3 op

Content
This is a part of the module Applied Metrology.

BEAU16A-1011 Work Placement: 30 op

Objectives
The student is familiar with work from the point of view of his or her professional field and is capable of applying the theory of his or her own field of studies to the practices of working life. The student is familiar with constant work and entrepreneurship that develops him, or herself and the professional field, gets work at the end of his or her studies, and can take on international tasks in the field.

• The student knows how to apply the knowledge that he or she has attained into practice,
• knows how to develop him, and herself as well as the professional field,
• knows how to function in an international working community, taking cultural factors into account,
• is capable operating in a an interactive situation flexibly, constructively, and in a goal-oriented manner,
• knows how to communicate as an expert in a structured, understanding and assuring manner.

EA00BH69 Work Placement 1: 15 op

Objectives
Work Placement, 30 cr

The student is familiar with work from the point of view of his or her professional field and is capable
of applying the theory of his or her own field of studies to the practices of working life. The student is familiar with constant work and entrepreneurship that develops him, or herself and the professional field, gets work at the end of his or her studies, and can take on international tasks in the field.

• The student knows how to apply the knowledge that he or she has attained into practice,
• knows how to develop him, and herself as well as the professional field,
• knows how to function in an international working community, taking cultural factors into account,
• is capable operating in a an interactive situation flexibly, constructively, and in a goal-oriented manner,
• knows how to communicate as an expert in a structured, understanding and assuring manner.

Content
This is a part of the module Work Placement.

**EA00BH70 Work Placement 2: 15 op**

Content
This is a part of the module Work Placement.

**EA00BO41 Production of Electric Power and Energy Metering: 15 op**

**Objectives**
The module explores the production methods of electrical energy, power transfer and distribution systems and the core installation components of the distribution system. Completing the module provides students with knowledge on the structure of the electric power production and distribution network and the ability to solve its related mathematical and physical parameters as well as choose and dimension distribution network components and cabling. Additionally, students have a control on the basic measurements of power engineering and are aware of the basics of electrical installations in buildings. Students have the ability to complete a group exercise that is required by the thesis process. Students have the necessary data acquisition skills to work efficiently and improve their professional skills.

Content
Power Engineering

Asiantuntijaviestintä 2, Finnish students

Practical Finnish 3, international students

Mathematics 5

Physics 4

Power Metrology

Electrical Installations

**Evaluation criteria**
Satisfactory (1-2)

The student has completed the module’s learning requirements on the minimal required level. The
student is aware of and recognizes the module’s core concepts and methods.

**Good (3-4)**

The student has completed the module’s learning requirements on a good level. The student understands and is able to implement knowledge imparted in the module in practice.

**Excellent (5)**

The student has completed the module’s learning requirements excellently and has an excellent control on the module’s concepts and models. The student knows how to apply and analyze their new knowledge in new situations.

**EA00BO43 Process Automation: 15 op**

**Objectives**

The module explores the automation of continuous processes, instrumentation and application design as well as the implementation of automation applications. Completing the module provides students an understanding of the core physical phenomena required for designing process automation, and they are able to plan and implement the basic metrological solutions of process automation.

Students are aware of the mathematical background required in designing process automation applications, know the most important instrumentation and bus technology solutions, are aware of the core features of the automation system used for process control and are able to create a small-scale automation application in the system.


**Content**

Fieldbus and Automation System

Swedish 1, Finnish students

Practical Finnish 4, international students

Mathematics 6

Physics Laboratory Works 1

Process Measurements and Instrumentation

**Evaluation criteria**

**Satisfactory (1-2)**

The student has completed the module’s learning requirements on the minimal required level. The student is aware of and recognizes the module’s core concepts and methods.

**Good (3-4)**

The student has completed the module’s learning requirements on a good level. The student understands and is able to implement knowledge imparted in the module in practice.

**Excellent (5)**
The student has completed the module’s learning requirements excellently and has an excellent control on the module’s concepts and models. The student knows how to apply and analyze their new knowledge in new situations.

**EA00BN95 Applied Programming: 15 op**

**Objectives**
Completing the module provides students with awareness of the system’s technology and the ability to apply it in engineering problems as well as using the application development environment in practice. Students have a command of the core mathematical skills relating to the module. Students are able to observe the core physical phenomena in practice and to document the results.

Students are able to work in an international, multicultural project environment and to communicate in English in both written and verbal form in working environments and tasks of the field of automation.

Finnish students: they are able to communicate in Swedish, both verbally and in writing, in professional environments and tasks. International students: Practical Finnish.

**Content**
- Embedded systems
- Swedish 2, Finnish students
- Practical Finnish 5, international students
- Professional English 1
- Mathematics 7
- Physics Laboratory Works 2,

**International Project and Innovation 1**

**Evaluation criteria**

**Satisfactory (1-2)**
The student has completed the module’s learning requirements on the minimal required level. The student is aware of and recognizes the module’s core concepts and methods.

**Good (3-4)**
The student has completed the module’s learning requirements on a good level. The student understands and is able to implement knowledge imparted in the module in practice.

**Excellent (5)**
The student has completed the module’s learning requirements excellently and has an excellent control on the module’s concepts and models. The student knows how to apply and analyze their new knowledge in new situations.
EA00BR17 Automation and Electrical Wiring Design: 15 op

Objectives
The module explores the design of building electrification as well as industrial electrical and instrumentation design by using various CAD software.

Completing the module provides students with the ability to use CAD software to design various electrical applications. They have a control of frequency and time level calculation methods and are aware of their importance for electrical systems.

Finnish students: they are able to communicate in Swedish, both verbally and in writing, in professional environments and tasks. International students, Practical Finnish.

Content
Industrial Electrical and Instrumentation Design

Swedish 3, Finnish students

Practical Finnish 6, international students

International Project and Innovation 2

Mathematics 8

Building Electrical Design and Design Project

Evaluation criteria
Satisfactory (1-2)

The student has completed the module’s learning requirements on the minimal required level. The student is aware of and recognizes the module’s core concepts and methods.

Good (3-4)

The student has completed the module’s learning requirements on a good level. The student understands and is able to implement knowledge imparted in the module in practice.

Excellent (5)

The student has completed the module’s learning requirements excellently and has an excellent control on the module’s concepts and models. The student knows how to apply and analyze their new knowledge in new situations.

BEAU16A-1015 PROFILING COMPETENCE: 90 op

EA00BR18 Distributed Energy Production Applications: 15 op

Objectives
Energy production applications of the future will be more varied, with local production rates set to increase. This requires energy distribution systems to have flexibility and intelligence. The module explores wind and solar energy production, with an eye on solar panel, wind power and solar collector technology. The module’s implementation is practical and in a partially or completely
Completing the module provides students an understanding of the effects of a distributed system on the operation of energy production applications and the ability to make use of metrology and control technology methods in designing and optimising the system. Students are able to choose the necessary equipment and control systems for a small power plant and have a control on authentic labour market communication situations.

Content
Distributed Energy Production Systems
Vaikuttajaviestintä, Finnish students
Practical Finnish 7, international students
Direct Current Technologies
Optimisation of Energy Production and Energy Production Project

Evaluation criteria
Satisfactory (1-2)
The student has completed the module’s learning requirements on the minimal required level. The student is aware of and recognizes the module’s core concepts and methods.

Good (3-4)
The student has completed the module’s learning requirements on a good level. The student understands and is able to implement knowledge imparted in the module in practice.

Excellent (5)
The student has completed the module’s learning requirements excellently and has an excellent control on the module’s concepts and models. The student knows how to apply and analyze their new knowledge in new situations.

EA00BO47 Automation Applications in Smart Home: 15 op

Objectives
The module explores the different building control systems and the new ways they allow for implementing smart controls as well as energy saving solutions. The course also explores various wireless control technologies and buildings’ remote control possibilities.

Completing the module provides students the ability to program building control systems and an understanding of their remote control possibilities. They will have knowledge of the most common wireless control technologies and general building cabling and the related information security solutions.

If necessary, module can be implemented in part or in whole as a project.

Content
Building Automation Solutions
Laboratory Exercises

Wireless Technologies and Premises Cabling

**Evaluation criteria**

**Satisfactory (1-2)**

The student has completed the module’s learning requirements on the minimal required level. The student is aware of and recognizes the module’s core concepts and methods.

**Good (3-4)**

The student has completed the module’s learning requirements on a good level. The student understands and is able to implement knowledge imparted in the module in practice.

**Excellent (5)**

The student has completed the module’s learning requirements excellently and has an excellent control on the module’s concepts and models. The student knows how to apply and analyze their new knowledge in new situations.

**EA00BO60 Advanced Automation Technologies: 15 op**

**Objectives**

The module explores the applications of control technology, robotics, machine vision, artificial intelligence and simulations on automation design and implementation. Completing the module gives students the ability to use the possibilities of simulation in designing robotics or control applications.

Students are able to design and implement a machine vision application using software. They are able to identify and select appropriate control structure and algorithm as well as use applications to support design and implementation. They are able to choose appropriate equipment for control system implementation.

**Content**

Machine Vision

Professional English 2

Robotics

Control Engineering

Simulation and Visualisation

**Evaluation criteria**

**Satisfactory (1-2)**

The student has completed the module’s learning requirements on the minimal required level. The student is aware of and recognizes the module’s core concepts and methods.

**Good (3-4)**

The student has completed the module’s learning requirements on a good level. The student understands and is able to implement knowledge imparted in the module in practice.
Excellent (5)

The student has completed the module’s learning requirements excellently and has an excellent control on the module’s concepts and models. The student knows how to apply and analyze their new knowledge in new situations.

EA00BO45 Production Automation Design: 15 op

Objectives
The module explores the design and implementation of automation in piece goods production. Completing the module gives students knowledge on the implementation methods of control and management in the production process. They are able to plan the operational and equipment configurations of the control system in a production process.

Students are able to create a small-scale production automation application for the control system as well as test and simulate its operation in practice. They know the features of typical production automation sensors and know how to use them in their automation application. Students are aware of the benefits of bus technology in systems integration.

The module is implemented as a project.

Content
Control Systems and Equipments

Data Transfer, Networks and Production Automation

Measurements and Controls

Evaluation criteria
Satisfactory (1-2)

The student has completed the module’s learning requirements on the minimal required level. The student is aware of and recognizes the module’s core concepts and methods.

Good (3-4)

The student has completed the module’s learning requirements on a good level. The student understands and is able to implement knowledge imparted in the module in practice.

Excellent (5)

The student has completed the module’s learning requirements excellently and has an excellent control on the module’s concepts and models. The student knows how to apply and analyze their new knowledge in new situations.

EA00BO01 Maintenance: 15 op

Objectives
The module is a general introduction to the core concepts of maintenance. Important themes include reliability-focused maintenance, production information systems and maintenance budgets.

The module is used to implement a maintenance plan that is based on the lifecycle approach.
Applying the methods are learned during the abovementioned themes. After completing the module student has awareness of the core concepts of maintenance and s/he has ability to apply them in practical situations with the help of the information systems in production.

**Content**
Reliability Centered Maintenance

Maintenance Information Systems

Maintenance Economics

Maintenance Plan

**Evaluation criteria**
Satisfactory (1-2)

The student has completed the module’s learning requirements on the minimal required level. The student is aware of and recognizes the module’s core concepts and methods.

Good (3-4)

The student has completed the module’s learning requirements on a good level. The student understands and is able to implement knowledge imparted in the module in practice.

Excellent (5)

The student has completed the module’s learning requirements excellently and has an excellent control on the module’s concepts and models. The student knows how to apply and analyze their new knowledge in new situations.

**BEAU16A-1033 Professional Skills: 15 op**

**Objectives**

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**99991206 Professional Skills: 15 op**

Content

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**BEAU16A-1013 FINAL THESIS: 15 op**

**Objectives**

The student demonstrates his or her familiarity and skills in his or her own professional field, shows a capability of working in a productive manner in a task typical for an engineer. The student is able to utilise all that he or she has learned during studies, to operate independently, actively, and in a creative manner when working on the thesis. He or she operates methodically, adhering to a schedule, and knows how to communicate both in writing and orally about the results of the work.

The student
- knows how to apply the knowledge and skills that he or she has acquired in the production of the
thesis
- knows how to operate systematically, and in a goal-oriented manner to achieve the goal of the thesis
- knows how to operate with the skills required of an engineer in the tasks of his or her professional field
- is capable operating in an interactive situation flexibly, constructively, and in a goal-oriented manner
- masters both written and oral expert communications in a structured, understandable, and convincing manner.

**EA15 Thesis: 15 op**

**Objectives**

Final Thesis, 15 cr

The student demonstrates his or her familiarity and skills in his or her own professional field, shows a capability of working in a productive manner in a task typical for an engineer. The student is able to utilise all that he or she has learned during studies, to operate independently, actively, and in a creative manner when working on the thesis. He or she operates methodically, adhering to a schedule, and knows how to communicate both in writing and orally about the results of the work.

The student
- knows how to apply the knowledge and skills that he or she has acquired in the production of the thesis
- knows how to operate systematically, and in a goal-oriented manner to achieve the goal of the thesis
- knows how to operate with the skills required of an engineer in the tasks of his or her professional field
- is capable operating in an interactive situation flexibly, constructively, and in a goal-oriented manner
- masters both written and oral expert communications in a structured, understandable, and convincing manner.