Häme University of Applied Sciences

DP in Electrical and Automation Engineering (BEEANU15A7)

An engineer specialised in electrical and automation engineering (B.Eng) knows how to plan electrification and automation both for ordinary household appliances as well as complicated industrial production equipment. The engineer knows how to utilise information and electrical technology in developing automation in new applications. Vehicles, shops, homes, industry, traffic control and street lighting are examples of the most common applications of electrical and automation engineering.

Instruction in electrical and automation engineering focuses on wide-ranging studies in electrical engineering, the automation of production and devices, and the maintenance of production facilities. The possibilities offered by new technology are utilised in the instruction, in the practical studies that include plenty of personal, first-hand activity.

In the English-language training for Electrical and Automation Engineering, the focus is on utilising automation engineering in new areas of application. The efficient and inexpensive new data technology devices in particular offer many interesting opportunities for automation applications.

An electrical and automation engineer typically works in a hightech company in tasks involving planning and expertise, and later, as experience mounts, in various supervisory tasks. The work is nearly always group work with experts from different fields in an international working environment.

DIFFERENCES BETWEEN EDUCATIONAL RESPONSIBILITY IN FINNISH AND ENGLISH LANGUAGES

The Finnish-language instruction in electrical and automation engineering focuses on electrical technology and the English-language instruction on Automation Engineering. This is reflected in the minimum 45-credit module of Finnish-language electrical engineering. In the module table text this is marked with the text SVT.

The Finnish language instruction remit for electrical engineering has 30 credits for its own content. Correspondingly the English language remit has 30 credits of its own content. In the following presentation, it is stated after the name of the module, if the module is the same in both language variations, or if it is directed only at one of the two languages.

GETTING WORK

An engineer specialised in electrical and automation engineering (B.Eng) typically works in planning and expert tasks after graduation. Such tasks are available in production facilities, design and consulting offices and companies specialising in software and hardware sales.

Planning tasks generally comprise projects for the design and implementation of the electrification of production equipment and processes, as well as the automation of guidance systems, for example. The electrification and building automation of residential and industrial buildings are also typical tasks in the work of a planning engineer, as well as tasks related to power tools, traffic guidance systems and electricity distribution.

Sales and marketing tasks often include mapping out the customer's needs, guiding customers in
questions related to electrical and automation technology, and the sales and marketing of systems that are suitable for them. The work often involves selling projects which can involve international enterprises from many different fields. Training customers to use products that they have bought can also be part of the job description.

Maintenance tasks include work related to the electrical and automation technology of production equipment and processes. They secure the uninterrupted function of a factory or productive machinery for a predetermined period of time. The work includes tasks such as analysing the frequency of faults in production automation and determining what work needs to be done during a maintenance shutdown.

In addition to mastering the technology, successful implementation of the tasks requires an active approach and group work skills, a willingness to travel, a customer-oriented way of thinking and presentation skills, as well as a good command of written and oral English.

An engineer graduating from the Finnish-language area of educational responsibility in electrical and automation engineering has the possibility, upon completion of an engineering degree, to independently apply for qualification as an electrical work supervisor and operations supervisor under the terms of the Finnish Electrical Safety Act.

SKILLS AND LEARNING PATHS TO BE ACHIEVED FOR THE DEGREE

The professional skills of an engineer of electrical and automation engineering (B.Eng) consist of several sub-sectors. Their content is briefly described below.

Basic skills in electrical and automation engineering comprise measurement technology, data and software technology in the electric and automation field, mathematical methods, physics and electronics.

Planning skills include processes, methods, and tools for planning, simulation methods, sizing and choosing devices and components, drafting documents, applying standards, quality systems and lifecycle thinking.

Electricity and equipment safety skills include key legislation, regulations and standards related to electricity and equipment safety.

Corporate and production skills include project activities, people management, entrepreneurship, marketing, and maintenance.

Application skills include electrical and electric energy systems, building automation process automation, production automation, and on a general level, the application of technology to new ranges of use.

Process, equipment, and system skills include the most important methods and equipment for electricity production, the most common production processes and machinery, the sensors, transmitters, and regulating units to be used in them, as well as guidance and regulatory systems.

LEARNING PATHS IN THE ENGLISH-LANGUAGE OPTION

The focus of the English-language educational responsibility is on automation engineering. There are two alternate learning paths available - production automation and process automation.
In Production automation students learn about the most important functions and equipment for the production of parceled goods as well as efficient and cost-effective equipment technology based on new-technology microcontrollers. Skills involving production equipment and new technology serve as a foundation for the planning and implementation of functional and efficient automation of production.

In Process automation students become familiar with the most important functions and equipment of the process industry, as well as industrial maintenance. Knowledge of a continuous process and its maintenance is the basis of successful planning and implementation of process automation.

The Industrial management and logistics module is available to all students. The module is implemented virtually. This module is recommended especially to students who have chosen the profile process automation.

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### Application Software (BEEAN15AEA06-1000)

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### Automation and Electrical Wiring Design (EA00BR16)

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### Automation of Automation Engineering (EA00BO02)

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### Automation and Control (EA00BO38)

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### Work Placement (BEEAN15AEA14-1000)

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### Process Automation (BEEAN15AEA07-1000)

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### Embedded Systems (BEEAN15AEA08-1000)

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### Production Automation (EA00BO35)

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### Maintenance (EA00BO14)

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### THESIS (BEEAN15A7777-1000)

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### Final Thesis (BEEAN15AEA15-1000, 99991203)

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**BEEAN15AYDIN-1000 CORE COMPETENCE: 174 op**

**BEEAN15AEA01-1000 Technology project: 16.5 op**
Objectives
The student is reliable, responsible, and works independently in his or her own studies and when functioning as a member of a group. He or she knows how to utilise mathematics and the basic tools of data technology. He or she is familiar with the typical tasks of the field and the career possibilities.

The student functions independently and responsibly in the HAMK learning environment, both in his or her own studies, and as a member of a group, knows how to communicate purposefully as a student and a member of the working community both face-to-face and on line, is capable of utilising the basic tools of information technology in solving problems in the field, is capable of utilising the basic tools of mathematics in solving problems, is familiar with the job description of an automation engineer and with the most common applications of automation

EA0101 Tools of information technology and study skills: 4 op

Content
This theme is a part of the module Technology Project.

EA0102 Basic tools of mathematics: 4 op

Content
This theme is a part of the module Technology Project.

EA0103 Working English: 1.5 op

Content
This theme is a part of the module Technology Project.

EA0104 Communications: 1.5 op

Content
This theme is a part of the module Technology Project.

EA0105 Basics of Practical Finnish: 1.5 op

Content
This theme is a part of the module Technology Project.

EA0106 Technology study project: 4 op

Content
This theme is a part of the module Technology Project.
BEEAN15AEA02-1000 Automation engineering: 16.5 op

Objectives
The student is familiar with and is capable of applying automation technology in its typical applications. He or she is capable of applying electronics in automation engineering. He or she is capable of communication on the use of information technology in automation engineering.

The student knows the basic solutions of automation engineering and the tools for their planning, and knows how to apply them in the practices in the field, is capable of communicating in foreign languages both orally and in writing in the working community of his or her own field, is familiar with the basics of electronics and digital technology and knows the areas of their use and their methods of application in the implementations of equipment applications.

EA0201 The fundamentals of automation engineering and their practical applications: 7.5 op

Content
This theme is a part of the module Automation Engineering.

EA0202 Communications: 1.5 op

Content
This theme is a part of the module Automation Engineering.

EA0203 Basics of Practical Finnish: 1.5 op

Content
This theme is a part of the module Automation Engineering.

EA0204 Electronics and digital technology: 6 op

Content
This theme is a part of the module Automation Engineering.

BEEAN15AEA03-1000 Natural Sciences in Automation Engineering: 15 op

Objectives
The student knows the scientific foundations of automation engineering and is able to apply them into practice in technical solutions. He or she is capable of communicating about the use of the natural sciences in automation.

The student knows the technological basic solutions of measurement technology and is capable of applying them to the practices of automation engineering, is capable of both written and oral communication in a technological working community, is aware of the basic laws of physics and mathematics that are related to automation engineering.
EA0301 Measurement technology and its practical applications: 7.5 op
Content
This theme is a part of the module Natural Sciences in Automation Engineering.

EA0302 Working English: 1.5 op
Content
This theme is a part of the module Natural Sciences in Automation Engineering.

EA0303 Mathematical basis of automation: 3 op
Content
This theme is a part of the module Natural Sciences in Automation Engineering.

EA0304 Physical Basis of Automation: 3 op
Content
This theme is a part of the module Natural Sciences in Automation Engineering.

BEEAN15AEA04-1000 Natural Sciences in Electrical Engineering: 15 op
Objectives
The student understands the importance of occupational safety and always acts according to safety regulations in the field. He or she knows and is able to apply electrical engineering in practical technical solutions. He or she understands the basic solutions of data communications technology as well as its importance in solutions for technical devices.

The student has understood the importance of general occupational safety, always acts in a manner required by electrical work safety, and observes legislation in the field in all planning work, knows and is capable of applying the laws of physics connected with electrical technology, knows the theoretical basic solutions of electrical engineering, and is capable of applying them to practices of electrical engineering, is capable of utilising data communications technology for solving practical technical problems.

EA0401 Occupational safety and safety in electrical work, directives and orders of electrical engineering: 5 op
Content
This theme is a part of the module Natural Sciences in Electrical Engineering.

EA0402 Theoretical electrical engineering: 4 op
Content
This theme is a part of the module Natural Sciences in Electrical Engineering.

**EA0403 Physics 1: 3 op**

**Content**
This theme is a part of the module Natural Sciences in Electrical Engineering.

**EA0404 Fundamentals of data communications technology: 3 op**

**Content**
This theme is a part of the module Natural Sciences in Electrical Engineering.

**BEEAN15AEA05-1000 Power Engineering: 19.5 op**

**Objectives**
The student knows the mathematical and technological foundation of power engineering. He or she is capable of applying power engineering into practice and communicating the results of his or her work. He or she masters Finnish civil servants’ requirements for the Swedish language.

The student knows the basics of power technology and its technological solutions, and is capable of applying them to practices in the field, knows how to communicate both in writing and orally in the working community of the field about the work he or she has done, knows the mathematical basis of power engineering, can pass the requirements for civil servants’ Swedish.

**EA0501 Power Engineering and its Practical Applications: 7.5 op**

**Objectives**
Power Engineering 15 cr

The student knows the mathematical and technological foundation of power engineering. He or she is capable of applying power engineering into practice and communicating the results of his or her work. He or she masters Finnish civil servants’ requirements for the Swedish language.

The student knows the basics of power technology and its technological solutions, and is capable of applying them to practices in the field, knows how to communicate both in writing and orally in the working community of the field about the work he or she has done, knows the mathematical basis of power engineering, can pass the requirements for civil servants' Swedish.

**Content**
This theme is a part of the module Power Engineering.

**EA0502 Practical Finnish: 4.5 op**
Content
This theme is a part of the module Power Engineering.

EA0503 Mathematics of Power Engineering: 3 op

Content
This theme is a part of the module Power Engineering.

EA0504 Communications: 1.5 op

Content
This theme is for Finns only. This is a part of the module Power Engineering.

EA0505 Swedish: 3 op

Content
This theme is for Finns only. This is a part of the module Power Engineering.

BEEAN15AEA06-1000 Application Software: 16.5 op

Objectives
The student is able to plan and implement in practice applications related to technology using software. He or she understands the significance of data security and applies it in practice. He or she knows how to communicate information on the applications of software technology. He or she knows, is able to take into consideration, and to communicate on the impact of scientific phenomena in practical planning work.

The student is familiar with the standardised programming languages of programmable logic controller and is able to plan and implement small-scale applications of logic, is able to communicate both in writing and orally in a foreign language in the working community of the field, is capable of carrying out programming applications in different kinds of equipment and systems, knows the significance of information security and takes its impact into consideration in programming, knows the theoretical foundations of the most important scientific phenomena, and is capable of taking their practical impacts in the application of the technology. The student is able to plan and implement in practice applications related to technology using software. He or she understands the significance of data security and applies it in practice. He or she knows how to communicate information on the applications of software technology. He or she knows, is able to take into consideration, and to communicate on the impact of scientific phenomena in practical planning work. The student is familiar with the standardised programming languages of programmable logic controller and is able to plan and implement small-scale applications of logic, is able to communicate both in writing and orally in a foreign language in the working community of the field, is capable of carrying out programming applications in different kinds of equipment and systems, knows the significance of information security and takes its impact into consideration in programming, knows the theoretical foundations of the most important scientific phenomena, and is capable of
taking their practical impacts in the application of the technology.

**EA1701 Programmable Logic Controller: 4 op**

**Objectives**

Application Software 15 cr

The student is able to plan and implement in practice applications related to technology using software. He or she understands the significance of data security and applies it in practice. He or she knows how to communicate information on the applications of software technology. He or she knows, is able to take into consideration, and to communicate on the impact of scientific phenomena in practical planning work.

The student is familiar with the standardised programming languages of programmable logic controller and is able to plan and implement small-scale applications of logic, is able to communicate both in writing and orally in a foreign language in the working community of the field, is capable of carrying out programming applications in different kinds of equipment and systems, knows the significance of information security and takes its impact into consideration in programming, knows the theoretical foundations of the most important scientific phenomena, and is capable of taking their practical impacts in the application of the technology. The student is able to plan and implement in practice applications related to technology using software. He or she understands the significance of data security and applies it in practice. He or she knows how to communicate information on the applications of software technology. He or she knows, is able to take into consideration, and to communicate on the impact of scientific phenomena in practical planning work. The student is familiar with the standardised programming languages of programmable logic controller and is able to plan and implement small-scale applications of logic, is able to communicate both in writing and orally in a foreign language in the working community of the field, is capable of carrying out programming applications in different kinds of equipment and systems, knows the significance of information security and takes its impact into consideration in programming, knows the theoretical foundations of the most important scientific phenomena, and is capable of taking their practical impacts in the application of the technology.

**Content**

This theme is a part of the module Application Software.

**EA1702 Programming: 4.5 op**

**Content**

This theme is a part of the module Application Software.

**EA1703 Practical Finnish: 1.5 op**

**Content**

This theme is a part of the module Application Software.
**EA1706 Communications: 1.5 op**

**Content**
This is for Finns only. This theme is a part of the module Application Software.

**EA1704 Information Security: 2 op**

**Content**
This theme is a part of the module Application Software.

**EA1705 Scientific Phenomena: 3 op**

**Content**
This theme is a part of the module Application Software.

**EA00BR16 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**
Automation System

Field Design

Electricity Design for a Production Process

Practical Design Work in Professional English

**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.

**EA00BO02 Applications of Automation Engineering: 15 op**

**Objectives**
The student knows the principles and application targets of safety automation. The student is familiar with household automation and wireless automation engineering. The student knows how to utilize automation engineering in production guidance systems.

The student knows the principles of security automation and knows how to take its requirements into consideration when making practical automation plans. Student knows how to plan household automation applications and is familiar with the operating principles of the ERP and MES system. Student knows how to utilize the ERP and MES system in practice and knows how to utilize the possibilities of wireless technology in automation applications.

**Content**
Security Automation

Building Automation

ERP System

Wireless Technology

**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.

**EA00BO38 Automation and Control: 15 op**

**Objectives**
The student knows and is able to implement control engineering. He or she is familiar with the technology basics of machine automation. He or she is able to plan and implement control application of piece goods industry.

The student is familiar with the basics of control engineering and knows how to tune a control circuit, how to plan hydraulic and pneumatic direction. He or she knows the methods of software technology and knows how to utilise software planning tools in plc application planning.
Content
Control Engineering

Hydraulics and Pneumatics

Application Development Environment in Test, Measurement, and Control

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.

BEEAN15AEA14-1000 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.

EA1401 Automation Engineering Work Placement: 10 op

Content
This theme is a part of the module Work Placement.

EA1402 Automation Engineering Work Placement: 10 op

Content
This theme is a part of the module Work Placement.

EA1403 Automation Engineering Work Placement: 10 op

Content
This theme is a part of the module Work Placement.
BEEAN15APROFILOIVA-1000 PROFILING COMPETENCE: 60 op

BEEAN15AEA07-1000 Process Automation: 15 op

Objectives
The student knows the functional principles of the most common production processes. He or she knows the ways of implementing instrumentation, is able to plan the instrumentation of a process and to communicate process automation in a foreign language.

The student knows the operating principles of the most important unit processes and automation methods, knows how to communicate both in writing and orally in a foreign language in a working community in the field about his or her own profession, knows the operating principles of field instruments and devices, and bus interfaces and knows how to plan and implement process instrumentation with them, knows the mathematical basis of process automation.

EA0701 Process Technology: 3 op

Objectives
Process Automation 15 cr

The student knows the functional principles of the most common production processes. He or she knows the ways of implementing instrumentation, is able to plan the instrumentation of a process and to communicate process automation in a foreign language.

The student knows the operating principles of the most important unit processes and automation methods, knows how to communicate both in writing and orally in a foreign language in a working community in the field about his or her own profession, knows the operating principles of field instruments and devices, and bus interfaces and knows how to plan and implement process instrumentation with them, knows the mathematical basis of process automation.

Content
This theme is a part of the module Process Automation.

EA0702 Professional English: 1.5 op

Content
This theme is a part of the module Process Automation.

EA0703 Instrumentation: 3 op
Content
This theme is a part of the module Process Automation.

EA0704 Fieldbuses: 4.5 op

Content
This theme is a part of the module Process Automation.

EA0705 Process Automation Mathematics: 3 op

Content
This theme is a part of the module Process Automation.

BEEAN15AEA08-1000 Embedded Systems: 15 op

Objectives
The student is familiar with the technology of an embedded system, knows how to apply it to technical issues and use the application development environment in practical implementation. The student can document the results of his or her work. The student knows how to apply for a work placement (traineeship).

The student knows the operational principle of an embedded system, a programming language, and is able to implement a small-scale automation application with it, knows the standards of the field and is able to draft the planning documents in accordance with the documentation practices in the field, knows the most important employment opportunities of his or her own field and how to apply for traineeships, knows how to plan and implement practical automation solutions in an application development environment.

EA0801 Microcontroller: 5 op

Objectives
Embedded Systems 15 cr

The student is familiar with the technology of an embedded system, knows how to apply it to technical issues and use the application development environment in practical implementation. The student can document the results of his or her work. The student knows how to apply for a work placement (traineeship).

The student knows the operational principle of an embedded system, a programming language, and is able to implement a small-scale automation application with it, knows the standards of the field and is able to draft the planning documents in accordance with the documentation practices in the field, knows the most important employment opportunities of his or her own field and how to apply for traineeships, knows how to plan and implement practical automation solutions in an application development environment.
Content
This theme is a part of the module Embedded Systems.

EA0802 CAD and Technical Documentation: 4 op

Content
This theme is a part of the module Embedded Systems.

EA0803 Career Guidance: 1.5 op

Content
This theme is a part of the module Embedded Systems.

EA0804 Application Development Environment: 4.5 op

Content
This theme is a part of the module Embedded Systems.

EA00BO35 Production Automation: 15 op

Objectives
The student is familiar with the applicability of new technologies in production. He or she knows how to apply them to automation of production. The student has the readiness to begin the drafting of his or her own thesis.

The student is familiar with the theoretical basis of robotics and knows how to draw up a real robot application in a development environment. He/she knows the mathematical foundation of machine vision and how to implement a real computer vision application.

The student is familiar with the mathematical basis of simulation, knows how to utilize simulation and a simulator in the automation planning of production, and is ready to start drafting his or her own thesis independently and successfully.

Content
Robotics

Computer Vision

Mathematics for Simulation

Simulation of Production

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.

**EA00BO14 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 Maintenance

Maintenance Information System

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.

**BEEAN15A7777-1000 THESIS: 15 op**

**BEEAN15AEA15-1000 Final Thesis: 0 op**

**99991203 Final Thesis: 15 op**
Objectives

DESCRIPTION
Thesis is a project in which you utilise your professional key areas. It is an independently produced research, product development or other development project.

LEARNING OUTCOMES
The student
• is able to put forward well-grounded, workplace-related development proposals
• is able to find and use source materials critically with respect to the source material’s intellectual property rights
• is able to conceptualize workplace-related phenomena based on research
• is able to use suitable development and research methods for producing new knowledge
• is capable of working together and responsibly with others in the workplace development projects and in other development projects
• is able to assess his/her own actions and decisions critically
• is able to manage entities and present his/her case logically and justifying
• is able to manage appropriate written, visual, and oral expression