

## Curriculum at LAB University of Applied Sciences 2024-2025

# Bachelor of Engineering, Electrical and Automation Engineering 24S, full-time studies, Lahti

Code	Name	1 y	2 y	3 y	4 y	ECTS total
<b>TLTISAT24S-1001 CORE COMPETENCE</b>						<b>180</b>
<b>TLTISAT24S-1002 Common Studies</b>						<b>15</b>
AY00BU56	Developing professional competence 1	1				1
AY00BU57	Developing professional competence 2		1			1
AY00BU58	Developing professional competence 3			1		1
A300CE13	Orientation to Sustainability Thinking	2				2
KE00BT61	English for Work	4				4
KR00BU42	Swedish for Work, Spoken		1			1
KR00BU43	Swedish for Work, Written		1			1
KS00BT59	Expert Communication Skills	4				4
<b>TLTISAT24S-1003 Professional Core Competence</b>						<b>120</b>
<b>TLTISAT24S-1004 Basic Studies in Mathematics and Physics</b>						<b>15</b>
AT00CW18	Basic studies in mathematics for electrical engineering	3				3
AT00CW19	Mathematics 1 for electrical engineering	3				3
AT00CW20	Mathematics 2 for electrical engineering		3			3
AT00BT70	Basic studies in physics	3				3
AT00CU21	Physics for electrical engineering	3				3
<b>TLTISAT24S-1005 Basic Studies in Machinery</b>						<b>15</b>
AT00CV93	Technical documentation and modeling	5				5
AT00BV38	Pneumatics and Hydraulics	5				5
AT00BV33	Basics of Manufacturing Methods	5				5
<b>TLTISAT24S-1006 Basics of Electrical Engineering</b>						<b>15</b>
AT00CW77	Basics of Electrical Engineering	5				5
AT00CT55	Electric Circuits	5				5
AT00CT56	Electrical Engineering Laboratory Work 1	5				5
<b>TLTISAT24S-1007 Electric drives and power electronics</b>						<b>15</b>
AT00CT60	Electrical Machines		5			5
AT00CT61	Electric drives		5			5
AT00CT59	Electrical Engineering Laboratory Work 2		5			5
<b>TLTISAT24S-1008 Applications of electrical engineering and automation</b>						<b>15</b>

AT00DA05	Basics of Programming	3			3
AT00BT79	Web and interactivity	3			3
AT00CV64	Robotics	3			3
AT00CV89	Electrical engineering applications	6			6
<b>TLTISAT24S-1009 Electrical design</b>					<b>15</b>
AT00CW52	Electrical inspections		2		2
AT00CT64	Electrical design in industrial installations		5		5
AT00CT65	Electrical design project work			6	6
AT00CW53	Preparation for the electrical safety examination (S1)			2	2
<b>TLTISAT24S-1010 Programmable logics</b>					<b>15</b>
AT00BX17	Basics of Programmable Logic		5		5
AT00BX19	Operation Panels		5		5
AT00BX18	Applications of Programmable Logic		5		5
<b>TLTISAT24S-1011 PC programming</b>					<b>15</b>
AT00BX20	PC-logics		5		5
AT00BX21	User interface and controls		5		5
AT00BX22	Automation Project			5	5
<b>TLTISAT24S-1012 Practical Training</b>					<b>30</b>
HA00CD55	Practical Training		10		10
HA00BU60	Practical Training 2			10	10
HA00BU61	Practical Training 3			10	10
<b>TLTISAT24S-1013 Thesis</b>					<b>15</b>
AO00BU62	Thesis Planning			5	5
AO00BU63	Thesis Project			5	5
AO00BU64	Thesis Report			5	5
<b>TLTISAT24S-1014 COMPLEMENTARY COMPETENCE</b>					<b>60</b>
<b>TLTISAT24S-1015 Industrial robotics</b>					<b>15</b>
AT00CW54	Basics of industrial robotics		5		5
AT00CG93	Production Robotics			5	5
AT00CW55	Industrial robotics project			5	5
<b>TLTISAT24S-1016 Simulation</b>					<b>15</b>
AT00CG95	Production Simulation			5	5
AT00CG96	Automation of Production Cells			5	5
AT00CS53	Digital Twin principles in different sectors			5	5
<b>TLTISAT24S-1017 Intelligent production line</b>					<b>15</b>
AT00CG68	IoT principles in different sectors		5		5
AT00CG99	Industrial programming			5	5
AT00CH00	Project			5	5
<b>TLTISAT24S-1018 Software engineering</b>					<b>15</b>
AT00BY07	Software engineering and architecture		5		5
AT00CV91	Embedded systems			7	7
AT00BY10	Software maintenance and testing		3		3

<b>TLTISAT24S-1019 Control engineering in power electronics</b>					<b>15</b>	
AT00CT58	Basics of power electronics			5		5
AT00CT67	Basics of control engineering		5			5
AT00CV92	Basics of digital control			5		5
<b>TLTISAT24S-1020 Electromobility</b>					<b>15</b>	
AT00CV61	Electromobility project			7,5	7,5	15
<b>TLTISAT24S-1021 Elective Studies</b>					<b>15</b>	

## **TLTISAT24S-1001 CORE COMPETENCE: 180 ECTS**

### **TLTISAT24S-1002 Common Studies: 15 ECTS**

### **AY00BU56 Developing professional competence 1: 1 ECTS**

#### **Learning outcomes**

The student is able to

- plan their own learning and cooperate in situations related to their own field of studies
- recognize their own competence and the needs to develop them further and to plan their careerpath observing them
- act as a group member
- operate in the learning environments of LAB University of Applied Sciences
- picture their own field of studies and its future skills- give feedback on tuition and services and thus participate in the development of education

### **AY00BU57 Developing professional competence 2: 1 ECTS**

#### **Learning outcomes**

The student is able to

- utilize various learning opportunities in curriculum
- recognize and aim their own competences to be in level with the future career requirements
- create a study plan that supports the future career goal
- give feedback on tuition and services and thus participate in the development of education

### **AY00BU58 Developing professional competence 3: 1 ECTS**

#### **Learning outcomes**

The student is able to

- identify themselves as a learner and develop their own learning skills
- evaluate innovative or alternative future competences required in their own field
- recognize and aim their own competences to be in level with the future career requirements
- masters the professional concepts of their own field and is able to point out their competenciesduring job recruitment processes
- give feedback on tuition and services and thus participate in the development of education

### **A300CE13 Orientation to Sustainability Thinking: 2 ECTS**

**Learning outcomes**

Identify and define central concepts and frameworks related to sustainability. Recognize the interconnectedness of economic, social and environmental sustainability issues. Understand and develop own individual role in driving sustainability.

**Evaluation criterias**

Level 1

Pass-Fail

**KE00BT61 English for Work: 4 ECTS****Learning outcomes**

Proficiency level: B2

The student is able to

- communicate clearly and effectively in different generic and field-specific workplace situations both orally and in writing
- find, evaluate and use information effectively
- function collaboratively in international working environments.

**KR00BU42 Swedish for Work, Spoken: 1 ECTS****Learning outcomes**

The student is able to

- convey and validate arguments
- use vital field-specific vocabulary
- communicate essential matters about their education, work experience and tasks
- present their field-specific operational environment
- communicate in various working life situations in Swedish.

The student completes the Public Administration Language Test in Swedish.

**KR00BU43 Swedish for Work, Written: 1 ECTS****Learning outcomes**

The student is able to

- use vital field-specific vocabulary
- communicate essential matters about their education, work experience and tasks
- understand and produce various short texts related to studies and working life
- acquire information on their field in Swedish
- use online dictionaries.

The student completes the Public Administration Language Test in Swedish.

**KS00BT59 Expert Communication Skills: 4 ECTS****Learning outcomes**

Proficiency level: C2

The student masters Finnish language as a mother tongue in all professional spoken and written

communication situations.

## **TLTISAT24S-1003 Professional Core Competence: 120 ECTS**

## **TLTISAT24S-1004 Basic Studies in Mathematics and Physics: 15 ECTS**

### **AT00CW18 Basic studies in mathematics for electrical engineering: 3 ECTS**

#### **Learning outcomes**

Student is able to

- calculate and simulate mathematical expressions
- solve pair and group of equations
- solve trigonometrical problems

### **AT00CW19 Mathematics 1 for electrical engineering: 3 ECTS**

#### **Learning outcomes**

Student is able to

- recognise different polynomial equations and polynomial graph
- solve inequalities
- solve basic derivation functions and utilise derivation in practice
- solve integrated polynomial functions and utilise integration in practice
- derive and integrate trigonometric functions

### **AT00CW20 Mathematics 2 for electrical engineering: 3 ECTS**

#### **Learning outcomes**

Student is able to

- basics of differential equations
- solve geometric problems
- solve and utilize basic plane and space vectors
- basic concepts of matrices and solving matrices with software

### **AT00BT70 Basic studies in physics: 3 ECTS**

#### **Learning outcomes**

Student is able to

- understand the purpose of the physics in technology
- describe and utilize the SI-unit system and implement
- solve mathematical problems in kinematics, mechanics and thermodynamics
- utilize vectors

### **AT00CU21 Physics for electrical engineering: 3 ECTS**

#### **Learning outcomes**

The student is able to

- Perform physical measurements and write a proper report of the results
- Process measurement results, make graphical representations thereof, and perform error evaluation
- Perform calculations related to electric charge and magnetism
- Describe the electromagnetic behaviour of electric devices

## **TLTISAT24S-1005 Basic Studies in Machinery: 15 ECTS**

### **AT00CV93 Technical documentation and modeling: 5 ECTS**

#### **Learning outcomes**

The student is able to

- interpret technical drawings
- create simple technical drawings using computer aided design

### **AT00BV38 Pneumatics and Hydraulics: 5 ECTS**

#### **Learning outcomes**

Student is able to

- use basic components in pneumatics and hydraulics
- design pneumatic application
- design hydraulic application

### **AT00BV33 Basics of Manufacturing Methods: 5 ECTS**

#### **Learning outcomes**

Student is able to

- apply different manufacturing methods for different materials
- recognise common manufacturing methods

## **TLTISAT24S-1006 Basics of Electrical Engineering: 15 ECTS**

### **AT00CW77 Basics of Electrical Engineering: 5 ECTS**

#### **Learning outcomes**

The student is able to

- recognize the fundamental electrical quantities and their interrelations
- solve simple DC and AC circuits
- explain the principle of a three-phase system and three-phase power
- describe the most common applications of electrical engineering

### **AT00CT55 Electric Circuits: 5 ECTS**

#### **Learning outcomes**

Student is able to

- solve simple AC and DC circuits
- utilise phasors
- describe the properties and some of the uses of most common semiconductor components
- use simulation software

## **AT00CT56 Electrical Engineering Laboratory Work 1: 5 ECTS**

### **Learning outcomes**

Student is able to

- use basic electrical measuring equipment
- plan and report laboratory work

## **TLTISAT24S-1007 Electric drives and power electronics: 15 ECTS**

## **AT00CT60 Electrical Machines: 5 ECTS**

### **Learning outcomes**

The student is able to

- describe the working principle, properties, and typical applications of the most common electric machine types
- form a single-phase equivalent circuit of an electric machine
- state the most important selection and dimensioning principles of electric machines in industrial applications

## **AT00CT61 Electric drives: 5 ECTS**

### **Learning outcomes**

The student is able to

- design and dimension the contactor controls of a direct-on-line electric drive
- design the safety circuit of an electric drive
- dimension the protective devices and cabling of an electric drive
- dimension and parameterise a frequency converter controlled electric motor drive
- describe the possibilities of connecting a frequency converter to the automation system

## **AT00CT59 Electrical Engineering Laboratory Work 2: 5 ECTS**

### **Learning outcomes**

The student is able to

- work safely in the laboratory at low voltage (< 1000 VAC)
- plan and implement electric setups in the laboratory
- perform electrical measurements, analyze and report results thereof, and write a report

## **TLTISAT24S-1008 Applications of electrical engineering and automation: 15 ECTS**

## **AT00DA05 Basics of Programming: 3 ECTS**

### **Learning outcomes**

The student is able to:

- perform tasks on a computer through programming
- utilize and process data programmatically

- understand common programming structures
- understand the syntax of a programming language.
- implement small programs in the Python programming language

## **AT00BT79 Web and interactivity: 3 ECTS**

### **Learning outcomes**

A student can:

- utilize JavaScript language to create dynamic web content
- utilize open source JavaScript libraries
- use css-preprocessor in creation and modification of css files

## **AT00CV64 Robotics: 3 ECTS**

### **Learning outcomes**

Student is able to

- understand the impact of robotics for society
- recognize the basics of service robotics
- describe basic operations of robotic process automation
- describe basics of industrial robotics
- understand possibilities of collaboration robotics
- describe basic utilizations of AI in robotics

## **AT00CV89 Electrical engineering applications: 6 ECTS**

### **Learning outcomes**

The student is able to

- describe the structure of electrical transmission and distribution networks and their essential design principles
- describe the essential design principles related to high voltage systems and their protective equipment
- utilize the decrees and guidelines related to electric installations in buildings

## **TLTISAT24S-1009 Electrical design: 15 ECTS**

## **AT00CW52 Electrical inspections: 2 ECTS**

### **Learning outcomes**

The student is able to

- explain the required inspections for the commissioning of an electrical installation
- write an inspection report

## **AT00CT64 Electrical design in industrial installations: 5 ECTS**

### **Learning outcomes**

The student is able to

- utilise CAD software as a tool in electric design
- read and create technical documentation related to electric design
- design an electric cabinet, select and dimension its components



- dimension and select cables
- design overload and short circuit protection

## **AT00CT65 Electrical design project work: 6 ECTS**

### **Learning outcomes**

The student is able to

- work in an electric design project, projects done for external companies or the university

## **AT00CW53 Preparation for the electrical safety examination (S1): 2 ECTS**

### **Learning outcomes**

The student is able to:

- master the subject matter of the national electrical safety examination (S1)

## **TLTISAT24S-1010 Programmable logics: 15 ECTS**

## **AT00BX17 Basics of Programmable Logic: 5 ECTS**

### **Learning outcomes**

Student is able to

- recognize basic structure of the logic program
- use TIA-portal
- use basic commands
- use data in programming
- carry out logic sequences using LD

## **AT00BX19 Operation Panels: 5 ECTS**

### **Learning outcomes**

Student is able to

- connect operation panel with programmable logic in TIA-portal
- design basic interface
- design optimal operation panel software
- use operation panel in production line control
- design compact data collection system in programmable logic

## **AT00BX18 Applications of Programmable Logic: 5 ECTS**

### **Learning outcomes**

Student is able to

- describe principal structures of sensors and inverter in programmable logics
- design linearic drive
- design product control system in programmable logics
- design material handling logic control with TIA-portal

## **TLTISAT24S-1011 PC programming: 15 ECTS**

## **AT00BX20 PC-logics: 5 ECTS**

### **Learning outcomes**

Student is able to

- describe differences between PC and PLC controls
- use PC-control fieldbus
- use PC-control software
- program PC-controls

## **AT00BX21 User interface and controls: 5 ECTS**

### **Learning outcomes**

Student is able to

- recognize the basics of user interface
- program alarms
- transfer user interface for PC control
- animate production lines
- create a control system for simple production line

## **AT00BX22 Automation Project: 5 ECTS**

### **Learning outcomes**

Student is able to

- carry out automation system for production line
- carry out fieldbus and PC-control
- carry out control panel

## **TLTISAT24S-1012 Practical Training: 30 ECTS**

## **HA00CD55 Practical Training: 10 ECTS**

### **Learning outcomes**

The student is able to

- describe work-related phenomena and use related concepts
- act in a productive way, following the practices of the workplace and the ethical principles of the profession
- use the techniques, work methods, models and processes that they have learnt
- act in a customer-oriented way in interactive situations in the workplace and in the cooperation network
- evaluate and develop their own competence into the work done in practical training

## **HA00BU60 Practical Training 2: 10 ECTS**

### **Learning outcomes**

The student is able to

- describe work-related phenomena and use related concepts
- act in a productive way, following the practices of the workplace and the ethical principles of the profession
- use the techniques, work methods, models and processes that they have learnt

- act in a customer-oriented way in interactive situations in the workplace and in the cooperation network
- evaluate and develop their own competence in the work done in practical training

### **HA00BU61 Practical Training 3: 10 ECTS**

#### **Learning outcomes**

The student is able to

- describe work-related phenomena and use related concepts
- act in a productive way, following the practices of the workplace and the ethical principles of the profession
- use the techniques, work methods, models and processes that they have learnt
- act in a customer-oriented way in interactive situations in the workplace and in the cooperation network
- evaluate and develop their own competence in the work done in practical training

### **TLTISAT24S-1013 Thesis: 15 ECTS**

### **AO00BU62 Thesis Planning: 5 ECTS**

#### **Learning outcomes**

The student is able to:

- describe the objectives and core contents of their thesis
- plan and describe the stages of the thesis process
- take into account the possible research permit and copyright issues

### **AO00BU63 Thesis Project: 5 ECTS**

#### **Learning outcomes**

The student is able to:

- implement the thesis on the basis of an approved thesis plan.

### **AO00BU64 Thesis Report: 5 ECTS**

#### **Learning outcomes**

The student is able to:

- present the results or output of their thesis
- report on their thesis in writing in accordance with the thesis guidelines of LAB University of Applied Sciences
- write a maturity test.

### **TLTISAT24S-1014 COMPLEMENTARY COMPETENCE: 60 ECTS**

### **TLTISAT24S-1015 Industrial robotics: 15 ECTS**

### **AT00CW54 Basics of industrial robotics: 5 ECTS**

#### **Learning outcomes**

Student is able to

- use robotics in different applications

## **AT00CG93 Production Robotics: 5 ECTS**

### **Learning outcomes**

Student is able to

- design and build robot cell
- recognize a robot as a part of the production line

## **AT00CW55 Industrial robotics project: 5 ECTS**

### **Learning outcomes**

The student is able to

- program robot application

## **TLTISAT24S-1016 Simulation: 15 ECTS**

## **AT00CG95 Production Simulation: 5 ECTS**

### **Learning outcomes**

Student is able to

- simulate a machine
- simulate a production line

## **AT00CG96 Automation of Production Cells: 5 ECTS**

### **Learning outcomes**

The student is able to

- simulate the operation of a manufacturing cell
- select automation components for a manufacturing cell
- apply bus technology in the data transfer of automation systems

## **AT00CS53 Digital Twin principles in different sectors: 5 ECTS**

### **Learning outcomes**

Student is able to

- describe a structure of the Digital Twin-system
- create overall view of Digital Twin technology possibilities
- compare simulation and Digital Twin technologies
- describe requirements for Digital Twin application
- use Digital Twin in business

## **TLTISAT24S-1017 Intelligent production line: 15 ECTS**

## **AT00CG68 IoT principles in different sectors: 5 ECTS**

### **Learning outcomes**

Student is able to

- describe a structure of the IoT-system
- knowledge basics of sensors and data collection in IoT systems
- compare IoT cloud environments
- describe requirements for IoT mobile software
- use IoT in business

## **AT00CG99 Industrial programming: 5 ECTS**

### **Learning outcomes**

Student is able to

- plan and program control systems
- program softwares
- describe database usage and report principals
- define database sources
- plan a reporting system

## **AT00CH00 Project: 5 ECTS**

### **Learning outcomes**

Student is able to

- create a project plan
- implement a advanced automation software
- report results

## **TLTISAT24S-1018 Software engineering: 15 ECTS**

## **AT00BY07 Software engineering and architecture: 5 ECTS**

### **Learning outcomes**

The student is able to

- explain different methods of software engineering
- use agile methods in software projects
- act as a software developer in multidisciplinary projects
- describe different software architectures and use them in development

## **AT00CV91 Embedded systems: 7 ECTS**

### **Learning outcomes**

The student is able to

- recognize the main components of an embedded system and understand the system architecture
- design and implement embedded software in the C programming language
- design and implement a simple embedded device

## **AT00BY10 Software maintenance and testing: 3 ECTS**

### **Learning outcomes**

The student is able to

- design and use basic software testing methods
- use software maintenance systems
- design the software to be maintained

## **TLTISAT24S-1019 Control engineering in power electronics: 15 ECTS**

### **AT00CT58 Basics of power electronics: 5 ECTS**

#### **Learning outcomes**

The student is able to

- Describe the properties of basic power electronic components and some of their uses
- Describe the most common DC/DC converter topologies and explain their principles of operation
- Describe the structure of a voltage source inverter, its principle of operation and most important applications

### **AT00CT67 Basics of control engineering: 5 ECTS**

#### **Learning outcomes**

The student is able to

- Model simple continuous-time dynamic systems
- Design a PID controller and simulate its behaviour

### **AT00CV92 Basics of digital control: 5 ECTS**

#### **Learning outcomes**

The student is able to:

- describe and analyze the characteristics of a discrete-time system
- discretize a continuous-time system
- design a discrete-time controller
- implement a discrete-time controlled in software

## **TLTISAT24S-1020 Electromobility: 15 ECTS**

### **AT00CV61 Electromobility project: 15 ECTS**

#### **Learning outcomes**

The student is able to:

- work as a member in a project team and interact with stakeholders
- define the requirements of a device or a system and design it according to the requirements
- implement selected aspects of a device or a system
- validate the fulfillment of the requirements using appropriate methods

## **TLTISAT24S-1021 Elective Studies: 15 ECTS**