13.02.2023

Curriculum at LAB University of Applied Sciences
2023-2024

Bachelor of Engineering, Electrical and Automation Engineering 23S, full-time studies, Lahti

Code	Name	1 y	2 y	3 y	4 y	ECTS total
TLTISAT23S-1007	**CORE COMPETENCE**					**180**
TLTISAT23S-1001	**Common Studies**					**15**
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
TLTISAT23S-1002	**Professional Core Competence**					**120**
TLTISAT23S-1008	**Basic Studies in Mathematics and Physics**					**15**
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
TLTISAT23S-1012	**Basic Studies in Machinery**					**15**
AT00CV93	Technical documentation and modeling	5				5
AT00BV38	Pneumatics and Hydraulics	5				5
AT00BV33	Basics of Manufacturing Methods	5				5
TLTISAT23S-1009	**Basics of Electrical Engineering**					**15**
AT00CW77	Basics of Electrical Engineering	5				5
AT00CT55	Electric Circuits	5				5
AT00CT56	Electrical Engineering Laboratory Work 1	5				5
TLTISAT23S-1013	**Electric drives and power electronics**					**15**
AT00CT60	Electrical Machines		5			5
AT00CT61	Electric drives		5			5
AT00CT59	Electrical Engineering Laboratory Work 2		2,5	2,5		5
TLTISAT23S-1014	**Applications of electrical engineering and automation**					**15**

CT00CL97	Introduction to Programming	6				6
AT00CV64	Robotics	3				3
AT00CV89	Electrical engineering applications	6				6
TLTISAT23S-1015 Electrical design						**15**
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
TLTISAT23S-1010 Programmable logics						**15**
AT00BX17	Basics of Programmable Logic		5			5
AT00BX19	Operation Panels		5			5
AT00BX18	Applications of Programmable Logic		5			5
TLTISAT23S-1011 PC programming						**15**
AT00BX20	PC-logics		5			5
AT00BX21	User interface and controls		5			5
AT00BX22	Automation Project			5		5
TLTISAT23S-1006 Practical Training						**30**
HA00CD55	Practical Training		10			10
HA00BU60	Practical Training 2			10		10
HA00BU61	Practical Training 3				10	10
TLTISAT23S-1005 Thesis						**15**
AO00BU62	Thesis Planning				5	5
AO00BU63	Thesis Project				5	5
AO00BU64	Thesis Report				5	5
TLTISAT23S-1003 COMPLEMENTARY COMPETENCE						**60**
TLTISAT23S-1016 Industrial robotics						**15**
AT00CW54	Basics of industrial robotics		5			5
AT00CG93	Production Robotics		5			5
AT00CW55	Industrial robotics project			5		5
TLTISAT23S-1017 Simulation						**15**
AT00CG95	Production Simulation				5	5
AT00CG96	Automation of Production Cells			5		5
AT00CS53	Digital Twin principles in different sectors			5		5
TLTISAT23S-1018 Intelligent production line						**15**
AT00CG68	IoT principles in different sectors		5			5
AT00CG99	Industrial programming			5		5
AT00CH00	Project			5		5
TLTISAT23S-1019 Software engineering						**15**
AT00BY07	Software engineering and architecture					0
AT00CV91	Embedded systems					0

AT00BY10	Software maintenance and testing					0
TLTISAT23S-1020	**Control engineering in power electronics**					**15**
AT00CT58	Basics of power electronics					0
AT00CT67	Basics of control engineering					0
AT00CV92	Basics of digital control					0
TLTISAT23S-1022	**Electromobility**					**15**
AT00CV61	Electromobility project					0
TLTISAT23S-1023	**Elective Studies**					**15**

TLTISAT23S-1007 CORE COMPETENCE: 180 ECTS

TLTISAT23S-1001 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.

TLTISAT23S-1002 Professional Core Competence: 120 ECTS

TLTISAT23S-1008 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
- regognise 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

TLTISAT23S-1012 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

TLTISAT23S-1009 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

TLTISAT23S-1013 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

TLTISAT23S-1014 Applications of electrical engineering and automation: 15 ECTS

CT00CL97 Introduction to Programming: 6 ECTS

Learning outcomes
On completion of this course student should:
• be able to use standard Python.
• be able to develop simple algorithms and implement them using the standard control structures.
• be able to use existing libraries and user defined functions when writing programs
• be able to write programs that promote code reuse.
• be able to write programs that correctly manipulate standard data and text files
• be able to handle exceptions thrown and writing own exception classes.
• be able to develop python programs that can read and update CSV files, for data analytics-based tasks at basic level.
• follow good coding guidelinesdevise strategies to test the programs developed.

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

TLTISAT23S-1015 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)

TLTISAT23S-1010 Programmable logics: 15 ECTS

AT00BX17 Basics of Programmable Logic: 5 ECTS

Learning outcomes
Student is able to
- regognize basic constructure 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
- descripe 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

TLTISAT23S-1011 PC programming: 15 ECTS

AT00BX20 PC-logics: 5 ECTS

Learning outcomes
Student is able to
- descripe 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
- regognize 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

TLTISAT23S-1006 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 int 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 int 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 int the work done in practical training

TLTISAT23S-1005 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.

TLTISAT23S-1003 COMPLEMENTARY COMPETENCE: 60 ECTS

TLTISAT23S-1016 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
- regognize 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

TLTISAT23S-1017 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

TLTISAT23S-1018 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

TLTISAT23S-1019 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

TLTISAT23S-1020 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

TLTISAT23S-1022 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

TLTISAT23S-1023 Elective Studies: 15 ECTS