IT23SP Bachelor Degree Programme in Information Technology (Internet of Things) (IT23SP)

Credits
240

Duration (years)
4

Language
English

Specifications

Degree
Bachelor of Engineering

Degree title
Bachelor of Engineering

Degree programme
Degree Programme in Internet of Things

Type of education
Bachelor’s degrees, full-time study

Person in charge
Mirka Savolainen

Description

Description
The degree programme in Internet of Things leads to a bachelor's degree, the title of the degree is Bachelor of Engineering in Information Technology (IoT). The scope of the studies is 240 ECTS credits and the duration is 4 years. The competences produced by the degree correspond to the level of higher education commonly defined in the European Union, which enables the mobility of the workforce and experts.

The programme qualifies the student to work in the fields of IoT, Big Data and Artificial Intelligence; especially, in companies operating within the digital health and industrial internet sectors. The student will also learn how to build IoT systems with good Cybersecurity which is a crucial part of modern IoT system design. The duties of an IoT graduate may vary from software design to electrical engineering, the design of smart wireless devices, and the whole IoT system in the cloud. Besides engineering skills, a student develops his/her communication, social and teamwork skills.

Internet of Things graduates are prepared to work in international environments and teams, and Savonia’s Bachelor of Engineering groups are multinational and multicultural by nature. This degree

provides you with the knowledge and skills you need to get a job in Finland or abroad. Themes in IoT program are aligned with Savonia’s strategic goals of Human Security. Internet of Things technology is a key enabler in advancing UN’s sustainable development goals.

The IoT programme develops students’ competencies with a focus on the industrial internet and digital health sectors. At the end of their studies students may choose to study Embedded Engineering (15 ECTS) or Cloud Engineering (15 ECTS).

Embedded Engineering specialisation is for students who like to build tangible things. The emphasis is on hardware and electronics. The students enhance their knowledge and skills with microcontrollers, sensors, their connectivity and will have hands-on experiences with the embedded systems.

Cloud Data Engineering specialisation is for students who are interested in the data processing. IoT Cloud Engineer transforms data into knowledge and supports decision-making. The students will acquire knowledge and skills with Big Data processing, data visualization and deploying cloud services.

Curriculum development and working life cooperation
In Savonia, the pedagogical starting point is the diverse combination of high-quality and working-life-oriented education and research and development activities. Co-development strengthens multidisciplinary activities, utilization of partnerships and closeness to working life.

Education close to working life emphasizes students' motivation and commitment to their studies. A variety of virtual and physical environments in Savonia and in partner organizations' facilities both at home and abroad connect theory and practice in an extensive and interesting way as part of the student's learning and the also the development of organizations. The education is characterized by multiformity, multidisciplinary and not bounded to time and place.

With comprehensive guidance, the student's professional growth is supported throughout the study path. In Savonia, every student is an individual. The training is carried out taking into account the different needs and goals of the students. Personalized education enables alternative methods of performance and individual paths according to the student's own goals.

In Savonia, the recognition of prior learning and the studification of work are used as part of the student's personal study plan when possible. Students can deepen or expand their skills by utilizing the offerings of Savonia's national and international higher education partners.

Responsibility, sustainable development and global human security challenges are taken into account in the contents and implementation methods of the annual themes and courses.

Objectives
In Savonia's curricula, the courses form broader study units. In this way, they support the overall development of the student and the development of expertise. At the same time, it becomes possible to combine teaching and working life-oriented research and development activities.

The curriculum for an IoT engineer is designed so that
• the degree produces the skills required in working life

• training ensures the development of the student's expertise.

Student
• prepares a personal study plan to support his/her studies, where previously acquired competence is recognized
• is responsible for the progress of his/her studies.

Savonia's teachers and other personnel guide and support in defining and achieving personal goals.

Annual themes (see the attachment)
• 1st year: IoT foundations in engineering and natural sciences
• 2nd year: Developing basic skills for IoT ecosystem engineering
• 3rd year: Deepening competencies in engineering and project management
• 4th year: Becoming professional in IoT Embedded Engineering or IoT Cloud Engineering

1st year
The student gets introduced to engineering studies and orientation to IoT technology. The student acquires basic knowledge of IoT ecosystems, programming, communication and language, physics, and mathematics.

2nd year
The student develops basic skills for IoT ecosystem engineering, e.g., programming, sensors and electronics, artificial intelligence, and cloud platforms. At the same time more advanced knowledge in mathematics and physics is acquired.

3rd year
The student acquires product development and project management skills through a large IoT project. Engineering competences are deepened further and specialization into embedded or cloud engineering starts.

4th year
The student finalizes specialization studies. Professional skills are developed and shown in the thesis process.

Code	Name	Sum
IT23SP	IT23SP Bachelor Degree Programme in Information Technology (Internet of Things)	240
IT23SP-1015	**BASIC STUDIES**	**50**
IT23SP-1022	**Basic Studies**	**50**
IM00BD21	Tools for International Engineering Students	5
4_EXX8110	Mathematics 1	5
4_EXX8140	Physics for Engineering	5
IM00BD26	Communication Skills for Engineering Students	5
4_EXX8120	Mathematics 2	5
IT00BG65	Orientation Project	5

4_EXX8130	Mathematics 3	5
4_EFP8150	Physics for Electrical Engineering	5
IM00BD29	Communication Skills for Engineering Experts	5
IT23SP-1021	Finnish or Swedish	5
IX00BF80	Basics of Finnish	5
4_EXX8060	Engineering Swedish	5
IT23SP-1016	**PROFESSIONAL STUDIES**	**130**
IT23SP-1023	**Professional Studies**	**115**
IM00BD23	Basics of Programming	5
4_EFS8010	Industrial IoT and Digital Health Ecosystems	5
4_EFA8150	Circuits and Systems	5
IT00BD89	Embedded Programming 1	5
4_EFS8070	Object Oriented Programming	5
4_EFA8020	User Interface Programming	5
4_EFA8040	Data Management and SQL	5
4_EFA8060	Electrical Measurements	5
4_EFA8070	Digital Electronics	5
4_EFA8090	Sensor Basics	5
IT00BD90	Basics of Artifical Intelligence	5
4_EFA8050	Browser Programming	5
4_EFA8100	Analog Electronics 1	5
4_EFA8030	Data Structures and Algorithms	5
IT00BD91	IoT Cloud Platforms	5
IT00BD92	Product Design and Development	5
IT00BD93	IoT Project 1	5
IT00BD95	IP Networks	5
IT00BD94	Cybersecurity Fundamentals	5
4_EFS8060	Wireless and Radiotechnology	5
IT00BD96	Industrial Internet and Automation	5
IT00BD97	Digital Signal Processing	5
IT00BD98	IoT Project 2	5
IT23SP-1019	**IoT Embedded Engineering**	**15**
4_EFA8110	Analog Electronics 2	5
IT00BE00	Embedded Programming 2	5
4_EFS8050	Real Time Systems	5
IT23SP-1020	**IoT Cloud Engineering**	**15**
4_EFS8020	Basics of Big Data	5
4_EFS8040	Business Intelligence	5

IT00BD99	Cloud Certification	5
IT23SP-1017	**ELECTIVE STUDIES**	**15**
IT23SP-1024	**Elective Studies**	**15**
IT23SP-1018	**INTERNSHIP**	**30**
IT23SP-1025	**Internship**	**30**
EX00BD39	Internship 1	5
EX00BD40	Internship 2a	5
EX00BD41	Internship 2b	5
EX00BD42	Internship 3a	5
EX00BD43	Internship 3b	5
EX00BD44	Internship 3c	5
THESIS	**THESIS**	**15**
THESIS-1001	**Thesis**	**15**
XT00BA53	Thesis Planning	5
XT00BA54	Thesis Implementation	5
XT00BA55	Thesis Finalisation	5
XT00BA56	Maturity Test	0

IT23SP IT23SP Bachelor Degree Programme in Information Technology (Internet of Things): 240 op

IT23SP-1015 Basic Studies: 50 op

Optionality
All compulsory

IT23SP-1022 Basic Studies: 50 op

Optionality
All compulsory

IM00BD21 Tools for International Engineering Students: 5 op

Credits
5 - 5

Objectives
After completing the course the student is able to
- plan his/her studies and use the information, counselling and guidance services available in Savonia UAS
- find support when needed in order to progress with the studies according to schedules
- evaluate and develop his/ her studying skills
- use the necessary IT tools and applications in his/her studies

- communicate, work and study in a multicultural environment

Content
- Orientation to UAS studies
- IT applications and skills in engineering studies
- Communication and grouping in a multicultural community

Assessment scale
Five step scale

4_EXX8110 Mathematics 1: 5 op

Credits
5 - 5

Objectives
The student revises the basics of algebra and trigonometry. He/she knows the basic properties of the most common functions used in technical applications. The student learns the elements of mathematical thinking and deduction. Furthermore, the student is able to recognize simple mathematical problems and solve them. The student achieves the readiness required to continue studying mathematics and to solve mathematical problems in engineering studies.

Content
- Laws of algebra of real numbers
- Equations and inequalities
- Linear systems of equations
- Trigonometry
- Elementary functions

4_EXX8140 Physics for Engineering: 5 op

Credits
5 - 5

Objectives
The general objective of the course is the introduction to the basic methods of physics. This includes the use of the SI system of units and a systematic mathematical way of analyzing physical systems.

The more specific topics of the course are the basics of temperature and thermal energy, and the Newtonian mechanics. The former includes phenomena like thermal expansion of solids, liquids and that of gases within the framework of the ideal-gas law. The student will also get to understand the energetics of the temperature changes and phase transitions.

The Newtonian mechanics is preceded by treatment of kinematics in one and two dimensions. Newtonian mechanics is about the Newton’s laws and the student will learn to apply them to fairly simple systems in one and two dimensions. The student will learn to make use of the concepts related to the definition of work done by a force, i.e. energy, energy principle, and power. After having completed the course, the student is able to apply the conservation law of linear momentum for collisions. He/she will also learn to treat impulsive forces in terms of impulse of a force.

Finally the student will learn dynamics of circular motion.

Content
International System of Units (SI)
Thermal Expansion
Thermal Energy
Ideal Gas Law
Mechanisms of Heat Transfer
Kinematics
Newton’s Laws
Friction
Work, Energy, and Power
Linear Momentum
Circular Motion

Prerequisites
None

IM00BD26 Communication Skills for Engineering Students: 5 op

Credits
5 - 5

Objectives
After completing the course, the student is able to:

- Communicate in different spoken and written contexts related to engineering studies
- Read, write, listen and talk in English about topics related to the student’s engineering field
- Use grammatical structures typical in the context of the study field
- Follow Savonia reporting practices concerning the academic reporting language, reference techniques and the use of the reporting template
- Search information for study purposes and evaluate information sources critically
- Understand job application process and create a CV and a job application message
- Interact and collaborate in an intercultural context

Content
- Oral and written communication related to the engineering studies
- Engineering vocabulary and terminology
- Technical texts and related grammatical structures
- Product and process descriptions
- Job application process and documents
- Presentation skills
- Academic and technical reporting with focus on Savonia reporting practices
- Critical Information retrieval

Further information
It is recommended to do the course 'Orientation Project' at the same time with this course. Some tasks may be linked to the project course.

4_EXX8120 Mathematics 2: 5 op

Credits
5 - 5

Objectives
The student understands the meanings of the derivative of a function and the integral of a function. He/she knows the rules of differentiation and integration. The student is also able to apply the concepts introduced during the course in engineering applications.

Content
-Differential calculus
-Integral calculus

Prerequisites
Mathematics 1

IT00BG65 Orientation Project: 5 op

Credits
5 - 5

Objectives
After completing the course, the student will be able to
- produce a report according to Savonia reporting style
- get acquainted with project work, time scheduling, team working, innovations and reporting
- describe a simple IoT use case

Content
Total 5 ECTS:

4 ECTS for the following contents:

- Making of teams for the project work
- Team working
- Enhancing language skills
- Reporting the phases of the project
- Making of design specifications and functions of IoT system, use cases and user interfaces of IoT and presenting them

1 ECTS for the following contents:
- Vectors and Scalar Quantities in Engineering
- Determinants and Matrix Operations
- Complex Numbers

4_EXX8130 Mathematics 3: 5 op

Credits
5 - 5

Objectives
The student can solve the most common differential equations and is able to apply them in engineering applications. The student is able to use classical probability and the most common distributions to model random events. He/she knows the basics of statistical inference and hypothesis testing.

Content
- Differential equations: separable equation, first order linear equation, second order linear equation
- Combinatorics and probability
- Random variable and distribution
- Discrete and continuous distribution
- Parameter estimation and statistical tests

Prerequisites
Mathematics 1, Mathematics 2

4_EFP8150 Physics for Electrical Engineering: 5 op

Credits
5 - 5

Objectives
The student understands the concepts of electric field, electric potential, and voltage and is able to apply these in simple DC currents. The student knows the role of resistors, capacitors, and voltage sources as parts of a DC circuit.

He/she understands the concept of magnetic field and is able to apply magnetic force in the case of a current-carrying wire and a wire loop in a magnetic field. The student knows the principle of magnetic induction in AC circuits, generators and electric motors.

The student masters the basic principles of oscillations and can perform calculations for harmonic oscillations. He/she can apply the theory of oscillations for light, sound and electromagnetic radiation.

The student knows the basics of rotational motion like torque, moment of inertia, and the equation of motion.

Content
Basics of rotational mechanics
Electric field
Potential
Magnetic field
Electromagnetic induction
Oscillations
Electromagnetic waves

Prerequisites
Physics for Engineering

IM00BD29 Communication Skills for Engineering Experts: 5 op

Credits
5 - 5

Objectives
After completing the course, the student is able to:

- Communicate in different spoken and written contexts related to intercultural working life, e.g. in projects
- Make the difference between different communication styles, and e.g. produce formal and informal messages
- Participate in meetings and negotiations in different roles and create related documents
- Develop documents needed in job application further and participate in job interviews
- Plan and give professional presentations on various technical topics
- Make summaries and reports following Savonia reporting guidelines
- Recognize how to develop one’s skills further and give feedback to others

Content
- Communication skills in work-related situations
- Corporate communication
- Business writing and styles
- Presentation skills
- Meeting skills
- Negotiation skills
- Job application process
- Job interviews
- Reporting
- Project communication

Further information
It is recommended to do this course with a project course running at the same time.

Assessment scale
Five step scale

IT23SP-1021 Finnish or Swedish: 5 op

Optionality
Select one

IX00BF80 Basics of Finnish: 5 op

Credits
5 - 5

Objectives
After completing this course, the student is able to
- use familiar everyday expressions and basic phrases
- introduce him/herself and others
- ask and answer simple questions
- interact orally in a simple way.

Content
Topics: getting to know each other, greetings, days of the week, numbers, countries, languages, weather, seasons, family, appearance, clock, apartment, traveling.

Grammar: personal pronouns, verb to be, change of consonants (KPT), types of verbs, questions, nominative plural, genitive, partitive, locatives.

Assessment scale
Five step scale

4_EXX8060 Engineering Swedish: 5 op

Credits
5 - 5

IT23SP-1016 Professional Studies: 130 op

Optionality
Select x cr

Credits
130 - 130

IT23SP-1023 Professional Studies: 115 op

Optionality
All compulsory

IM00BD23 Basics of Programming: 5 op

Credits
5 - 5

Objectives
After completing the course, the student will be able to
- understand basic concepts of programming
- implement programs by given requirements
- use debugger on error tracking
- use 3rd party libraries
- use language and library documentation

Content

Variables
- If-elif-else statements
- While statements
- Switch statements
- For statement
- Random numbers
- Functions (no recursion)
- Collections
- File handling
- Elementary OOP

Prerequisites
-

Assessment scale
Five step scale

4_EFS8010 Industrial IoT and Digital Health Ecosystems: 5 op

Credits
5 - 5

Objectives
Student will have an deep knowledge of the ecosystems related to Industrial Internet and Digital Health fields. Ecosystem means technological, business, development, market, product, social, sales, testing, stakeholders, companies and universities participation in operating the digital industry and digital social and health care sphere.

Content
How the Internet of Things revolution will dramatically alter manufacturing, energy, agriculture, transportation and other industrial sectors of the economy. It will also fundamentally transform how people will work through new interactions between humans and machines. Dubbed the Industrial Internet (of Things), will bring along with new risks, to business and society. It will combine the global reach of the Internet with a new ability to directly control the physical world, including the machines, factories and infrastructure that define the modern landscape. how it will impact existing industries, value chains, business models and workforces.

The Digital Health sector Ecosystem comprises of research, product development, innovation, companies, hospitals, research centers, manufacturers of the field. The public and the private sector of the digital health are included in Ecosystem.

There are systems that pay for, coordinate and deliver care. There are also systems that help people self-manage a lifestyle goal or healthcare condition. Platforms provide the connected infrastructure that enables service providers and consumers to exchange value. Healthcare enterprises also need a rich and robust portfolio of digital partners to form their future business ecosystems.

Ecosystems will extend beyond technology to connect the capabilities, expertise and services that touch healthcare organizations, consumers and clinicians. Healthcare organizations that take a

leadership role in transformation realize that the strategic platform and ecosystem decisions they make today determine their future success

4_EFA8150 Circuits and Systems: 5 op

Credits
5 - 5

Objectives
After completing the course, the student will be able to
- understand the fundamental concepts and laws of electric circuits
- learn circuit analysis methods
- solve problems related to electric circuits

Content
-Circuits and Systems (DC Circuits): Circuit variables and elements, Symbols, Basic concepts and solving methods of direct current circuits, Application of Kirchhoff’s laws.

-Circuit analysis: Node-Voltage Method, Mesh-Current Method, Source Transformations, Thevenin and Norton Theorems, Maximum Power Transfer Theorem, Superposition Method, The operational amplifier.

-Circuits and Systems (AC Circuits): Contents of capacitance, inductance, and mutual inductance. Sinusoidal voltage and current Circuit analysis with differential equations, sinusoidal equations, phasors, Impedance calculation, problem solving with phasors.

IT00BD89 Embedded Programming 1: 5 op

Credits
5 - 5

Objectives
After completing the course, the student will be able to
- understand the basic concepts of microprocessors and microcontrollers
- apply embedded programming principles
- develop software in an embedded programming language
- know the basic hardware blocks
- describe memory and interface concepts
- use relevant IDE to develop, load and run elementary programs for a microcontroller

Content
- learning embedded programming language like C
- microprocessor and its architecture
- buses, memory, and interfacing
- microcontroller and its architecture
- programming a microcontroller
- internal and external memory

Assessment scale

Five step scale

4_EFS8070 Object Oriented Programming: 5 op

Credits
5 - 5

Objectives
You understand the object-oriented programming paradigm
You realize what a class is
You are able to define a class
You realize what an object is
You are able to create instances of a class
You realize what an attribute is
You are able to create attributes into a class
You realize what a method is
You are able to create a dynamic method bound to an instance of a class
You are able to create a static method
You are able to use objects when modelling an application domain
You are able to design classes according to an application domain model
You realize what data encapsulation means
You realize what is an accessor
You realize what is an mutator
You realize what a mutator is used for
You realize what an accessor is used for
You realize what access control attributes are
You are able to restrict visibility of attributes
You are able to restrict visibility of methods
You are able to create accessors
You realize what inheritance is about
You are able to inherit a class
You are able to override a method in a subclass
You are able to restrict the visibility of inherited attributes in a subclass
You are able to restrict the visibility of inherited methods in a subclass
You realize what aggregation means
You realize what composition means
You realize what overriding a method means
You are able to realize an aggregation
You are able to realize an composition
You are able to utilize code reusability in a larger project
You realize the role of polymorphism in inheritance
You realize the role of polymorphism in methods
You realize what overriding a method means
You realize how data type conversions work
You are able to write an overridable method
You are able to override a method
You realize what exceptions are
You realize how exceptions are used

You are able to catch an exception
You are able to throw an exception
You are able to design an exception class of your own
You realize what is an interface
You are able to design interfaces
You are able to realize interfaces
You are able to realize several interfaces into one class
You realize what is an abstract class
You are able to design an abstract class
You are able to design an abstract method
You are able to realize an abstract method
You are able to design an implementation model for the application domain
You are able to choose inheritance, aggregation and composition regarding the needs of the application domain
You realize what threads are
You are able to use threads in your programs
You realize parallel processing using threads
You know the fundamental generic classes of the programming language
You are able to utilize generic classes

Content
Object-oriented paradigm and modelling
Classes and instances
Data encapsulation
Static and dynamic attributes and methods
Accessors and mutators
Inheritance
Polymorphism
Abstract classes
Interfaces
Aggregation and composition
Threads
Exceptions

Prerequisites
Basics of Programming , User Interface Programming

4_EFA8020 User Interface Programming: 5 op

Credits
5 - 5

Objectives
You understand the event-driven programming paradigm
You are able to create forms
You are able to use a button-component
You are able to use a text field-component
You are able to use a label-component

You are able to connect mouse-events into graphic components
You are able to connect keyboard-events into graphic components
You are able to use a message-box
You are able to define text into a message-box
You are able to define buttons into a message-box
You are able to define icons into a message-box
You are able to create a menu
You are able to use a listbox -component
You are able to use a combobox-component
You are able to make scheduled events
You are able to design, code and test simple event-driven programs
You are able to show data received from a text file in a graphic user interface
You are able to write data from graphic user interface into a text file
You are able use structured data in a graphic user interface
You are able to throw an exception
You are able to handle an exception
You understand the meaning of a try block in exception handling

Content
User interface components
Event-driven programming
Struct-datatype
Class-datatype (basics)
Storing and reading data
Exception handling
File handling

Prerequisites
Basics of Programming 1

4_EFA8040 Data Management and SQL: 5 op

Credits
5 - 5

Objectives
You understand principles of relational database design and their mechanics
You are familiar with Database Management Systems and areas of usage
You are able to create database design diagrams and implement them to real databases
You are able to use graphical and shell based Database Management Systems
You are able to utilize databases as part of information system

Content
Data management concepts
Designing relational databases
Concept analysis and Entity Relationship-diagrams (ER-diagrams)
Data models
Basics of SQL language
Database Management Systems (eg. MariaDB)

Steps to database based application development

4_EFA8060 Electrical Measurements: 5 op

Credits
5 - 5

Objectives
The student knows the basics of the electrical safety at work and is able to operate electrical equipment safely. The student knows the basic methods and instruments to measure the electrical magnitudes like voltage, current and power. He/she is familiar with properties of the common measurement equipment and practise safe and accurate measuring procedures. The student understands the measurement process from target definition, design and equipment selection to reporting and evaluation of the measurement results.

Content
- Legislation on the electrical safety
- Legislation on the electrical competency, laymen vs. professionals
- Electrical work permitted to licensed professionals
- Electrical work permitted to laymen
- Electrical measurement technology, terms and methods
- Measuring device properties and accuracy
- Instrument transformers and transducers
- Voltage, current, power, energy and impedance measurument
- Digital multimeter, power analyzer, electrical installation tester, oscilloscope

Further information
Participation to all measurement exercises at the laboratory is compulsory.

4_EFA8070 Digital Electronics: 5 op

Credits
5 - 5

Objectives
The student understands the fundamental topics in digital system design. He/she is familiar with basic concepts of the digital techniques and their mutual dependences. The student knows essential applications of the digital electronics and constructions.

Content
Digital technique basics and applications
Number systems, Boolean algebra and codes
Combinational circuit design
Sequential circuit design, state machines and diagrams
Programmable logic or alternatively basics of VHDL
Electrical statistics
Laboratory exercises

4_EFA8090 Sensor Basics: 5 op

Credits
5 - 5

Objectives
The student knows the principles of the most common sensors and understands their operating principles. He/she is acquainted with the physical effects and mathematical principles related to sensors. The student is able to utilize his/her knowledge in various measurement tasks as well as to design and build new sensor based implementations. He/she has a good overview of instability and terminology related to measurement technology.

Content
1. Sensors and transmitters
heat/temperature sensors
pressure sensors
flow sensors
level sensors
mechanical motion (displacement, position, velocity, acceleration) sensors
proximity sensors
RFID sensors

2. Micro- and biosensors
physical sensors
chemical sensors
biological sensors
electrochemical sensors
microfluidics fundamentals

3. Optical sensor basics and applications
optical sensors
image sensors (CCD, CMOS, MCP)

4. Sensor interfaces
sensors in process control
signal processing (filtering and amplifying)
sensor protection

IT00BD90 Basics of Artifical Intelligence: 5 op

Credits
5 - 5

Objectives
After completing the course, the student will be able to
- understand the terms Artificial Intelligence, related fields, and the philosophy of AI
- learn the societal applications of AI and how it could predict the future
- become familiar with basic statistics and probability used in AI

- solve simple machine learning and deep learning AI problems
- utilize basic AI algorithms in IoT optimization problems

Content
- Statistics and Probability know-how, especially Bayes Rule and Regression
- Fundamental concepts on Neural Networks, Machine Learning, and Deep Learning
- Study of Datasets
- Classification Methods- Nearest Neighbor classification, Decision trees, Discriminant Analysis, Support vector machine
- Predictive models and finding their accuracies and improvement

4_EFA8050 Browser Programming: 5 op

Credits
5 - 5

Objectives
Student can implement web pages with HTML and CSS
Student can use chosen user interface libraries
Student can implement functionality to the client side of web application (Javascript, DOM)
Student can implement a multi-layer web application which uses database
Student can use Javascript programming language
Student can make an ajax request to the server by using Javascript
Student knows the most common data transfer and storage formats (JSON, XML) and knows how to use them
Student can implement the server side logic with chosen programming framework

Content
HTML5 ja CSS
Basics of Javascript
Utilization of CSS- ja Javascript-libraries
Utilization of server api

4_EFA8100 Analog Electronics 1: 5 op

Credits
5 - 5

Objectives
The student is familiar with passive components and most common semiconductors and their features. He/she can draw and simulate functions of simple DC-circuits utilizing a SPICE simulator program. The student recognizes most common components and blocks in circuit diagrams.

Content
Passive components
Repetition of the circuit theory

Diodes, rectifiers and power supplies
Semiconductor basics (BJT’s, FET’s)
Passive filter approximations and implementations
Ideal and real operational amplifier theory and implementations

4_EFA8030 Data Structures and Algorithms: 5 op

Credits
5 - 5

Objectives
Student understands the importance of algorithms and can analyse asymptotic time complexity of simple algorithms.
Student can select and reason correct data structure (abstract data type) for an application and use the chosen structure efficiently.
Student can use efficiently the standard library of his/hers programming language.
Student knows and can implement most common abstract data types, list, tree, and set.
Student can design and implement an algorithm for a simple problem.
Student can search, select, and apply proper algorithm from literature for given problem.
Student knows the principle of recursion and can implement a recursive algorithm.

Content
Algorithms and running time analysis.
Abstract data types.
Implementing data structures.
Searching and sorting algorithms.
Simple recursive algorithms.

Prerequisites
Basics of Programming 1, Basics of Programming 2

IT00BD91 IoT Cloud Platforms: 5 op

Credits
5 - 5

Objectives
After completing the course, the student will be able to
- know the features and limitations of the commonly used cloud services as part of the IoT architecture
- select and use the selected cloud services as a part of an IoT architecture
- select appropriate tools for data analysis based on the IoT solutions
- carry out data analysis

Content
- network architectures: sensors - IoT devices - edge - cloud
- cloud configuration
- edge, fog, and cloud computing
- cybersecurity

- data analysis and visualization

Assessment scale
Five step scale

IT00BD92 Product Design and Development: 5 op

Credits
5 - 5

Objectives
After completing the course, the student will be able to
- apply product development principles to new projects
- understand all phases of product development
- employ most phases of product development
- sketch project documentation
- demonstrate skills of new IoT-related IT topics

Content
- development project management
- project documentation
- product opportunity and customer needs identification
- product specifications and concepts
- industrial design
- design for environment
- design for manufacturing
- prototyping
- robust design
- intellectual property
- other relevant product development topics
- IoT-related IT module, e.g., mobile programming

Further information
Recommended to be studied simultaneously with IT00BD93 IoT Project 1

Assessment scale
Five step scale

IT00BD93 IoT Project 1: 5 op

Credits
5 - 5

Objectives
After completing the course, the student will be able to
- produce a technical product development plan
- employ teamwork to execute the plan
- write technical documentation of the project
- demonstrate new technical skills acquired through learning and development work

- understand how a new IoT product is brought from idea to implementation

Content
- project topic covers one or more IoT technologies like sensors, embedded systems, wireless and wired networks, edge and cloud computing, artificial intelligence, and data analytics
- development project management
- project documentation
- teamwork skills
- technical reporting
- learning modules which support the project

Further information
Recommended to be studied simultaneously with IT00BD92 Product Design and Development

Assessment scale
Five step scale

IT00BD95 IP Networks: 5 op

Credits
5 - 5

Objectives
After completing the course, the student will be able to
- understand the basic structure of a computer network, OSI model, IP addressing
- use functions of the most common data communication protocols
- understand the basic functions of a router and a switch, virtual local area network (VLAN)
- use static and dynamic routing
- explain the basics of computer network security

Content
Exploring the network
- network protocols and communications
- basics of router and switch configuration commands
- IP Addressing (IPv4, IPv6)
- basics of switched networks
- VLANs
- static routing
- dynamic routing
- Wide Area Networks
- broadband solutions
- basics of computer network security

Assessment scale
Five step scale

IT00BD94 Cybersecurity Fundamentals: 5 op

Credits

5 - 5

Objectives
After completing the course, the student will be able to
- explain cybersecurity terminology
- apply principles of cybersecurity to hardware and software design
- recognize security threats and understand how they can be prevented
- know how to assess reliability and feasibility of different cybersecurity methods for hardware and software

Content
- terminology of cybersecurity
- physical security
- hardware security
- software security
- wired and wireless network security
- OSI layers of security
- IoT ecosystem security
- cyberattacks and their prevention
- cybersecurity standards, regulations and legislation
- organization’s security policy

Assessment scale
Five step scale

4_EFS8060 Wireless and Radiotechnology: 5 op

Credits
5 - 5

Objectives
The student is able to apply wireless and Rf-technologies to data transmission. The student knows the special requirements and propagation of short-range radio technology. The student is able to apply the theory of antennas and to design antennas. The student has in-depth knowledge of multipath propagation mechanisms and their influence on receiving of signals and signal quality. Student can apply wireless technologies and transmission wireless protocols to embedded radio systems.

Content
Use of radio systems and their general structure. ISM frequency ranges and their application. Short-range technologies: Bluetooth, WLAN, UWB, &LowPan, Zigbee. Most usual long range technologies like LORA and Sigfox. Wireless sensor networks and protocols, GPRS network. Propagation of radio signals. Calibration of antennas. Special processors of wireless devices. Energy management and harvesting technologies.
Interfacing of sensors to embedded wireless systems.
RF-transmission media and matching of the impedancies

IT00BD96 Industrial Internet and Automation: 5 op

Credits
5 - 5

Objectives
After completing the course, the student
- knows the principles of the automation system in terms of structure and application environments, as well as automation components and bus solutions.
- knows the functions of control software and how user operations take place and affect the process itself.
- understands the structure and services of the industrial internet.
- has skills to realize modern control system with deep learning ability.

Content
- Functions of the automation system
- Structure and programming of a decentralized automation system
- Controlling and connecting field devices to the system
- Control room and HMI interface
- The structure and services of an industrial internet.
- Intelligent Robotics
- Deep learning structures of automation

Assessment scale
Five step scale

IT00BD97 Digital Signal Processing: 5 op

Credits
5 - 5

Objectives
After completing the course, the student will be able to
- understand mathematical basis for digital signal processing
- apply digital signal processing using computational software
- implement digital signal processing techniques on DSP hardware

Content
- mathematical presentation of discrete signals
- sampling
- convolution
- z transform
- frequency response
- Fourier series
- discrete Fourier transform
- Fast Fourier Transform
- digital FIR and IIR filters and their design
- Wavelet transform
- implementing FFT and digital filters with DSP

Assessment scale
Five step scale

IT00BD98 IoT Project 2: 5 op

Credits
5 - 5

Objectives
After completing the course, the student will be able to
- generate an idea of implementing an innovative project
- implement an IoT project from the scratch
- utilize and demonstrate earlier skills in IoT technologies
- create an advanced technical documentation and project report
- realize the project in a professional manner

Content
- themes related to the IoT such as embedded computing, programming, wireless and sensor technologies
- project documentation
- teamwork skills
- advanced technical reporting
- learning modules that support the project

IT23SP-1019 IoT Embedded Engineering: 0 - 15 op

Optionality
Select according to specific criteria

Credits
0 - 15

Criteria

4_EFA8110 Analog Electronics 2: 5 op

Credits
5 - 5

Objectives
The student is familiar with common AC-circuits like amplifiers and active filters. He/she can draw and simulate functions of AC-circuits utilizing a SPICE simulator program. The student recognizes most common components and blocks in circuit diagrams.

Content
Implement studies of analog electronic 1 –course in practice
AC waveform and circuit theory
Amplifier models
Concepts of amplifiers and frequency response

Interfacing analog electronics to digital system, AD- and DA-converters
Waveform generators and oscillators

IT00BE00 Embedded Programming 2: 5 op

Credits
5 - 5

Objectives
After completing the course, the student will be able to
- develop low-level software for a microprocessor or a microcontroller
- design, implement and test simple programs for microprocessors or microcontrollers
- have basic knowledge of various integrated development environments (IDE)
- understand how to connect common digital and analog components to a microprocessor or microcontroller

Content
- low-level programming of a microcontroller
- embedded design and programming fundamentals
- connect digital and analog components to a processor or microcontroller
- design and run programs in a simulator
- design and run programs in target hardware

Assessment scale
Five step scale

4_EFS8050 Real Time Systems: 5 op

Credits
5 - 5

Objectives
Students learn most important features of the real time programming, the alternatives of the operating systems and the reasons why the using of real time system is necessary. Students learn to implement a small scale application into a microprocessor card.

Content
The teaching of the theory and programming exercises are included into following subjects:

1. Real Time Operating System
The structure of the real time application
Parallel programming: Tasks, Scheduling, Priorities
Messages: Post boxes, semaphores, event groups, comon data
Time dependent programming, reaction times
Device interfaces: interrupt handling, device drivers
Memory Management
Implementing system services: files, stdio
Most common errors: deadlock, starving

2. Most common operating systems
FreeRTOS
Embedded Linux

3. The programming of the own application

Prerequisites
Good knowledge of C/C++ programming

IT23SP-1020 IoT Cloud Engineering: 0 - 15 op

Optionality
Select according to specific criteria

Credits
0 - 15

Criteria

4_EFS8020 Basics of Big Data: 5 op

Credits
5 - 5

Objectives
To understand principles of mining and analyzing massive unstructured data sources
To understand basics concepts, methods and tools of Big Data solutions

Content
Concepts and tools in Big Data: eg. Hadoop, Hive, Pig. Analyzation and visualization of data.

4_EFS8040 Business Intelligence: 5 op

Credits
5 - 5

Objectives
Student is able to analyze and visualize data collected with some tool like Microsoft BI tools, IBM Watson analytics or Big Data Hadoop tools. Student is able to combine data from many sources. Student knows how to turn data into nice visualized reports that can be used to make business decisions. Students are able to use artificial intelligence and deep learning methods to make analysis and decisions of the industrial or digital health process.

Content
Alternative content:
Microsoft Excel Power tools, Microsoft Power BI, Basics of DAX language.
IBM Watson analytics tool
Big Data analytic with Hadoop

Decision making in business, Digital Health and industrial processes:
Artificial Intelligense decision making
Deep learning procedures

IT00BD99 Cloud Certification: 5 op

Credits
5 - 5

Objectives
After completing the course, the student will be able to
- explain cloud computing concepts, models, and services, such as public, private, and hybrid cloud as well as infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS).
- deploy cloud services on the selected platform
- use methods for security, privacy, compliance, and trust

Content
- follow cloud service provider’s standard certification requirements
- cloud service provider can be selected based on availability and student’s needs

Assessment scale
Five step scale

IT23SP-1017 Elective Studies: 15 op

Optionality
Select x cr

Credits
15 - 15

IT23SP-1024 Elective Studies: 15 op

Optionality
Select x cr

Credits
15 - 15

IT23SP-1018 Internship: 30 op

Optionality
All compulsory

IT23SP-1025 Internship: 30 op

Optionality
All compulsory

EX00BD39 Internship 1: 5 op

Credits
5 - 5

Objectives
After completing the course the student is able to
- recognize different jobs in the field of education
- apply to jobs suitable for Internship 1
- make an internship contract and write an internship report
- evaluate his/her professional competencies and development needs
- observe the workplace's requirements and practices

Content
Applying for a job. Making an internship contract. Working in an internship place. Writing an internship report

Assessment scale
Five step scale

EX00BD40 Internship 2a: 5 op

Credits
5 - 5

Objectives
After completing the course the student is able to
- apply to jobs suitable for Internships 2-3 and plan his/her career path
- make an internship contract and write an internship report
- work and follow guidance in practical tasks that are central to the professional field
- apply the knowledge and skills learned at studies into practice
- recognize and follow the industry's requirements and practices, and understand the company's operations
- evaluate his/her professional competencies and development needs

Content
Applying for a job. Making an internship contract. Working in an internship place. Writing an internship report.

Assessment scale
Five step scale

EX00BD41 Internship 2b: 5 op

Credits
5 - 5

Objectives

After completing the course the student is able to
- apply to jobs suitable for Internships 2-3 and plan his/her career path
- make an internship contract and write an internship report
- work and follow guidance in practical tasks that are central to the professional field
- apply the knowledge and skills learned at studies into practice
- recognize and follow the industry's requirements and practices, and understand the company's operations
- evaluate his/her professional competencies and development needs

Content
Applying for a job. Making an internship contract. Working in an internship place. Writing an internship report.

Assessment scale
Five step scale

EX00BD42 Internship 3a: 5 op

Credits
5 - 5

Objectives
After completing the course the student is able to
- apply to jobs suitable for Internships 2-3 and plan his/her career path
- make an internship contract and write an internship report
- work and follow guidance in practical tasks that are central to the professional field
- apply the knowledge and skills learned at studies into practice
- recognize and follow the industry's requirements and practices, and understand the company's operations
- evaluate his/her professional competencies and development needs

Content
Applying for a job. Making an internship contract. Working in an internship place. Writing an internship report.

Assessment scale
Five step scale

EX00BD43 Internship 3b: 5 op

Credits
5 - 5

Objectives
After completing the course the student is able to
- apply to jobs suitable for Internships 2-3 and plan his/her career path
- make an internship contract and write an internship report
- work and follow guidance in practical tasks that are central to the professional field
- apply the knowledge and skills learned at studies into practice

- recognize and follow the industry's requirements and practices, and understand the company's operations
- evaluate his/her professional competencies and development needs

Content
Applying for a job. Making an internship contract. Working in an internship place. Writing an internship report.

Assessment scale
Five step scale

EX00BD44 Internship 3c: 5 op

Credits
5 - 5

Objectives
After completing the course the student is able to
- apply to jobs suitable for Internships 2-3 and plan his/her career path
- make an internship contract and write an internship report
- work and follow guidance in practical tasks that are central to the professional field
- apply the knowledge and skills learned at studies into practice
- recognize and follow the industry's requirements and practices, and understand the company's operations
- evaluate his/her professional competencies and development needs

Content
Applying for a job. Making an internship contract. Working in an internship place. Writing an internship report.

Assessment scale
Five step scale

THESIS Thesis: 15 op

Duration (years)
0

Primary teaching language
English

Details

Person in charge
Jari Linden

Description

Description

Thesis Planning (5 ECTS)
Thesis Implementation (5 ECTS)
Thesis Finalisation (5 ECTS)

Further information
The student shall acquire the material required for the thesis him/herself. Savonia’s thesis reporting instructions.

The student may create an individual yet appropriate timetable for the thesis process.

Curriculum development and working life cooperation
The thesis is always working life oriented. It may take the form of a
a) development work planned and implemented by a student or a group of students to meet the user's or client's needs. Development may focus on a product, service, process, working method, learning material or instruction, digital material, supervised activity etc. The student shall present the plan, its implementation and its evaluated output and the need for further development in a report whose form is suitable for the professional field in question.
b) research-based thesis, in which a student or a group of student approaches a practical problem or item to be developed with appropriate research methods. The student shall prepare a report describing the planning, implementation and results of the thesis and interpreting the results.
c) production, in which a student of a group of students demonstrates competence as an expert or as an artist by planning and implementing an event, a seminar, an artistic performance etc. The student shall present the plan, its implementation and its evaluated output in a report whose form is suitable for the professional field in question.
d) compiled thesis, in which parts planned as a thesis (e.g. projects) are implemented and reported. In the written synthesis, article or other publication, which is part of the thesis, the student shall present the essential results/output in a form that is suitable for the professional field in question.

Objectives
Student can
- choose a topic for thesis that is suitable for his or her field and his or her professional development and justify the choice from different perspectives
- plan and implement a working life oriented research and development work based on the needs of the user/client
- apply scientific and evidence-based information in the thesis process and in the development of his or her expertise
- appropriately use research and development methods or artistic methods that are suitable for his or her professional field and for the topic of the thesis
- prepare a clearly defined, logical and professionally appropriate report on his or her thesis
- evaluate the essential contents, results or output of his or her thesis and justify their significance from the perspectives of his or her field, the client’s/user’s need and his or her professional development
- evaluate his or her thesis process, its reliability and ethicality as well as his or her professional growth and learning during the work
- cooperate in a flexible manner with players involved in the thesis process and demonstrate his or her expertise
- take the maturity test on his or her thesis.

Optionality, prerequisites and offering information

Optionality
All compulsory

Prerequisites
Research methodology studies of the degree programme.

THESIS-1001 Thesis: 15 op

Optionality
All compulsory

XT00BA53 Thesis Planning: 5 op

Credits
5 - 5

Objectives
The student can
- choose a topic that is relevant for the development of both the field of study and his/her own expertise
- motivate his/her topic choice from various viewpoints
- create a thesis topic proposal and complete it into a thesis plan (= work plan)
- work flexibly with other people and parties involved in the thesis process
- present his /her knowledge and skills.

Content
Selecting a thesis topic and narrowing it down. Writing a thesis topic proposal. Signing a thesis project agreement. Finding a thesis supervisor. Information retrieval and reporting practices. Writing a thesis plan (= work plan) and finding source materials.

Further information
The student may create an individual yet appropriate timetable for the thesis process.

Prerequisites
Research methodology studies of the degree programme.

Assessment scale
Five step scale

XT00BA54 Thesis Implementation: 5 op

Credits
5 - 5

Objectives
The student can
- implement a working-life-oriented research and development project, which meets the needs of a

user/client
- apply scientific and evidence-based knowledge to the thesis process in order to increase and develop his/her expertise
- create a report that is concise and logical and meets the professional standards of his/her field of study.
- assess the main contents, results and outcomes of the thesis and discuss their relevance to the field, the needs of a user/the client and the development of his/her expertise
- work flexibly with other people and parties involved in the process and demonstrate his/her expertise

Content
- working independently on the thesis
- guidance related to the various phases of the thesis
- the results/outcome of the thesis
- presentation of the thesis in a seminar

Further information
The student may set an individual yet appropriate timetable for his/her thesis process.

Prerequisites
Research methodology studies of the degree programme.
Course: Thesis Planning (5 ECTS).

Assessment scale
Five step scale

XT00BA55 Thesis Finalisation: 5 op

Credits
5 - 5

Objectives
The student can
- create a report that is concise and logical and meets the professional standards of his/her field of study
- assess the main contents, results and outcomes of the thesis and discuss their relevance to the field, the needs of a user/the client and the development of his/her expertise
- assess the thesis process, its reliability and ethicalness as well as his/her professional growth and development
- work flexibly with other people and parties involved in the process and demonstrate his/her expertise
- write a maturity test essay on the thesis process.

Content
- finalizing the thesis as well as writing and editing the report based on the feedback received in the thesis seminar and from the thesis supervisor
- detection of plagiarism
- submitting the thesis for assessment

Further information
The student may set an individual yet appropriate timetable for the thesis process.

Prerequisites
Research methodology studies of the degree programme.
Courses: Thesis Planning (5 ECTS) and Thesis Implementation (5 ECTS).

Assessment scale
Five step scale

XT00BA56 Maturity Test: 0 op

Credits
0 - 0

Objectives
The student can
- write the maturity test showing expertise in the field of his/her studies and proficiency in communication and language skills
- discuss the maturity test task/ question in a logical manner, showing professional competence and with relevance to the task
- summarise his/her thesis and focus on the essential concepts, facts and findings
- write a professional text in the appropriate style and without grammar mistakes.

Content
Enrolling to and writing the maturity test.

Further information
The information on student’s maturity test is included in the degree certificate.

Prerequisites
Completion of Thesis (15 ECTS)

Assessment scale
Five step scale