Software and Service Engineering (SSE) 2022-2024

Code: SCI3043

Extent: Long (60 credits) or compact major (40 credits). Students taking a compact major take also a minor (20–25 cr). Students taking a long major may include an optional minor in their elective studies.

Responsible professors: Casper Lassenius

Abbreviation: SSE

School: School of Science

Objectives

Digital products and services are crucial to economies, societies and human well-being. For companies and other organizations, they offer exponentially expanding opportunities for new functionality and capabilities beyond traditional product boundaries. Students of Software and Service Engineering learn how to design, develop, and manage digital products and services that create business value and satisfy user needs within modern organizations. Students learn how to tackle wicked, real-world problems taking human, societal and organizational factors into account.

Students are encouraged to ensure that they have technical knowledge of software development, e.g, by combining the major with a technical minor, or by including technical courses, such as web software development or full-stack development in their studies.

The major has three tracks making it possible to specialize in software engineering, service design and engineering, or enterprise systems.

Structure and Content

SSE offers both long and compact majors. The following tracks are available:

1. Software Engineering
2. Service Design and Engineering (SDE)
3. Enterprise Systems

All the students majoring software and service engineering take the major common courses (10 credits). In addition, they take courses according to their study track. It is strongly recommended that students also participate in the Portfolio in Software and Service Engineering course (CS-E4920)

Major common courses 10 credits

CODE	NAME	CREDITS	PERIOD/YEAR
CS-C3150	Software Engineering *	5	I-II
CS-E4900	User-centred Methods for Product and Service Design	5	I-II

* If the course has been taken as part of the B.Sc. studies, it can be substituted with any optional courses of the track the student is studying. If the student has taken a similar course at another institution, the professor should be contacted for discussing possible substitution.

Study tracks

› Enterprise Systems

Professor in charge: Casper Lassenius
Other professors: Jari Collin
Extent: Long (60credits) or compact major (40 credits). Students taking a compact major take also a minor (20–25 credits). Students taking a long major may include an optional minor in their elective studies.

Objectives

For most companies and organizations, developing and managing information systems has become increasingly critical for how the companies create and capture value, how they work with partners and users, and how they secure competitive advantage. The Enterprise Systems track provides its students the knowledge, competences, and skills they will need to act successfully in the industry and society to tackle these challenges and opportunities.

Learning outcomes

After completing the track, the students should be able to understand the opportunities of digitalization in industrial applications and related domains and to turn these opportunities to actual business value by defining, creating, deploying, and managing relevant information systems. They will have the skills needed to work effectively in multidisciplinary teams including business and technology experts.

Structure

Students are expected to take the major common courses and track compulsory courses. In addition, they take courses from the track optional course list. It is strongly recommended that students also participate in the Portfolio in Software and Service Engineering course (CS-E4920).

Major common courses (10 credits)

CODE	NAME	CREDITS	PERIOD
CS-C3150	Software Engineering *	5	I-II
CS-E4900	User-centred Methods for Product and Service Design	5	I-II

Track compulsory courses (15 credits)

CODE	NAME	CREDITS	PERIOD
CS-E5300	Enterprise Systems Architecture *	5	I
CS-E5310	ICT Enabled Service Business and Innovation	5	II
CS-E5000	Seminar in Software and Service Engineering	5	I-II, III-V

Track optional courses

CODE	NAME	CREDITS	PERIOD
SELECT 15-30 CREDITS FROM THE FOLLOWING			
CS-E4920	Portfolio in Software and Service Engineering	1–5	I-V
CS-E5002	Special Course in Software and Service Engineering	1-10	varies
CS-E5004	Individual Studies in Software and Service Engineering	1-10	agreed with teacher
CS-E5330	IT Governance	5	II
CS-E5340	Introduction to Industrial Internet	5	IV
CS-E4950	Software Architectures *	5	III-V
CS-E4940	Requirements Engineering *	5	III-V
CS-E4930	Software Processes and Projects	5	III
CS-E5480	Digital Ethics	3-5	V
37E01500	Project Management and Consulting Practice	6	II
37E00200	Strategic Information Technology Management	6	II
57E00500	Business Intelligence	6	IV-V
IN ADDITION, SELECT 0-20 CREDITS FROM THE FOLLOWING (LONG MAJOR)			

CS-E5005	Research Methods in Software and Service Engineering	3–5	I-II
TU-E4300	Introduction to Digital Business and Venturing	3	I
TU-E4310	Digital Business Management	4	II
TU-E1021	Strategies for Growth and Renewal	5	III-IV
TU-E1120	Strategic Management of Technology and Innovation	5	III-V

* If any of these courses have been taken as part of the B.Sc. studies, they can be substituted with any elective courses of the track. If the student has taken similar courses at another institution, the professor should be contacted for discussing possible substitutions.

› Service Design and Engineering

Professor in charge: Marjo Kauppinen, Marko Nieminen and Johanna Viitanen
Extent: Compact (40 credits) or long (60 credits) major. Students taking a compact major also take a minor (20–25 credits). Students taking a long major may include an optional minor in their elective studies.
Abbreviation: SDE

Objectives

Digital services and software form an integral part of modern everyday life. The Service Design and Engineering (SDE) track is for students who want to specialise in developing human-centric digital services and analysing their impact on business and society.

The SDE track focuses on collaborative software and service design, where understanding customer and user needs is essential. The track provides theoretical and practical means for working with customers, users, and other stakeholders throughout the whole lifecycle of digital services. Students learn to work in multidisciplinary teams where they create innovative, and commercially viable solutions. They apply user-centred and software engineering methods to support design and evaluation activities.

After completing their studies, students can work in design and engineering companies, industry, public organisations, and startups. Typical roles include product owners, software developers, user interface and interaction designers, usability specialists, user experience managers, service designers, project managers, and business analysts. The track also provides a good starting point for doctoral studies.

Learning outcomes

In the SDE track, students learn to

1. discover and analyse customer, user and business needs
2. apply methods from software engineering, service design and user-centred design in practice
3. define an an efficient design process for the needs of a company and projects
4. collaboratively develop digital services that create customer and business value
5. create innovative service concepts in multidisciplinary teams
6. critically evaluate service concepts and digital services
7. build up a strong conceptual foundation for continuous learning.

Content and structure

Service Design and Engineering Compact Major 40 credits

The compact major of the SDE track consists of two major common courses. In addition to these courses, the Data-Driven Concept Design is the only compulsory course. Students can also select courses from the track optional course list. It is strongly recommended that students also participate in Portfolio in Software and Service Engineering course (CS-E4920). Combined with personal discussions with responsible professors of the track, this course supports students in finding their individual study and career profile.

It is strongly recommended that students select a minor that emphasises multidisciplinarity. Students taking the SDE track who wish to focus on entrepreneurship are recommended to take the Startup Minor as their minor.

Major common courses (10 credits)

CODE	NAME	CREDITS	PERIOD / YEAR
CS-C3150	Software Engineering *	5	I-II/1st year
CS-E4900	User-centred Methods for Product and Service Design	5	I-II / 1st year

Track compulsory course (5 credits)

CODE	NAME	CREDITS	PERIOD
CS-E5250	Data-Driven Concept Design	5	III / 1st year

Track optional courses (20–25 credits)

CODE	NAME	CREDITS	PERIOD
CS-E4920	Portfolio in Software and Service Engineering	1–5	I-V
CS-E5000	Seminar in Software and Service Engineering	5	I-II, III-V
CS-E5230	Collaborative Evaluation of Interactive Systems	5	IV-V / 1st year
CS-E5220	User Interface Construction	5	II
CS-C3180	Software Design and Modeling*	5	I-II /1st year
CS-E4930	Software Processes and Projects	5	III/1st year
CS-E4940	Requirements Engineering	5	III-V/1st year

CODE	NAME	CREDITS	PERIOD
CS-E4950	Software Architectures	5	III-V/1st year
CS-E4960	Software Testing and Quality Assurance	5	I-II
CS-E5005	Research Methods in Software and Service Engineering	5	I-II

In addition to the above, courses from the other tracks of the SSE major can be included as optional courses. Also other optional courses can be included per agreement with a professor in charge of the track.

') If any of these courses have been taken as part of the B.Sc. studies, they can be substituted with any elective courses of the track. In the case the student has taken similar courses at another institution, the professor should be contacted for discussing possible substitutions.

Service Design and Engineering Long Major 60 credits

The long major of the SDE track consists of two major common courses. In addition to these courses, the Data-Driven Concept Design is the only compulsory course. Students can also select courses from the track optional course list. It is strongly recommended that students also participate in the course Portfolio in Software and Service Engineering (CS-E4920). Combined with personal discussions with responsible professors of the track, this course supports students in finding their individual study and career profile.

Students selecting the long major focus on various aspects of digital service design including user-centred design, business and customer analysis combined with software engineering. Students with a long major have the possibility to tailor the major personally in collaboration with their supervising professor. Additionally, the long major lays a proper foundation for doctoral studies in the field.

Students taking the SDE track who wish to focus on entrepreneurship are recommended to take the Startup Minor as part of their elective studies.

Major common courses (10 credits)

CODE	NAME	CREDITS	PERIOD
CS-C3150	Software Engineering *	5	I-II / 1st year
CS-E4900	User-centred Methods for Product and Service Design	5	I-II / 1st year

Track compulsory course (5 credits)

CODE	NAME	CREDITS	PERIOD
CS-E5250	Data-Driven Concept Design	5	III / 1st year

Track optional courses (select 35–45 credits from the following)

CODE	NAME	CREDITS	PERIOD
CS-E4920	Portfolio in Software and Service Engineering	1–5	I-V
CS-E5000	Seminar in Software and Service Engineering	5	I-II, III-V
CS-E5230	Collaborative Evaluation of Interactive Systems	5	IV-V/1st year
CS-E5220	User Interface Construction	5	II
CS-C3180	Software Design and Modeling*	5	I-II /1st year
CS-E4930	Software Processes and Projects	5	III/1st year
CS-E4940	Requirements Engineering	5	III-V/1st year
CS-E4950	Software Architectures	5	III-V/1st year
CS-E4960	Software Testing and Quality Assurance	5	I-II
CS-E5005	Research Methods in Software and Service Engineering	5	I-II
TU-E4310	Digital Business Management	4	II
CS-E5300	Enterprise Systems Architecture	5	I
CS-E5310	ICT Enabled Service Business and Innovation	5	I-II
CS-E5340	Introduction to Industrial Internet	5	IV
CS-E4400	Design of WWW Services	5	I-II
CS-E4460	WWW Applications	5	I-II
CS-E4675	Full Stack Web Development	5-7	I-V
CS-E4270	Device-Agnostic Design	5	I, III-V

Courses that strengthen the multidisciplinary contents of the studies are especially recommended. These include, for instance, the following courses. The student shall make sure that participating in those courses is possible.

CODE	NAME	CREDITS	PERIOD
37E00100	Information Economy	6	IV
TU-E4300	Introduction to Digital Business and Venturing	3	I
TU-E4320	Global Business in the Digital Age	4	V

Also other optional courses can be included per agreement with a professor in charge of the track.

Software Engineering

Professor in charge: Casper Lassenius
Other professors: Marjo Kauppinen
Extent: Long (60 credits) or compact (40 credits) major. Students taking a compact major also take a minor (20–25 credits). Students taking a long major may include an optional minor in their elective studies.

Objectives

Software is at the core of most developed economies and organizations. The software engineering track is intended for students who want to become proficient in developing and managing development of software systems and services in real-world organizations, big and small.

The track combines theoretical studies with a large number of practical assignments done both in groups and as individuals, providing opportunities not only to understand but to apply the various methods and tools taught. Many of the assignments are either done for industrial customers representing real-life organizations or based on cases from industry. Many courses use lecturers from industry to provide practical viewpoints to the subjects studied.

Software engineering majors typically work in industry in roles such as Scrum Master, team lead, software architect, project manager, test lead, process engineer, or product owner. Students of software engineering are recommended to take a technical minor in computer science, but the major can also be fruitfully combined with e.g. strategic management, organizational development, or occupational psychology and leadership. The long major gives students the possibility to study software engineering more in-depth, giving the possibility to focus on a specific area of interest. This lays a good foundation for expert roles in industry, or for PhD studies in software engineering.

Learning outcomes

In the software engineering track, students learn the processes, methods and techniques used in professional software development in organizations and projects of various sizes. Core subjects include various software development activities, such as requirements engineering, design, implementation, testing and deployment, as well as supporting activities including project management, organizational development, and configuration management.

Software Engineering long major (60 credits)

The long major in software engineering gives students the opportunity to specialize in software engineering to help become software engineering experts in industry, as well as lays a good foundation for graduate studies. Students of the long major have the possibility to tailor the major personally in collaboration with their supervising professor.

The students take the major common courses and track compulsory courses. In addition, they take courses from the track optional course list. It is strongly recommended that students participate in Portfolio in Software and Service Engineering course (CS-E4920).

Major common courses (10 credits)

CODE	NAME	CREDITS	PERIOD / YEAR
CS-C3150	Software Engineering *	5	I-II / 1st year
CS-E4900	User-centred Methods for Product and Service Design	5	I-II / 1st year

Track compulsory courses (15-18 credits)

CODE	NAME	CREDITS	PERIOD / YEAR
CS-C3180	Software Design and Modelling*	5	I-II / 1st year
CS-E4910	Software Project 3	5–8	I-V / 2nd year
CS-E5000	Seminar in Software and Service Engineering	5	I-II, III-V

Track optional courses

SELECT 20-40 CREDITS FROM THE FOLLOWING

CODE	NAME	CREDITS	PERIOD / YEAR
CS-E4920	Portfolio in Software and Service Engineering	1–5	I-V / 1st year
CS-E5005	Research Methods in Software and Service Engineering	5	I-II / 2nd year
CS-E4930	Software Processes and Projects	5	III / 1st year
CS-E4940	Requirements Engineering	5	III-V / 1st year
CS-E4950	Software Architectures	5	III-V / 1st year
CS-E4960	Software Testing and Quality Assurance	5	I-II / 1st year
CS-E5004	Individual Studies in Software and Service Engineering	1–10	Agreed with the teacher
CS-E5002	Special Course in Software and Service Engineering	1–10	varies

IN ADDITION, SELECT 0-22 CREDITS FROM THE FOLLOWING

CODE	NAME	CREDITS	PERIOD
35E00800	Intellectual Property Rights	6	II
37E00200	Strategic Information Technology Management	6	II
TU-C3010	Introduction to Product Management	5	IV-V
TU-E1120	Strategic Management of Technology and Innovation	5	III-V

* If the course has been taken as part of the B.Sc. studies, it can be substituted with any optional courses of the track. In the case the student has taken similar courses at another institution, the professor should be contacted for discussing possible substitutions.

In addition to the above, courses from the other tracks of the SSE major can be included as optional courses. Also other optional courses can be included per agreement with a professor in charge of the track.

It is recommended to take most of the software engineering specific courses (Software Engineering, Software Design and Modelling, Software Processes and Projects, Requirements Engineering, Software Architectures, and Software Testing and Quality Assurance) during the first year of studies. Their content is to be applied in practice on the Software Project 3 course during the second year.

Software Engineering compact major 40 credits

The compact major aims at teaching students the main elements of software engineering to give them a sound foundation for future careers in industry.

The students take the major common courses (10 credits) and track compulsory courses (10–13 credits). In addition, they take courses from the track optional courses list. Students taking a compact major must have a minor (20–25 credits). It is strongly recommended that students also participate in the Portfolio course in Software and Service Engineering (CS-E4920).

Major common courses (10 credits)

CODE	NAME	CREDITS	PERIOD/YEAR
CS-C3150	Software Engineering *	5	I-II / 1st year
CS-E4900	User-centred Methods for Product and Service Design	5	I-II / 1st year

Track compulsory courses (10-13 credits)

CODE	NAME	CREDITS	PERIOD / YEAR
CS-C3180	Software Design and Modelling *	5	I-II / 1st year

CODE	NAME	CREDITS	PERIOD / YEAR
CS-E4910	Software Project 3	5–8	I-V / 2nd year

Track optional courses

SELECT 17-20 CREDITS FROM THE FOLLOWING

CODE	NAME	CREDITS	PERIOD / YEAR
CS-E4920	Portfolio in Software and Service Engineering	1–5	I-V / 1st year
CS-E5000	Seminar in Software and Service Engineering	5	I-II, III-V
CS-E5005	Research Methods in Software and Service Engineering	5	I-II
CS-E4930	Software Processes and Projects	5	III / 1st year
CS-E4940	Requirements Engineering	5	III-V/ 1st year
CS-E4950	Software Architectures	5	III-IV / 1st year
CS-E4960	Software Testing and Quality Assurance	5	I-II / 1st year

* If the course has been taken as part of the B.Sc. studies, it can be substituted with any optional courses of the track. In the case the student has taken similar courses at another institution, the professor should be contacted for discussing possible substitutions.

In addition to the above, courses from the other tracks of the SSE major can be included as optional courses. Also other optional courses can be included per agreement with a professor in charge of the track.

It is recommended to take most of the software engineering specific courses (Software Engineering, Software Design and Modelling, Software Processes and Projects, Requirements Engineering, Software Architectures, and Software testing and Quality Assurance) during the first year of studies. Their content is to be applied in practice on the Software Project 3 course during the second year.