JÖNKÖPING UNIVERSITY
School of Engineering

PROGRAMME SYLLABUS
Preliminary, not confirmed

Sustainable Production Development (master), 120 credits

Sustainable Production Development (master), 120 högskolepoäng

Programme Code:	TASP5	Programmestart:	Autumn 2025
Confirmed:		Education Cycle:	Second-cycle level

Title of qualification

Degree of Master of Science (120 credits) with a major in Production systems specialisation in Sustainable Production Development

Teknologie Masterexamen med huvudområdet Produktionssystem inriktning Sustainable Production Development

Programme overview

Main field of study

The main field of study production systems includes the scientific study of organisation, processes and technology for the production of products. Production systems include the technology, people and organization needed to turn an identified customer need for goods and associated services into reality. Focus in the main field of study is on development, operation and management of production systems, integrated with other elevant processes in organisations active on a regional, national or global market. Within the main field of studies theories concerning production engineering, production system development, integrated product- and production development, quality management, logistics and supply chain management, is combined with theories on organisation and operations management.
The studies in the field are based on a holistic view on production and its interaction with the entire product realisation process, including the interface with customers and suppliers. Economic, social and environmental aspects are considered. A system perspective is applied, and both quantitative and qualitative approaches are applied. Studies with the main field of study aims at deep understanding and knowledge of central elements of a production system, its development, operation and management. Knowledge and skills required for development, operation and management of globally competitive production systems are aimed at.

Background

Today, the manufacturing industry faces significant challenges and must adapt to a rapidly changing business environment. Markets are evolving quickly, and increased demand for product renewal results in shorter product lifetimes. Simultaneously, it is essential to deliver products in small series and according to customer specifications. To manage these demands, manufacturing companies need to swiftly adapt their production systems to new circumstances.

Moreover, adopting new technologies and increasing levels of digitalization and automation are crucial for maintaining competitiveness. Fast information exchange and coordination between product development and production development are also key to success. Additionally, international competition necessitates continuous development of the manufacturing industry, both technologically and strategically, with the ambition to contribute to a sustainable society.

Future manufacturing companies are also challenged by the European Union's mission to transition the industry towards a circular economy by 2050. This goal requires manufacturing companies to aim for sustainable production development and circular flows.

A holistic view of manufacturing is essential for companies to understand and enhance their capabilities to reuse existing knowledge and invest in flexibility to respond to new trends and changes. Furthermore, companies must deeply understand the production system design process to manage an increased number

of product variants, shorter delivery times, high delivery precision, and sustainability, including circular flows. This comprehensive perspective considers both the preconditions and possibilities of manufacturing, enabling companies to adapt and thrive in a dynamic environment.

Competitive sustainable production systems, therefore, require engineers with a comprehensive understanding of production requirements and possibilities. Engineers need advanced knowledge about the design and functionality of production systems.

Objectives

The master programme in Sustainable Production Development aims to equip students with the skills to perform engineering tasks and manage the development of sustainable production systems. It provides students with knowledge about flexible and adaptive production systems that can proactively respond to industrial changes. The program builds expertise in both production development and the operation of production systems within the context of digitalization, automation, and circularity.

Graduates will emerge as highly skilled engineers with a sustainable and innovative mindset, ready to drive the future development of complex, digitalized, and sustainable manufacturing industries.

Post-graduation employment areas

Graduates will be highly skilled engineers' with knowledge of sustainable, digitalized and complex production system. The programme provides a good foundation for working in a wide range of industrial positions or an academic career - nationally or internationally. Possible working areas include production development, production management, and production engineering, project manager, or consultant. This master programme also qualifies you to apply for continued postgraduate studies leading to an academic career.

Programme Supportive Research

The program is directly supported by research at School of Engineering, Jönköping Universtiy, which focuses on industrial product development in collaboration. The research is conducted partly in projects within the university's departments. The department whose research primarily contributes to the research anchoring in the programme is Product and Production Development department. At the Department of Product and Production Development, the research focuses on methodology and technology for the development and manufacturing of industrial products.

The examinators and most of the course coordinators and teachers in the program are researchers engaged in a variety of research projects. Therefore, all courses contain insights and examples of cases from ongoing or completed research projects. This implies that the program offers relevant knowledge, providing students with insights into cutting-edge research development.

Objectives

Common learning outcomes

After the completion of the programme, students must meet the intended learning outcomes, as described in The Higher Education Ordinance by Degree of Master and also the intended learning outcome, as described by JTH:

Knowledge and Understanding

1. demonstrate knowledge and understanding in the main field of study, including both broad knowledge of the field and a considerable degree of specialised knowledge in certain areas of the field as well as insight into current research and development work
2. demonstrate specialised methodological knowledge in the main field of study

Competence and Skills

3. demonstrate the ability to critically and systematically integrate knowledge and analyse, assess and deal with complex phenomena, issues and situations even with limited information
4. demonstrate the ability to identify and formulate issues critically, autonomously and creatively as well as to plan and, using appropriate methods, undertake advanced tasks within predetermined time frames and so contribute to the formation of knowledge as well as the ability to evaluate this work
5. demonstrate the ability in speech and writing both nationally and internationally to clearly report and discuss his or her conclusions and the knowledge and arguments on which they are based in dialogue with different audiences
6. demonstrate the skills required for participation in research and development work or autonomous employment in some other qualified capacity

Judgement and Approach

7. demonstrate the ability to make assessments in the main field of study informed by relevant disciplinary, social and ethical issues and also to demonstrate awareness of ethical aspects of research and development work

8. demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used
9. demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning
JTH. prove ability to embrace interdisciplinary approaches.

Programme-specific learning outcomes
Upon completion of the program, the intended learning outcomes provided for programme must also be met.

Knowledge and Understanding
10. demonstrate knowledge and understanding of a production system based on the turbulent, competitive environment in which a production system operates
11. demonstrate knowledge and understanding of the state-of-the art in the research field of production system development

Competence and Skills
12. demonstrate the ability to apply different methods, tools used for development, deployment, operation and improvement of sustainable production system
13. demonstrate skills of how integration can support circularity and sustainability in product realization
14. demonstrate the ability to report and discuss how production development activities and decisions affect a sustainable productions system
15. demonstrate the ability to work in a multi-disciplinary project and be able to go into the role of a leader to drive the project towards goals following time plans

Judgement and Approach
16. demonstrate understanding of the multidisciplinary nature of a product realization process
17. demonstrate the ability to evaluate economic, social and environmental sustainability impacts regarding development and improvements of a production system.

Contents

Programme principles
The Master Programme in Sustainable Production Development is founded on three areas that align with its overarching objectives of the programme:

Sustainability: Central to the programme is the commitment to sustainability. This principle ensures that students are equipped with the knowledge and skills to develop and manage sustainable production systems. Included in this principle, the programme promotes the principles of the circular economy, encouraging students to develop production systems that minimize waste and maximize the reuse and recycling of materials.

Digitalization and Automation: Recognizing the transformative impact of digitalization and automation, the programme integrates these areas in both theoretical and practical aspects. Students gain expertise in methods and tools for example simulation, automation and AI.

Product realization: The programme also integrate knowledge about product realization.

Research basis
There is a clear connection between the master program and the research carried out in the sub area production system within the research area of industrial product realization at School of Engineering, Jönköping University. The ambition is to transfer knowledge from research as well as integrate students to contribute and extend knowledge related to different sub-areas relevant to ongoing research.

Equal terms, gender equality and diversity
The School of Engineering (JTH) strives in all its activities to ensure that all individuals are given equal opportunities and treated equally. At both the JU and JTH levels, this is reflected in governing documents concerning organizational and personnel matters, the establishment and delivery of programmes and courses, as well as the monitoring of educational quality. At JTH, student influence is also ensured through student representation in various educational and industry councils.

Questions regarding equal conditions, gender equality, and diversity are addressed in the courses within the education in for example the course Leading sustainable operations.

Study abroad
JTH has internationalization as a focus area where the educational programmes include opportunities for both international experiences at home as well as various opportunities to do internships and study abroad, giving students valuable experiences and skills to prepare them for a global labour market.

Semester 3 of the programme is intended as an exchange semester. The student must find substitute courses for the mandatory courses *Project course* and *Applied AI for product and production development*, and the elective courses of the programme, *Mathematical Statistics* or *Integration supporting circularity and sustainability in product realization*. The student also chooses 15 credits (two courses) in the subjects Production system or equivalent. Courses that reinforce the programme in line with the School of Engineering's broadening concept (i.e. courses in languages, economics, sustainability or project management) can also be chosen. The choice of courses is made in consultation with the programme manager via Jönköping University's internal system for study abroad.

The students who choose not to go on a study abroad programme follow a predetermined course package at the School of Engineering.

Programme progression

The programme is based on three areas, and there is progress in the programme for each area. The three areas are sustainable production, digitalization and automation, and product realisation.

Courses included in the area sustainable production are: *Sustainable production development* (semester 1), *Leading sustainable operations and Circular economy and production* (semester 2) and *Integration supporting circularity and sustainability in product realization* (semester 3).

Courses included in the digitalization and automation area are: *Simulation tools for production* (semester 1), *Automation and production technology* (semester 2) and *Applied AI for product and production development* (semester 3).

Courses in the area of product realisation are: *Integrated product and production development* (semester 1), *Product and production platforms* (semester 2). In semester 3 the knowledge of the topic will be deepened and combined with the other two areas in the courses *Integration supporting circularity and sustainability in product realization* and *Applied AI for product and production development.*

The program begins with a course in *Sustainable production development*. In this course, the students will gain knowledge of the design and development of a production system with a focus on sustainablity. In parallel, the course *Research methododolgy on advanced level* takes place. This course emphasizes skills and abilities needed to conduct studies in production system, but also focuses on writing skills and the ability to search and analyze information in a systematic and structured process.

Semester 1 period 2 begins with the course *Integrated product and production development* which provides knowledge of integration of product engineers and production engineers during the product realization process. This course demonstrates and offers knowledge of the impact of various design decisions on the possibility of achieving a desired and sustainable production system. In parallel with the course, *Simulation tools for production* takes place. The Simulation course equips the students with theoretical and practical knowledge in simulation tools, essential for designing sustainable production systems. In this course, the students will use the knowledge from the Sustainable production development course in period 1.

Semester 2 period 1 begins with a management course, *Leading sustainable operations.* In this course emphasis is put on interpersonal communication, diversity and group dynamics, and social sustainability. In parallel with this course, the students will further deepen their knowledge of developing sustainable production system in the course *Automation and production technology*. In this course, students become familiar with the fundamentals of industrial automation, including techniques used in robotics and vision systems.

Semester 2 period 2 includes a course in *Product and production platforms*. This course is a progression of the Integrated product and production development course. It introduces and describes planning, developing and analysing product and production platform design and how it is used in practice. The other course in period 2 is *Circular economy and production*. The course covers the fundamentals of circular economy as well as frameworks for implementation in production system such as 10Rs.

The students admitted to the program having less than 21 credits mathematics must take the 7.5 credits course Mathematical statistics (during the first period in the third semester) to obtain a Master of Science degree. During Semester 3 students have three scenarios depending on if they decide to study in Sweden or study abroad.

If the student chooses to stay at the university, semester 3 begins with a course in either *Integration supporting circularity and sustainability in product realization* or *Mathematical statistics*. Students that do not have 21 credits in Mathematics will choose Mathematical statistics. Students that have 21 credits in Mathematics will choose the Integration supporting course. In period 2 students will study *Applied AI for*

product and production development. This course combines knowledge from the other courses in the program and aims to explore how AI can be applied in product and production.

During Semester 3, including both period 1 and period 2, students who stay at the university will study the *Project course*. The course that is oriented to practical work where through forming multidisciplinary groups an industrial problem in the field of integrated product and production development is solved. In this course, the students will also learn how to plan, conduct and report a project.

For those seeking to add further international experience to their portfolio, there is the opportunity to go abroad during the third elective semester, see chapter above about Study abroad.

Semester 4 includes a course in *Final project work*. This course provides further scope and depth in areas taught in the various courses in the program. When writing up the thesis the student uses the knowledge and experience gained during the program to carry out a research and development project based on an industrially or socially relevant problem.

Courses

Course changes can occur, as long as they do not substantially affect the programme's content and learning goals.

Mandatory courses

Semester	Course Name	Credits	Main field of study	Specialised in	Course Code
1	Research Methodology on Advanced Level	7.5	Product Development, Production Systems	A1N	T2FPAN
1	Sustainable Production Development	7.5	Production Systems	A1N	THPR25
1	Integrated Product and Production Development	7.5	Product Development, Production Systems	A1N	TPPR25
1	Simulation Tools for Production	7.5	Production Systems	A1F	TSTS25
2	Automation and Production Technology	7.5	Production Systems	A1F	TAPS22
2	Circular Economy and Production	7.5	Production Systems	A1F	TCES26
2	Product and Production Platforms	7.5	Product Development, Production Systems	A1F	TPDS22
2	Leading Sustainable Operations	7.5	Production Systems	A1N	TSOR22
3	Project Course	15	Product Development, Production Systems	A1N	TPJS22
3	Applied AI in Product and Production Development	7.5	Product Development, Production Systems	A1N	TTAR26
4	Final Project Work in Production Systems	30	Production Systems	A2E	TEUT23

Elective courses

Semester	Course Name	Credits	Main field of study	Specialised in	Course Code
3	Integration Supporting Circularity and Sustainability in Product Realisation	7.5	Production Systems	A1F	TICS26
3	Mathematical Statistics	7.5		G1F	TMSK17
3	Industrial Placement in Production Engineering and Management	7.5	Production Systems	A1F	TPES22

Teaching and examination

The academic year is divided into two semesters, and the semesters into two study periods. In each study period two courses are generally taken in parallel. Assessment is part of each course or module. Modes of assessment and grades are shown in each course syllabus.

Entry requirements

The applicant must hold the minimum of a bachelor´s degree (i.e the equivalent of 180 ECTS credits at an accredited university) with at least 90 credits in mechanical engineering, industrial engineering and management, civil engineering, or equivalent. The bachelor's degree should comprise a minimum of 15 credits in mathematics. Proof of English proficiency is required.

Continuation Requirements

To begin the second year, at least 37,5 credits from the programme's first year must be completed.

Qualification Requirements

To obtain a Degree of Master of Science (120 credits) with a major in Production Systems, specialisation in Sustainable Production Development, students must complete a minimum of 120 credits in accordance with the current programme syllabus, at least 60 credits of which must be in the main field of study Production Systems and 21 credits in Mathematics.
In addition a Degree of Bachelor of Science in Engineering/Degree of Bachelor of Science or an equivalent Swedish or foreign qualification is required.

Quality Development

At JTH, systematic quality assurance is carried out within JU's established quality system. This system, based on the requirements of the Higher Education Act, the Higher Education Ordinance, and the *Standards and Guidelines for Quality Assurance in the European Higher Education Area*, has been reviewed and approved by the Swedish Higher Education Authority.

Active and continuous course evaluation, including student feedback through course surveys, forms one of the cornerstones of this system. Annual programme evaluations and student representation in JTH's various educational and industry councils are two additional examples.

Other Information

Admission is under 'Admission regulations for first- and second cycle courses and study programmes at Jönköping University (Admission regulations)'.

This syllabus is based on 'Regulations and guidelines for first-, second- and third-cycle education at Jönköping University'.