

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 relevant 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 large challenges, and they need to adapt to changes in the business environment in which they operate. Markets are changing rapidly and increased demands for product renewal mean shorter product lifetimes, while at the same time it must be possible to deliver products in small series and according to customer demands. To manage this, manufacturing companies need to quickly adapt their production system to new circumstances and demands. Moreover, they also adopt new technologies and increase the levels of digitalization and automation to be competitive. Fast information exchange and coordination between product development and production development is also a key for success. Furthermore, the international competition induces a need for continuous development of the Swedish manufacturing industry both technologically as well as strategically with the ambition to contribute to a sustainable society. Future manufacturing companies are also challenged by the European Union mission for moving the industry towards a circular economy by the year 2050. This means that the manufacturing companies aim at sustainable production development and circular flows.

It has become of utmost importance for large as well as small and medium-sized manufacturing companies in Sweden to understand and improve their capabilities to re-use existing company knowledge and/or invest in flexibility to respond to new trends and changes. It is further crucial that the companies have an increased understanding of the production system design process so that the system is able to handle increased number of product variants, shorter delivery times to the customers and high delivery precision as well as

sustainability and circular flows. This requires the companies to take a holistic view of manufacturing including its preconditions and possibilities, respectively.

Competitive production systems therefore require engineers with an overall understanding of production requirements and possibilities. Engineers need to have advanced knowledge about the design and functionality of production systems.

Objectives

The Master program Sustainable Production Development aims to prepare students with skills to carry out engineering work and manage development of sustainable production. It provides the student with knowledge regarding flexible and adaptive production systems that can proactively respond to industrial changes. The program builds knowledge in both production development, operations of production system in the context of digitalization, automation and circularity. Furthermore, the students will gain knowledge of interaction between product development and production development which contributes to an efficient product realization process in a sustainable way. Due to this, the program offers a holistic view and understanding of how various organizational functions need to be coordinated and integrated to achieve various goals associated with the development of new product and introduction of the new product in an existing or new production system. This includes, among others, aspects related to selection of technologies and methods, degrees of automation and flexibility, and circularity. Graduates will be highly skilled engineers with sustainable, innovative mindset for future development of complex and digitalized and sustainable manufacturing industry.

Post-graduation employment areas

Graduates will be highly skilled engineers with holistic view of production system, with the ability to being proactive within a sustainable, digitalized and complex system. The programme provides a good foundation for working in a wide range of industrial positions or an academic career - nationally or internationally. Possible tasks include production development, production management, and production engineering, project manager, trainee, consultant. The Master's programme also qualifies you to apply for continued postgraduate studies leading to an academic career.

Objectives

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:

Common learning outcomes

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 requirements placed on 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 in the field of development of production systems, including sustainability circular economy, digitalization and automation as well as integrated product and production development.

Competence and Skills

12. demonstrate the ability to apply different methods, tools used for development, deployment, operation and improvement of a production system

13. demonstrate skills of how to integrate circularity in production

14. demonstrate ability to apply simulation, automation and AI in production 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 the ability to critically reflect on differences and similarities in product realization including production system

17. demonstrate the ability to evaluate economic and sustainability impacts regarding development and improvements of a production system.

Contents

Programme principles

The programme has a holistic view of production including development of the production system and its interaction with the entire product realization process.

The first part of the programme focuses on design and development of sustainable production systems including an outlook into manufacturing strategies, automation, and production engineering to give the student a deep understanding in the main field of study. Thereafter, management of production systems is in focus where simulation tools will be introduced for analysis of a production system. Furthermore, taking a holistic view of the product realization process allows the students to understand the importance of integration of organizational functions, persons' knowledge, and competences to achieve designing of the right product but also secure its industrialization and production ramp-up to the required volumes, quality, and cost. Consequently, integration of persons from organisational functions such as product development, production and logistics is a key towards smooth introduction of a newly developed or face-lift products in a new or existing productions system.

A fundamental principle of the programme is for students to have the opportunity to link theory to industrial practice. Therefore, it is particularly important that students apply the knowledge they have acquired during their studies. Thus, a substantial part of the studies is carried out in projects where the students can apply theories to analyse and solve problems from praxis. The projects combine various theory areas of the program and function as important instruments giving students profound understanding of and increasing their abilities for the integration needed between different actors and competence areas. In each project, the individual contribution will be crucial and contribute to coaching each student to actively contribute. To start the next course in the program, the students must be registered and attended the courses before. The programme progression is based on the courses in the programme plan, where some are mandatory and some elective. The elective courses are selected from the offers in the table below.

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

General text.

Study abroad

JU and the School of Engineering collaborate with several partner universities and offer a number of international campuses. Students can preferably go abroad during semester 3 in year 2. Students who go abroad are required to take courses equivalent to 30 credits within the main field of study. The recommendation is to select courses within the specialisation, but some complementary topics might be relevant, given students' personal preferences and career plans. Students choose the courses in coordination with the School of Engineering faculty.

Programme progression

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 sustainable production in a course titled. This course offers knowledge regarding production system development approaches supporting proactive mindset, as well as deepens students' knowledge in manufacturing changeability and sustainability. In parallel, the course *Research Methodology 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 analyse information in a systematic and structured process.

In 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 cost-efficient 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 parallel with this course, the students will further deepen their knowledge of developing sustainable production system in the course *Automation and Production technology*. This course aims to explore the area of automation and robotics in combination with other production technologies to contribute to knowledge about technologies utilized in a production system. Students become familiar with the fundamentals of industrial automation, including techniques used in robotics and vision systems. This course not only provides students with valuable technical skills but also a deep understanding of how these skills can be applied in the context of sustainable production development. This course builds on the knowledge students have gained during courses in semester 1 period 1 and the course Simulation for production.

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. 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.

When a student stays in Sweden, the semester 3 begins with a course in either *Integration for circularity* or *Mathematical statistics*. This course Integration for circularity builds upon Sustainable Production development, circular economy and production courses. After the Integration for circularity course students will study *Applied AI for Product and production*. This course combines knowledge from the other courses in the program and aims to explore how AI can be applied in product and production. For SPD the course will focus on the applicability of AI in production. During Semester 3, including both period 1 and period 2, students are offered a course oriented to practical work where through forming multidisciplinary groups an industrial problem in the field of integrated product and production is solved. The students will learn also about planning and conducting projects. The course is titled *Project Course* and it is a compulsory course for the students staying at JTH, Sweden.

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.

The progression between the courses is also built to gradually move from a development focus to a focus having skills to develop a production system. Sustainability, digitalization as well as managerial aspects relevant for designing a production system will be integrated throughout the courses included in the programme.

Courses

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

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

General text.

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'.