JÖNKÖPING UNIVERSITY
School of Engineering

PROGRAMME SYLLABUS
Preliminary, not confirmed

Production Engineering and Automation (master), 120 credits

Production Engineering and Automation (master), 120 högskolepoäng

Programme Code:	TAPEA	Programmestart:	Autumn 2028
Confirmed:		Education Cycle:	Second-cycle level

Title of Qualification

Degree of Master of Science (120 credits) with a major in Production systems specialisation in Production Engineering and Automation

Teknologie Masterexamen med huvudområdet Produktionssystem inriktning Production Engineering and Automation

Programme Overview

Main field of study

The main field of study production systems includes the scientific study of organization, 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, operations and management of production systems, integrated with other relevant processes in organizations active on a regional, national or global market.

Within the main field of study theories concerning production engineering, production system development, integrated product- and production development, quality management, logistics and supply chain management, are combined with theories on organization and operations management.

The studies in the field are based on a holistic view on production and its interaction with the entire product realization process, including the interface with customers and suppliers. Economic, social and environmental aspects are considered. A system perspective is applied, using both quantitative and qualitative approaches. Studies within the main field of study aim at deep understanding and knowledge of central elements of a production system, its development, operations and management.

Knowledge and skills required for development, operations and management of globally competitive production systems are aimed at.

Background

Modern industry is undergoing rapid transformation, driven by automation, digitalisation, and the growing demand for sustainable value creation. Companies worldwide need engineers who can integrate advanced production technologies with data-driven methods to design and operate resilient, efficient, and changeable production systems. This programme equips students with exactly those skills.

The students will gain a holistic understanding of production, developing the skills to design, implement, and optimise production systems across their entire lifecycle, from design and industrialisation to ramp-up, operation, and continuous improvement. Throughout the lifecycle, attention is given to quality, sustainability, adaptability, and cost efficiency, ensuring systems are robust and future-ready.

The curriculum includes advanced courses in production engineering, manufacturing processes, automation, robotics, AI/ML, and industrial digitalisation, combined with systems thinking and sustainability. Students also develop strong capabilities in problem-solving, data analysis, and interdisciplinary collaboration, preparing them to lead complex development projects and drive innovation in international, high-tech, and sustainable industrial environments.

Graduates emerge as versatile engineers, ready to contribute to production development, automation projects, sustainable industrial practices, and to pursue advanced academic research if desired.

Objectives
The master programme in Production Engineering and Automation aims to prepare students to meet the challenges of a rapidly transforming industry shaped by automation, digitalisation, and the demand for sustainable value creation. The programme equips students with the ability to integrate advanced production technologies and data-driven methods to design resilient, efficient, and changeable production systems.

Graduates will develop as highly skilled engineers with strong problem-solving abilities, expertise in data analysis, and the capacity for interdisciplinary collaboration. They will be prepared to lead development projects and drive innovation in international, high-tech, and sustainable industrial environments.

Post-graduation employment areas
Graduates of this programme will become highly skilled engineers with expertise in production development, automation, and sustainability. The programme equips students with a wide range of industrial roles, both nationally and internationally, including production engineer, production manager, automation specialist, project manager, or consultant. It also provides a strong foundation for continued postgraduate studies and an academic career in engineering and industrial research.

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 Jönköping School of Engineering (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 programme, 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 environment it operates in
11. demonstrate knowledge and understanding of the state-of-the art in the research field of production system development
13. demonstrate knowledge and understanding of how to integrate circularity and sustainability into product

realization

Competence and Skills

12. demonstrate the ability to apply different methods and tools used for development, deployment, operation and improvement of production system
14. demonstrate the ability to apply and evaluate automation, AI, and machine learning solutions 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 understanding of the multidisciplinary nature of a product realization process
17. demonstrate the ability to assess, develop and integrate automated production systems

Contents

Programme principles

The Master Programme in **Production Engineering and Automation** is founded on three principles that align with its overarching objectives of the programme:

Automation: Recognizing the transformative impact of digitalization and automation, the programme integrates these areas in both theoretical and practical aspects. Automation here refers to the use of technologies, tools, and methods that support, enhance, and substitute manual operations in industrial production. Through robotic programming in online and offline modes, and integration of machine learning algorithms for intelligent decision-making in a data-driven context, this approach strives to increase efficiency, flexibility, and operational quality in manufacturing processes. At its core, automation enables production systems to adapt quickly to change and operate more intelligently over time. Students gain expertise in various methods and tools such as simulation, robot programming, and machine learning in production.

Sustainable production: Central to the programme is the commitment to sustainable production within modern industrial contexts. This principle ensures that students are equipped with the knowledge and skills to develop and manage production systems that balance efficiency, environmental responsibility, and economic viability. Sustainable production here refers to the design and operation of production systems that leverage advanced technologies to optimize resource utilization, minimize waste streams, and reduce environmental impact throughout the production lifecycle. It integrates areas such as circularity, energy optimization, material flow management, and intelligent process control, ensuring that industrial value creation supports long-term economic, social, and environmental sustainability while maintaining competitiveness in global markets.

Product realization: The programme also integrates knowledge about product realization This includes a comprehensive understanding of the product lifecycle, from initial concept and design to manufacturing, distribution, use, and end-of-life management. Students will learn about the principles and practices of sustainable product and production development, product and production platforms as well as how to produce products in a sustainable and effective manner.

Research basis

The programme is directly supported by research at JTH, Jönköping University (JU), which focuses on industrial product realization 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 the department of Product development, Production and Design (PPD). The department has a strong research emphasis on production development both related to sustainability and automation in integration with product development.

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

Equal terms, gender equality and diversity

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 within the education, for example in the course *Production system development.*

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 when it is possible to study outside of Sweden. The courses in the semester are substituted with similar courses at the receiving university. Courses that reinforce the programme in line with the JTH's broadening concept (sustainability, project management, etc.) can also be selected. The choice of courses is made in consultation with the programme manager to ensure relevance and coherence.

The students who choose not to go on a study abroad programme follow a predetermined course package at JTH.

Programme progression

The programme is based on the three principles, automation, sustainable production, and product realization. These principles are interconnected and permeate all the courses to different extent.

In the course *Production system development* the three principles and their connection are introduced. It gives a foundation for the upcoming courses.

- Courses focused on automation includes: *Automation and production technology* (semester 1), *Critical infrastructure and industrial cybersecurity* (semester 2), *Applied industrial automation* (semester 2), *Intelligent automation systems* (semester 3) and *Applied AI for Production and Production Development* (semester 3).
- The course focusing specifically on sustainable production is *Circular production systems* (semester 2).
- Courses in the area of product realization includes: *Integrated product and production development* (semester 1), *Product and Production Platforms* (semester 2).

The programme begins with a course in *Production system development*. In this course, the students will gain knowledge of the design and development of a production system considering automation, sustainability and changeability. 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 analyze information in a systematic and structured way.

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, *Automation and Production Technology* takes place. The course equips the students with fundamental knowledge of concepts related to automation in production systems, industrial control systems, and computer-integrated manufacturing. In this course, students will use the knowledge from the course *Production system development* in period 1.

Semester 2 period 1 begins with the course *Circular Production Systems*. The course covers the fundamentals of circular economy as well as how circularity can be used in production system. The other course in period 1 is *Applied Industrial Automation* where a hands-on experience in developing, programming, and implementing automation solutions for industrial production environments is provided. Students gain practical expertise in programming, robot trajectory planning, and system integration while working with industry-standard simulation tools and hardware platforms. Through project-based learning and real-world applications, students get to develop skills in evaluating automation technologies, assessing system performance, and implementing safety protocols for production processes.

Semester 2, period 2, includes the 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 to enable changeability and how it is used in practice. In parallel with this course, the students will further deepen their knowledge of industrial automation systems in the course *Critical Infrastructure and Industrial Cybersecurity*. In this course, students become familiar with risks and vulnerabilities that could affect critical infrastructures. This course investigates state-of-the-art industrial systems that leverage robotics, standardized communication protocols, and Industrial Internet of Things (IIoT) frameworks, by analyzing their technological and practical implementation in advanced manufacturing ecosystems.

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

If the student chooses to stay at the university, semester 3 begins with a course in either *Intelligent Automation Systems* or *Multivariable Calculus*. The students admitted to the programme having less than 21 credits Mathematics must take the 7.5 credits course *Multivariable Calculus* (during the first period in the third semester) to obtain a Master of Science degree.

Students that have 21 credits in Mathematics will choose the course *Intelligent Automation Systems*. This course focuses on integrating machine learning and artificial intelligence into industrial automation systems to create adaptive and intelligent production environments. Through hands-on programming and project-based learning using open-source frameworks, participants gain skills in designing data-driven decision-making systems that enhance traditional automation capabilities. In period 2 students will study *Applied AI for Production and Production Development*. This course combines knowledge from the other courses in the programme 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 can select between the *Project Course* and *Industrial Placement in Production Engineering and Automation*. Both of the courses are oriented to practical work. In the project course the student work in multidisciplinary groups to solve an industrial problem in the field of integrated product and production development. In this course, the students will also learn how to plan, conduct and report a project. In the course *Industrial Placement in Production Engineering and Automation*, the student undertakes an industrial placement within a company to apply and develop their competences and skills in a real industrial context relevant to the focus of the program.

Semester 4 includes a course *Final project work*. This course provides further scope and depth in areas taught in the various courses in the programme. When writing up the thesis the student uses the knowledge and experience gained during the programme 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	Automation and Production Technology	7.5	Production Systems	A1N	T2AOPC
1	Research Methodology on Advanced Level	7.5	Product Development, Production Systems	A1N	T2FPAN
1	Production System Development	7.5	Production Systems	A1N	T2UAPD
1	Integrated Product and Production Development	7.5	Product Development, Production Systems	A1N	TPPR25
2	Circular Production Systems	7.5	Production Systems	A1N	T2CPPZ
2	Critical Infrastructure and Industrial Cybersecurity	7.5	Computer Science	A1F	T2KIOI
2	Applied Industrial Automation	7.5	Production Systems	A1F	T2TIAN
2	Product and Production Platforms	7.5	Product Development, Production Systems	A1F	TPDS22
3	Possibility to study abroad	30			
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	Intelligent Automation Systems	7.5	Production Systems	A1F	T2IAKC
3	Industrial Placement in Production Engineering and Automation	15	Production Systems	A1F	T2NKIP
3	Multivariable Calculus	7.5		G1F	TFVK17

3	Project Course	15	Product Development, Production Systems	A1N	TPJS22

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, Product Development, Materials Engineering, Manufacturing Engineering, Production Engineering, Industrial Engineering, Civil or Construction Engineering, Industrial Organization and Economics 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.

During the first year there is a progression between the courses *Production System Development*, *Automation and Production Technology*, and *Applied Industrial Automation*, i.e. the two courses in semester 1 must be completed before the start of the course *Applied Industrial Automation* in semester 2.

During the first year there is also a progression between the courses *Integrated Product and Production Development* in semester 1 and *Product and Production Platforms* in semester 2, i.e. the course in semester 1 must be completed before the start of the course in semester 2.

To start the course *Intelligent Automation System* in semester 3 the course in *Applied Industrial Automation* from semester 2 must be completed.

Qualification Requirements

To obtain a Degree of Master of Science (120 credits) with a major in Production systems, specialisation in Production Engineering and Automation, 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'.