JÖNKÖPING UNIVERSITY
School of Engineering

PROGRAMME SYLLABUS
Preliminary, not confirmed

Materials Engineering for the Manufacturing Industry (master), 120 credits

Materials Engineering for the Manufacturing Industry (master), 120 högskolepoäng

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

Title of Qualification

Degree of Master of Science (120 credits) with a major in Product Development specialisation in Materials Engineering for the Manufacturing Industry

Teknologie Masterexamen med huvudområdet Produktutveckling inriktning Materials Engineering for the Manufacturing Industry

Programme Overview

Main field of study

The field of product development addresses the creation and advancement of products as technical systems, from initial needs or technological opportunities to validated solutions ready for use and continuous improvement. It combines engineering knowledge, systematic methods, and creative processes with perspectives from business, sustainability, and human factors. The discipline is inherently interdisciplinary, drawing on materials and manufacturing, mechanical design, information technology, electronics, and production. Students gain skills in requirement analysis, concept generation, system design, simulation, and validation, while also learning to manage development activities across the full product life cycle. Emphasis is placed on collaboration in diverse teams, applying a holistic perspective to innovation, product realization, and sustainable industrial value creation.

Background

Materials and manufacturing are at the heart of innovation in industries such as aerospace, automotive, electronics, biomedical, and energy. The growing demand for advanced, sustainable, and high-performance materials makes this field more vital than ever, and skilled professionals are increasingly sought after worldwide. In this programme, students will explore the relationship between material structures and their properties, gaining the ability to design and optimize materials for specific applications. Alongside this, they will develop a deep understanding of manufacturing processes, from traditional methods to modern technologies and simulations, learning how these influence the performance and sustainability of final products.

The programme offers a broad foundation in materials science—including metals and alloys, polymers, and composites—together with their role in the entire product development process. In the second year, students can tailor their education through an industrial placement or a research-oriented project, preparing them for impactful careers in industry or further studies in academia.

Objectives

The goal of this programme is to:

- provide advanced knowledge in materials science and manufacturing technologies, closely aligned with the needs of modern industry.
- equip students with the skills to select suitable materials and production methods, and to design products that optimize performance, geometry, and sustainability.
- provide hands-on experience with industry case studies, so students gain insight into real-world challenges, developing practical skills to contribute to innovation, efficiency, and sustainable solutions in manufacturing.

Post-graduation employment areas

Graduates are highly sought after by leading companies in aerospace, automotive, biomedical, and high-tech manufacturing sectors. With strong industry connections and exposure to real projects, students gain the experience and professional competence needed to secure roles in research and development, production management, quality assurance, and engineering consulting, positioning them for successful careers in top industries worldwide.

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 outcomes, 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 programme, the intended learning outcomes provided for programme must also be met.

Knowledge and Understanding

10. demonstrate a comprehensive understanding of materials science, manufacturing processes, and product design principles, including metals, polymers, and composites.
11. understand advanced computational, analytical, and experimental techniques for materials processing, characterization, and product realization.
12. recognize the principles of sustainable engineering, life-cycle thinking in product development.

Competence and skills

13. apply theoretical knowledge to analyse, design, and optimize materials, processes, and products using experimental and computational methods.
14. conduct material characterization, testing, and simulations to evaluate performance and inform engineering decisions.
15. integrate multidisciplinary approaches, including thermodynamics, fluid dynamics, surface engineering, and material selection, to develop manufacturable and sustainable products.

Judgement and Approach

16. critically evaluate materials, manufacturing processes, and design alternatives to select optimal solutions that balance performance, cost, and sustainability.
17. demonstrate strategic problem-solving and innovative thinking in complex, multidisciplinary engineering challenges, anticipating risks and long-term impacts.

Contents

Programme principles

The master programme in Materials Engineering for the Manufacturing industry is a two-year curriculum divided into four semesters, with each semester consisting of two periods. Courses are typically 7.5 credits, while a project course or an industrial placement course is 15 credits. The thesis work is 30 credits. This comprehensive curriculum ensures that students gain both practical and theoretical knowledge. This is also emphasized in the master thesis, to ensure that students will be skilled for applying their knowledge in the manufacturing industries.

During the first year, students will take eight courses, gaining a deep understanding of material properties, characterisation methods, and manufacturing processes. Additionally, they will acquire theoretical knowledge and practical simulation skills to model and analyse manufacturing systems. All courses are designed with the focus of industry needs and therefore, they are applied and with hands-on learning approach to ensure students gain not only the knowledge but also experience in using modern tools, equipment, and software relevant to materials engineering.

In the second year, students will have the opportunity to apply the knowledge and skills acquired in the first year through an industrial project course (IPC) and the master thesis, which are performed in collaboration with companies. Through strong partnerships with manufacturing industries students are provided with good opportunities to solve real industrial problems, gaining insight into current challenges and best practices. A course in Research methodology also acts to deepen the students knowledge in academic practices.

The program is designed to combine first-year fundamentals (simulation, characterization, and sustainable product realization) with second-year applied experiences (industry projects, thesis, and advanced technologies), ensuring a seamless progression from knowledge acquisition to practical application and independent research.

Research basis

The research activities that form the foundation of this master's programme are closely connected to industry and real-world applications. They emphasize a holistic approach to developing sustainable materials and manufacturing technologies, combining technical excellence with environmental responsibility.

The main research focus lies within the following areas:

1. Advanced Manufacturing Processes

- Casting Technologies: Development of innovative casting methods aimed at improving material performance while reducing energy usage.
- Post-Processing Techniques: Optimization of coating and anodizing processes to enhance corrosion and wear resistance, with a strong focus on minimizing environmental impact.

2. Mechanical Property Optimization

- Microstructure Engineering: Investigation of how variations in processing parameters and material composition influence microstructure, leading to improved mechanical properties and performance.
- Testing and Simulation: Application of advanced computational models and simulations to predict material behaviour under different conditions, supporting the design of high-performing and more reliable components.

3. Sustainability and Circularity of materials

- Environmental Impact Assessment: Knowledge about the environmental footprint of materials and processes, focusing on energy consumption, waste generation, and lifecycle emissions.

Through this integrated approach, linking advanced processing methods, mechanical performance, and sustainability metrics, the programme prepares graduates to actively contribute to the creation of environmentally responsible solutions in the materials and manufacturing sectors. Students will gain both a deep scientific understanding and practical experience that position them to lead the transition towards a more sustainable manufacturing ecosystem.

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.

The Master programme in Materials Engineering for the Manufacturing industry is strongly committed to fostering an inclusive, equitable, and respectful academic environment. We believe that diversity enriches education and research, and we actively work to ensure that individuals from all backgrounds and identities have equal access to opportunities, resources, and support.

We particularly promote gender equality, encouraging the participation of individuals of all genders in both academic and social aspects of the programme. The field of materials and manufacturing is not associated with any specific gender—it is an area of science and engineering where innovation and collaboration are driven by people with diverse perspectives.

The department of Materials and Manufacturing provides a study and work environment that is designed to be functional and accessible for everyone. Hands-on projects, laboratories, and facilities are developed to accommodate individuals of all genders, body sizes, and heights, ensuring equal opportunities to engage in practical work. In addition, shared exchange rooms and common areas are available and accessible for all.

Through these measures, the programme aims to create a learning atmosphere where every student feels included, valued, and empowered to succeed.

Study abroad

The School of Engineering 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.

In the third semester, students in this master's programme have the option to study abroad. This provides a valuable opportunity to gain experience with different educational systems while immersing themselves in a new culture.

If a student chooses to study abroad, the courses taken at the host university will replace the corresponding courses at Jönköping University. Students are responsible for assembling a replacement package of courses, which must be submitted for approval by JU. The replacement courses should be equivalent to at least one semester of full-time study, ensuring academic continuity and full credit transfer.

Studying abroad not only enriches your academic experience but also helps develop intercultural skills, independence, and a global perspective – key qualities for a successful career in materials and manufacturing

Programme progression

The Master Programme in Materials Engineering for the Manufacturing Industry is carefully designed to guide students from foundational concepts to advanced, hands-on expertise, preparing them to develop sustainable, high-performance materials and components.

- Year 1 – Building Core Knowledge

Thermodynamics and Physical Metallurgy: Learn the fundamentals of material behavior, including solidification and phase transformations. Understanding how microstructures determine material properties, and how to tailor them for specific applications.

Computational Fluid Dynamics for Manufacturing Processes: Gain tools to analyze heat transfer and fluid flow in manufacturing, providing a foundation for process design.

Liquid Metal Processing: Explore sustainable approaches in metal processing.

Applied Materials Testing and Characterization for Engineers: Master key techniques to evaluate material properties and performance.

- Year 2 – Applying Knowledge to Design and Sustainability

Material and Process Selection for Product Design: Learn to select the right materials and manufacturing processes for real-world applications, balancing performance, cost, and sustainability.

Simulations for integrated product realization: Integrate your first-year knowledge to simulate and optimize manufacturing processes using advanced computational tools.

Sustainable Product Realization: Develop the ability to design products holistically, considering materials, manufacturing, design, sustainability, and life cycle assessment.

Applied Polymers and Composites: Manufacturing and Design: Learn advanced methods for designing and manufacturing polymer-based materials and composites, focusing on performance, sustainability, and real-world applications.

Surface Technology: Enhance components further by engineering surfaces for durability, wear resistance, and aesthetics, completing your skills as a materials engineer.

Research methodology on Advanced Level. This course is essential for their master thesis or if they would like to continue with an academic career. It provides them with the necessary skills to conduct research, analyze data, and write effectively, preparing them for advanced academic pursuits.

Industrial Placement: through this course, students gain experience in academic research in co-production with industry, independently designing and executing a research study. Develop skills in data analysis, project contribution, and practical problem-solving in an industrial or research environment. This course also makes them ready for their master thesis work, which is based on a real-world application and mainly is in collaboration with the industries.

Throughout the programme, students progressively acquire the expertise to design and manufacture components that are not only technically advanced but also sustainable and optimized for performance. By the end of the programme, you will be ready to tackle real-world challenges in materials engineering, bringing together science, technology, and sustainability in innovative ways.

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	Computational Fluid Dynamics for Manufacturing Processes	7.5	Product Development	A1N	T2BFTQ
1	Liquid Metal Processing	7.5	Product Development	A1N	T2SOSQ
1	Applied Materials Testing and Characterization for Engineers	7.5	Product Development	A1N	T2TMOK
1	Thermodynamics and Physical Metallurgy	7.5	Product Development	A1N	T2TOFM
2	Simulations for Integrated Product Realization	7.5	Product Development	A1F	T2SFIP
2	Applied Polymers and Composites: Manufacturing and Design	7.5	Product Development	A1F	T2TPOK
2	Sustainable Product Realisation	7.5	Product Development	A1F	THFS25
2	Materials and Process Selection for Product Design	7.5	Product Development	A1N	TMPR25
3	Possibility to study abroad	30			
3	Research Methodology on Advanced Level	7.5	Product Development, Production Systems	A1N	T2FPAN
3	Surface Technology	7.5	Product Development	A1N	T2YTSV
4	Final Project Work in Product Development	30	Product Development	A2E	TETT23

Elective Courses

Semester	Course Name	Credits	Main field of study	Specialised in	Course Code
3	Industrial Placement Course - Research Track	15	Product Development	A1F	TNSS25
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 Materials and Manufacturing, Materials Engineering, Mechanical Engineering, Chemical Engineering, Product Development or Engineering Physics or equivalent. The bachelor’s degree should comprise a minimum of 15 credits in Mathematics. Proof of English proficiency is required.

Continuation Requirements

In order 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 Product Development, specialisation in Materials Engineering for the Manufacturing Industry, students must complete a minimum of 120 credits in accordance with the current programme syllabus 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’.