JÖNKÖPING UNIVERSITY
School of Engineering

PROGRAMME SYLLABUS
Preliminary, not confirmed

Mechanical Engineering (BSc), 180 credits

Maskinteknik: Material och Produktutveckling, 180 högskolepoäng

Programme Code:	TGMMO	Programmestart:	Autumn 2028
Confirmed:		Education Cycle:	First-cycle level

Title of Qualification

Degree of Bachelor of Science in Mechanical Engineering, specialisation in Materials Engineering and Product Development.

Högskoleingenjörsexamen i Maskinteknik, inriktning Material och Produktutveckling

Programme Overview

Engineering field and Main field of study

Mechanical engineering concerns the development, analysis and manufacture of mechanical products and systems, from medical devices and household appliances to vehicles and energy systems. The field is built on applied physics and mathematics and spans mechanics, thermo-fluids, machine design, mechatronics, engineering materials and manufacturing technology.

A product is only as good as the material it is made of and the process by which it is made. Its geometry, the choice of alloy or polymer and the parameters of processes such as casting, forming and moulding together determine its microstructure and defects, and thereby its strength, service life, cost and environmental footprint.

Mechanical engineers therefore treat design, material and process as a whole, combining experiments and materials characterisation with computer-aided design and simulation of products and processes to create lighter, more reliable and more resource-efficient solutions for a circular manufacturing industry

Background

Manufacturing industry needs engineers who understand how design, choice of material and manufacturing process together determine the function, quality and environmental impact of a product. The transition towards lighter structures, circular material flows and large cast components, such as megacasting, makes this competence increasingly important. The programme builds on the research and education environment in materials and manufacturing at the School of Engineering, with particular strength in metal casting, and on its close collaboration with industry.

Objectives

The programme aims to develop the knowledge and skills required to develop products and processes in which design, material and manufacturing process are treated as a whole, from requirements and concepts through material and process selection, simulation and manufacture to testing, with consideration of the needs of users and of sustainable development.

Post-graduation employment areas

After graduation, the student can work as, for example, design engineer, product developer, process or production engineer, materials engineer or quality engineer, with tasks such as material and process selection, design for casting and other manufacturing processes, testing and failure analysis. Employers are primarily manufacturing companies and their suppliers, for example in the automotive, foundry and polymer industries, as well as consultancy firms.

Studies after graduation

The programme provides a foundation for further studies at advanced level. The School of Engineering offers master's programmes within the field, among them Materials Engineering for the Manufacturing

Industry, which forms a natural continuation of the programme. Studies at advanced level can in turn lead to doctoral studies.

Educational concept at the School of Engineering

The education concept at the School of Engineering consists of several common elements included in the academic programmes to enhance the quality and appeal of the education, ensuring that students become professionally skilled and in demand. The concept particularly emphasizes industry collaboration and internationalization as two key components for creating successful and attractive programmes. All three- and five-year programmes include a mandatory industrial placement course (IPC) worth 15 credits and an "internationalization semester" that facilitates studying abroad. They also feature 15 credits for "broadening courses" outside the technical or core area of specialized technical knowledge.

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 Bachelor of Science in Engineering (1-11) and also the intended learning outcomes, as described by JTH:

Knowledge and Understanding

1. demonstrate knowledge of the disciplinary foundation of the engineering field chosen and proven experience in this field as well as awareness of current research and development work,
2. demonstrate broad knowledge in the engineering field chosen and relevant knowledge of mathematics and the natural sciences,

JTH. demonstrate broadening knowledge outside the chosen engineering field for the future professional role or demonstrate knowledge within the engineering field in an international context (study abroad).

Competence and Skills

3. demonstrate the ability to identify, formulate and deal with issues autonomously and creatively using a holistic approach and to analyse and evaluate technological solutions,
4. demonstrate the ability to plan and using appropriate methods undertake tasks within predetermined parameters,
5. demonstrate the ability to use knowledge critically and systematically to model, simulate, predict and evaluate series of events on the basis of relevant information,
6. demonstrate the ability to design and manage products, processes and systems while taking into account the circumstances and needs of individuals and the targets for economically, socially and ecologically sustainable development set by the community,
7. demonstrate the capacity for teamwork and collaboration with various constellations,
8. demonstrate the ability to present and discuss information, problems and solutions in speech and writing and in dialogue with different audiences, in both national and international contexts,

JTH. demonstrate ability to apply the acquired knowledge in practical work and demonstrate insight into the future career,

Judgement and Approach

9. demonstrate the ability to make assessments informed by relevant disciplinary, social and ethical aspects,
10. demonstrate insight into the possibilities and limitations of technology, its role in society and the responsibility of the individual for how it is used, including social and economic aspects as well as environmental and occupational health and safety aspects,
11. demonstrate the ability to identify the need for further knowledge and undertake ongoing development of his or her skills,

Programme-specific learning outcomes

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

Knowledge and Understanding

12. demonstrate knowledge of the relationships between manufacturing process, material structure and properties for engineering materials, with particular depth in metal casting,
13. demonstrate knowledge of the thermal and mechanical systems principles required to design and analyse components that meet customer needs,
14. demonstrate knowledge of methods for testing and selecting materials and components, and of how defects and design details affect performance and service life,

Competence and Skills

15. demonstrate the ability to select materials and manufacturing processes for a component on the basis of functional, economic and environmental requirements, and to design the component for its manufacturing process,
16. demonstrate the ability to use digital engineering tools and resources to design components and manufacturing processes,

17. demonstrate the ability to design experiments to develop, predict and verify the performance of products and processes,
18. demonstrate the ability to carry out a design project in a team from requirements to a manufactured and tested solution, and to document the work in a professional engineering portfolio,

Judgement and Approach

19. demonstrate the ability to assess design, material and process choices with respect to resource efficiency, circularity and environmental impact over the life cycle, as well as to the needs of users and society.

Contents

Programme principles

The programme provides students with broad and progressively deepening knowledge in materials engineering and product development. During the first year, students take three courses in materials and manufacturing. These courses introduce the structure and properties of engineering materials, manufacturing processes and the relationship between material selection, manufacturing and product performance. Together, they establish the foundation for the programme's specialization in Materials Engineering and Product Development.

As the programme progresses, students build on this foundation through courses that develop their knowledge of materials, manufacturing, product development and engineering design. The integration of these areas enables students to understand and address the interrelationships between functional requirements, material properties, manufacturing methods, sustainability and product performance.

Team-based design projects constitute an important part of the programme. In these projects, students apply knowledge and skills from previously completed and parallel courses to the development of products and technical solutions. The projects provide opportunities to work with realistic, open-ended engineering problems and to develop their abilities in problem formulation, concept generation, material and manufacturing selection, design evaluation and communication.

The design projects emphasize learning by doing and provide students with experience of collaborative and iterative engineering work. Through the projects, students progressively develop both technical and professional competences, including teamwork, project planning, problem-solving and the ability to integrate knowledge from different fields. The completed projects also form a portfolio that documents the students' knowledge and skills and may be used to support their continued studies and future professional careers.

Education in this international programme is carried out in English.

Research connection

The connection between research and education is ensured in the following ways:

- Through teachers with a doctoral degree, associate professors or professors with a research connection teaching in the courses of the programme and thereby conveying knowledge based on current research.
- Through laboratory work, design projects and degree projects connected to research at one or more departments of the School of Engineering, including the use of advanced methods for materials characterisation.
- Through the examination of assignments, seminars or project work in which a connection to research is made, for example through the use of scientific publications.

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.

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 is the designated internationalisation semester of the programme. Students who study abroad take courses corresponding to 30 credits at a partner university of the School of Engineering, which replace the courses of semester 3 and are chosen in consultation with the programme manager to match the profile

of the programme. Alternatively, the Industrial Placement Course in semester 4 can be carried out at a company abroad.

Programme progression

The programme gives a foundation in mechanical engineering, complemented by a specialisation in engineering materials, manufacturing and product development. Theoretical and practical courses alternate, and in the design projects the students apply their knowledge to realistic engineering problems. Towards the end of the programme, the courses are increasingly directed towards the link between material, process and product.

Semester 1: Two introductory courses in materials engineering and manufacturing and a course in mechanics, covering statics and basic solid mechanics, open the programme. The first design project, in which an accessibility tool is designed and made, concludes the semester.

Semester 2: A course in materials processing, with emphasis on solidification, casting and heat treatment, is given in parallel with a course in mechatronics. A course in calculus and the second design project, a lightweight redesign of a load-bearing component, conclude the semester.

Semester 3: Courses in mechanics and thermo-fluids are followed by the broadening course Leadership and Project Management and a course in mathematical statistics. This semester is chosen as the most suitable for studies abroad.

Semester 4: Courses in machine design and in manufacturing process simulation and design, connected through a joint project, are followed by the Industrial Placement Course in Mechanical Engineering, in which theory is put into practice through a design-related project at a company.

Semester 5: Courses in sensors and instrumentation and in design of experiments and optimization and machine learning are given in parallel with the third and fourth design projects, in which the students develop a load-bearing thermal management component and an automatic sorting station for material separation.

Semester 6: Two elective courses conclude the programme together with a degree project of 15 credits.

When studying at the School of Engineering, Jönköping University, the student chooses from the elective courses specified in this programme syllabus. An exception to this rule is made for studies abroad, where only matching against the profile of the programme applies, which is decided in consultation with the programme manager.

Education in this international programme is carried out in English.

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	Materials Engineering and Manufacturing 1	7.5			
1	Mechanics 1	7.5			
1	Materials Engineering and Manufacturing 2	7.5			
1	Mechanical Engineering Design 1	7.5			
2	Materials Processing	7.5			
2	Mechatronics	7.5			
2	Mechanical Engineering Design 2	7.5			
2	Basic Calculus	7.5		G1N	TGAG19
3	Mechanics 2	7.5			
3	Thermo-fluids	7.5			
3	Mathematical Statistics	7.5			
3	Possibility to abroad	30			
3	Leadership and Project Management	7.5	Industrial Engineering and Management	G1N	TLPG18

4	Machine Design	7.5			
4	Manufacturing Process Simulation and Design	7.5			
4	Industrial Placement Course in Mechanical Engineering	15	Mechanical Engineering	G2F	TNMN17
5	Sensors and Instrumentation	7.5			
5	Mechanical Engineering Design 3	7.5			
5	Design of Experiments and Optimisation	7.5			
5	Mechanical Engineering Design 4	7.5			
6	Elective course - Applied Materials Science	7.5			
6	Elective course - Further materials course, to be specified	7.5			
6	Elective course - Industrial Finance and Controlling	7.5			
6	Elective course - Linear Algebra	7.5			
6	Elective course - Undergraduate Research Project in Mechanical Engineering	7.5			
6	Final Project Work in Mechanical Engineering	15	Mechanical Engineering	G2E	TEMP10

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

General entry requirements and Physics 2, Chemistry 1, Mathematics 3c, English 6 with required grade passed in the Swedish upper secondary school system or international equivalent. Or: Physics level 2, Chemistry level 1, Mathematics further level 1c, English level 2 (or the equivalent).

Continuation Requirements

In order to begin the second year, at least 37,5 credits from the programme's first year must be completed. In order to begin the third year, at least 90 credits from the programme's first and second year must be completed.

Qualification Requirements

To obtain a Degree of Bachelor of Science in Mechanical Engineering, specialisation in Product Development and Industrial Design, the student shall complete the course requirements of at least 180 credits in accordance with the current programme syllabus.

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 arrangements for first and second level at Jönköping University'.

This syllabus is based on 'Regulations and guidelines for education at undergraduate, postgraduate and doctoral studies at Jönköping University'.