SCHOOL OF ENGINEERING
JÖNKÖPING UNIVERSITY

PROGRAMME SYLLABUS

Master of Science in Product Development specialisation Industrial Design, 120 credits

Programmestart: Autumn 2015

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PROGRAMME SYLLABUS

Master of Science in Product Development specialisation Industrial Design, 120 credits

Teknologie masterprogram i Produktutveckling med inriktning Industridesign, 120 högskolepoäng

Programme code:	TAPI3	Programmestart:	Autumn 2015
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Title of qualification

Degree of Master of Science (120 credits) with a major in Product Development, specialisation in Industrial Design.

Programme overview

Background

There are ever-increasing demands on firms to develop well-designed products in an effective and lean manner. Their products must be competitive in the face of a growing supply of new products offered to consumers and companies on today's world market. We want products that are well adapted to users' requirements while at the same time being efficiently produced and distributed in line with increasing environmental influence demands. These days products compete on a global 24/7 market. Consumers can choose products based on price, quality, performance, reliability and feeling. On such a market, design is crucial for the success or failure of a product. Developing well-designed products often requires a competent staff with a holistic and interdisciplinary approach and a good understanding of the whole product development process. Traditionally, Sweden has had an interdisciplinary approach in product development and design. We have many small and medium-sized enterprises with efficient decision processes and a flat organisation. Consequently there is a great need for qualified product designers being able to handle complex issues as well as having detailed knowledge of the integral components of a product. Nowell materials are being developed at a rapid pace with the increasing demands for sustainable development. Technical as well as aesthetic functions become more and more important when it comes to materials. An increased expertise and cooperation between different competences in materials is a success factor for successful product solutions.

Industrial Design as a skill has a holistic focus and aims at developing products that can communicate meaning and content through their design, thus enhancing technology and content quality. Industrial Designers are trained in handling complex issues as well as having detailed knowledge of the various components that make up a product. The combination of technical skills and artistic ability provides a solid basis of education in line with industry demands.

Objectives

The aim of the Master Programme in Industrial Design is to develop the knowledge, skills and experience required to be able to work in product developing and manufacturing companies with the development of products with a focus on product design. The programme is intended to offer an interdisciplinary approach with a main focus on advanced knowledge of the design and management of colour, shape, surface and material. The programme also aims at practising skills in developing and communicating

ideas and suggestions. It further aims at giving a good understanding of the interaction between man and machine and the qualifications and opportunities man has to manage products and systems. Further the programme aims at giving a broad understanding of the context in which products work, covering the entire product life cycle from production via market and utilisation to destruction. The programme also aims at providing skills in functioning and working in teams with different competencies. The aim of the education is to deepen artistic design in the product development field as well as technical skills.

Post-graduation employment areas
The programme qualifies graduates to work as industrial designers in many various areas, for instance as consultants or SME designers or in a team of product developers with different competencies. The programme provides a platform for work in product-developing companies with tasks requiring both good skills in visualising problems and alternatives using simple as well as advanced visualisation methods along with considerable technical skills.

Research supporting the programme
In the main field of study of product development, research is conducted in the areas of Product Development (specialising in computer-aided design), Industrial Design (specialising in functional surfaces) and Materials and Manufacturing – Casting.

Product development focused on computer supported engineering design
Computer Supported Engineering Design
Implemented knowledge as a competitive factor in the manufacturing industry
Success in manufacturing companies is always based on deep knowledge of the product characteristics and the production processes used. This knowledge is stored in the minds of employees, written down in documents or implicit in proprietary computer codes. This is a knowledge structure that is often the company's most important asset. Using modern information technology, this knowledge can be structured and stored for later retrieval and automated reuse for new development projects.
Computer tools for automated engineering design
Functions for storage of knowledge and inferring conclusions from this are fundamental for design systems aimed at design synthesis tasks. The possibilities to create such systems for automated design have improved dramatically. The technology of Artificial Intelligence has provided rule-based programming tools as well as more implicit methods in the category of "computational intelligence". In combination with parametric CAD systems these techniques are suitable to capture experience, rules of thumb as well as algorithmic design rules.
Within this technical domain we try to establish generic guide lines for how Intelligent Design systems should be composed to match different design tasks. How cost and benefit should be balanced in different applications and how length of operational life, transparency and quality of these systems is assured. We seek to penetrate the potential and constraints of the technology in a systematic fashion so that companies who intend to carry out industrial applications can find optimal solutions. Since we always work with real industrial examples the technological contents naturally cover a wide spectrum.
Industrial Design - Functional Surfaces
Today, a product's visual and tactile qualities has become more important to achieve a high quality of the perceived value of a product. It is therefore important to increase knowledge and understanding of the aspects that affect and control the design of products with a focus on experience and customer requirements. Many factors contribute to how a product is perceived and experienced constituted by subjective judgments that are affected over time and context, but surprisingly many of the characteristics that affect the experience of a product and puts the customer requirements, is fairly objective and robust. These properties can be measured and verified in different ways and thus make the process more robust, and characteristics of the products more stable. It leads to increased design freedom and contributes to a focus on the characteristics that make a product successful in the market, better adapted to the climate, simplified production, shorter lead times, increased impementation processes etc. A product's surface texture affect eminently how a product is perceived and understood both visually as tactile. It is desirable that the surface properties to a greater extent become a design parameters early in the design process, and

that these can be quality assured and maintained until the finished product. The research in affective surface engineering has the ambition to be a cross-border meeting between technical features and aesthetic functions linked to production functions. By measuring the properties in different ways and link measurement result, connection may be mapped in various properties and thus be controlled in a more robust manner. The link between surface characteristics and material properties is clear.

Materials and manufacturing focused on casting
The research within Materials and manufaturing is multidisciplinary and could comprise research areas such as product development, properties of components, internal material structures and related properties of components, production/manufacturing aspects etc. The research has support within a wide spectrum of subject areas: e.g. fluid dynamics, solid mechanics, material science, material technology, material physics, chemistry, as well as simulation and optimization. In the product development chain, the main part of the research is conducted in the interface between engineering design on one side and manufacturing/usage aspects on the other, with a special focus on product properties. The overall goal of the operation is to conduct fundamental research with the purpose of solving problems related to material science and manufacturing of advanced cast metal components, in close cooperation with industry and research institutes.
The different steps in the product development process, from conceptual design to material selection and manufacturing method, all have a decisive influence on the final properties of the component. This is especially true for metal casting and for shaping of polymers. As a consequence, it is natural that simulation and optimization tools/methodologies today are indispensable when designing and manufacturing complex shaped components of advanced materials.

Educational concept at the School of Engineering
All educational training at the School of Engineering in Jönköping (JTH), is determined by an educational concept. The concept offers a *holistic perspective*, where *Business Community Contacts, Internationalisation* and *Entrepreneural Drive* are key words. Besides technical knowledge within the programme, *Leadership and Communication, Professional Attitude* and *Sustainable Development* are important parts of the concept.
Business Community Contacts means that JTH has an established collaboration with the business communtiy in various forms throughout the training. An example is the course located directly in the business community *(Näringslivsförlagd kurs, NFK)*, which is part of all programmes. The aim with this course is to provide the students with an understanding for future professional tasks, and the ability to relate these to the training.
Internationalisation means that students e.g. are given the opportunity to train languages and intercultural communication through exchanges with foreign universities. JTH has approximately 70 partner universities all over the world, and participates in several international exchange programmes for students. There are opportunities to spend parts of the training abroad and account to the foreign credits in the exam. Due to this student exchange, a great number of courses at JTH are given in English.
Entrepreneural Drive is received through the holistic perspective of the training programme. Significant is the exchange with the business community, the leadership training, the association with professional work in project based courses, and the economy elements, among other things.
Leadership and Communication includes e.g. training in verbal and written communication, project based work, leading and motivating people and also to understand decision processes in companies and organizations.
Professional Attitude comes through basic knowledges in economics, marketing, and business planning. These knowledges are further developed and integrated in technical contexts. Engineers and technicians with such experiences are useful within a great number of areas in the business community.
Sustainable Development includes understanding of compatibility with a sustainable society and environmental and human aspects in the future productivity and products. The instructions are fully integrated in their technical context and treat social, economical and ecological aspects of sustainable development.
Project based Training is also a part of the educational concept. Assuming responsibility for projects of

various sizes frequently occurs as a professional. As a preparatory step, the students are responsible for real projects in connection with the business community in some of the courses.
Student influence is a great and important part in JTH's continuous quality development. Through student representatives in all boards, councils and decision-making committees, the students actively influence their education.

Objectives

After the completion of the programme, students must meet the intended learning outcomes, as described in the Ordinance by Higher Education (m), and also the intended learning outcomes, as described by JTH (j):

Common learning outcomes
Knowledge and understanding
1. demonstrate knowledge and understanding in their main field of study, including both broad knowledge in the field and substantially deeper knowledge of certain parts of the field, together with deeper insight into current research and development work; and,(m)
2. demonstrate deeper methodological knowledge in their main field of study.(m)
Skills and Abilities
3. demonstrate an ability to critically and systematically integrate knowledge and to analyse, assess and deal with complex phenomena, issues and situations, even when limited information is available,(m)
4. demonstrate an ability to critically, independently and creatively identify and formulate issues and to plan and, using appropriate methods, carry out advanced tasks within specified time limits, so as to contribute to the development of knowledge and to evaluate this work,(m)
5.demonstrate an ability to clearly present and discuss their conclusions and the knowledge and arguments behind them, in dialogue with different groups, orally and in writing, in national and international contexts; and,(m)
6. demonstrate the skill required to participate in research and development work or to work independently in other advanced contexts.(m)
7. prove ability to independently apply acquired knowledge in practical work, and insights in future professional positions,(j)
Judgement and Approach
8. demonstrate an ability to make assessments in their main field of study, taking into account relevant scientific, social and ethical aspects, and demonstrate an awareness of ethical aspects of research and development work,(m)
9. demonstrate insight into the potential and limitations of science, its role in society and people's responsibility for how it is used; and(m)
10. demonstrate an ability to identify their need of further knowledge and to take re-sponsibility for developing their knowledge.(m)
11. prove insights in the professional engineering role and responsibility in the society, assuming human conditions and needs and the goals for economical, social and ecological sustainable development in the society,(j)
12. prove immersed ability to interdisciplinary manners and to apply a system perspective,(j)

Programme-specific learning outcomes
The intended learning outcomes provided for programmes, must also be met.
13. have knowledge of different stakeholders impact on product design and evaluate a product based on the meaning it has for those who will use it.
14. have knowledge of human interaction with products and design methodology and design theory (human factor).
15. have developed the ability to design products with consideration to functional as well as aesthetic values ??and acquired knowledge about how the choice of color, shape, surface texture and materials affect the final product.
16. have developed the ability to communicate ideas using both sketches, models, and data-driven

animations orally and in writing.
17. to have knowledge of the design and production aspects, and know and understand the different material properties and its importance to the design of products.
18. have developed an approach to design??knowledge and the ability to reflect from an artistic as well as engineering perspective and developed a stable professional identity.
19. have knowledge about entrepreneurship principles and how to run and manage projects, and developed their ability to work together with other competencies and individuals

Contents

Material properties and its importance to product design and the material's capabilities and limitations are taught theoretically and practiced in projects.

Programme principles

The interdisciplinary character of the programme linked with problem-based learning aims at teaching a design-oriented approach facilitating dealing with complex issues and problem presentation. The programme has three main principles: methods and tools for design, strategies for design and artistic design ability. Man/machine issues play an important role in the programme. Great importance is attached to craftsmanship in design work, and training in sketching, modelling and various computer tools to be able to rapidly visualise ideas and concepts will be provided. Practical work will be carried out in the design studio and workrooms of the University. There will be cooperation with other Master programmes. The programme has close collaboration exchange with partner universities and offers opportunities for studies abroad. Several projects are carried out together with external parties.
The study programme ends with a degree project in which the students apply the knowledge and experience acquired during their studies to carry out a research and/or development work based on an issue relevant to industry and society.

Programme progression

The programme begins with a block where an introduction to the science of product Development and industrial design methodology starts. Students are given the knowledge of stakeholders' influence on product development and how a product can be given a meaning for those who will use it. In addition, students learn a methodical design approach and an introduction to various visualization tools. Students learn the basics of modelling and sketching. Material properties and its importance to product design and the material's capabilities and limitations are taught theoretically and practiced in projects. Students practice their ability to work in projects and learn the principles of project work in groups and as individuals. They get learn to deal with different areas of expertise in Product Realisation. Different cultural and anthropological differences and similarities in dynamic work. Artistic development and capacity for artistic reflection theorized and practiced. Great emphasis is placed on the individual's approach to product and the first level of understanding of product design and one owns reflection.

During the second block, human factors and the second order of understanding of product design are to be studied. Students practice their ability to communicate with models, sketches and data-driven animations. Great emphasis is placed on oral presentation of project work and feedback to their gestalt. Teaching is in the form of a project in collaboration with external companies.

Students will learn the principles of entrepreneurship and develop products in collaboration with companies. Design Communications spans over the whole block.

During the second year of the education, a major focus on how to manage the entire product development process in projects are to be trained. Science of Design and design theory is taught and practiced. Great emphasis is placed on the individual's ability to communicate their knowledge in words and pictures. The programme ends with a thesis in which the knowledge obtained during the education is theorized and practiced by a project in collaboration with a company or institution. The thesis is examined in the form of an exam, exhibition and report.

Prerequisite mathematics qualifications
For a degree of Master of Science, 21 credits in mathematics are required. Students admitted to the programme having 15 credits in mathematics will be offered an elective course in mathematics within the programme.

Courses

Mandatory courses

Course Name	Credits	Main field of study	Specialised in	Course Code
Design and Emotion (Human Factors 3)	6	Product Development	A1F	TDUS25
Design Philosophy and Practice (Human Factors 1)	6	Product Development	A1N	TDPR23
Design Communication 1	9	Product Development	A1N	TD1R23
Design Communication 2	9	Product Development	A1F	TD2S24
Design Communication 3	6	Product Development	A1F	TD3S24
Ergonomics (Human Factors 2)	15	Product Development	A1F	TERS24
Final Project Work in Product Development	30	Product Development	A2E	TEUV24
Industrial Design Project	9	Product Development	A1F	TIDS24
Industrial Product Realization, Process - Methods - Leadership	9	Production Systems, Product Development	A1N	TIFR23
Materials and Design	6	Product Development	A1N	TMDR23
Industrial Placement Course in Product Development	9	Product Development	A1F	TNFS24

Elective courses

Course Name	Credits	Main field of study	Specialised in	Course Code
Business and Economy[1]	6		G1F	TFEK14
Mathematical Statistics[1]	6		G1N	TMSG14

Programme overview

Year 1

Semester 1		Semester 2	
Period 1	Period 2	Period 3	Period 4
Industrial Product Realization, Process - Methods - Leadership, 9 credits	Materials and Design, 6 credits	Design Communication 2, 9 credits	
Design Communication 1, 9 credits		*Business and Economy [1], 6 credits*	Ergonomics (Human Factors 2), 15 credits
Design Philosophy and Practice (Human Factors 1), 6 credits		*Mathematical Statistics [1], 6 credits*	

Year 2

Semester 3		Semester 4	
Period 1	Period 2	Period 3	Period 4
Industrial Placement Course in Product Development, 9 credits	Design Communication 3, 6 credits	Design and Emotion (Human Factors 3), 6 credits	
	Industrial Design Project, 9 credits		
	Final Project Work in Product Development, 30 credits		

Teaching and examination

Academic year is divided into two semesters and normally read two courses in parallel. The courses are woven together with each other in projects. Examination forms and grades are given by each course plan, respectively. The programme overview shows the programme structure for both years and may be changed during the programme. For updated programme overview see http://www.jth.hj.se

Prerequisites

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 ECTS credits in mechanical engineering, civil engineering, architecture (with relevant courses in construction and design), or equivalent. The bachelor's degree should comprise a minimum of 15 ECTS credits in mathematics. Additionally, a home assignment must be submitted that shows artistic skills and aptitude for the profession. Proof of English proficiency is required.

Continuation Requirements

In order to begin the second year, at least 30 credits from the programme's first year must be completed.

Qualification Requirements

To obtain a Degree of Master of Science in Product Development, specialisation in Industrial Design, students must complete a minimum of 120 higher education credits in accordance with the current programme syllabus, at least 60 of which must be in the main field of study Product Development 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

Management councils , Head of Programmes, teachers and students work together with the development of the programmes and courses. All students get the opportunity to do a course evaluation after each completed course and before graduation time. The results of the evaluation are presented to the Head of Programmes, Head of Departments, Course Coordinators and to the Director of Education for further development.
Head of Departments, or corresponding, and Head of Programmes raise questions regarding the programme development within the Council of Programmes.
Student representatives, Director of Education and Study Counselor meet four times per year to discuss the recent completed courses within the programmes.
The chairman of students Educational Committee is a regular member in Council of Education.

Other Information

Course included in the programme can be read as a separate course, subject to availability. Prerequisites are stated in the syllabus.
Non-EU/EEA/Switzerland citizens pay tuition fees at the current rate. For further information see http://www.hj.se, / / Tuition and Application Fee / /