JÖNKÖPING UNIVERSITY
School of Engineering

PROGRAMME SYLLABUS

Sustainable Building Information Management (master), 120 credits

Programmestart: Autumn 2017

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PROGRAMME SYLLABUS

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Programme code:	TASB7	**Programmestart:**	Autumn 2017
Confirmed by:	Dean 2017-03-01	**Education Cycle:**	Second-cycle level
Version:	1		
Reg number:	JTH2017/2708-312		

Title of qualification

Degree of Master of Science (120 credits) with a major in Product Development, specialisation in Sustainable Building Information Management

Programme overview

Background

In an era of digitalization, much of the product development is done on virtual computer models making elaborate predictions of the product's behaviour in all phases of the product life cycle. This has led to both more optimized products with better performance and shorter development times and at the same time less environmental impact. A progress can also be seen towards more individualized products, customized to better meet the needs of the costumer. This is further enhanced by advancements in such areas as virtual reality, augmented reality and additive manufacturing.

The built environment sector is the largest single sector in most countries. The sector is responsible for the realization of the complex and very individualized products that make up the built environment, i.e. buildings, lighting systems, roads and water and sewer networks. The sector is a key actor in the process of creating sustainable value, both for the client and for society. Digitalization in the built environment has entailed major developments and new applications such as Geographic Information Systems (GIS) and Building Information Models (BIM) and has created the prerequisites for Industrialized processes.

Traditionally, BIM has been an acronym for Building Information Models. However, when the knowledge developed of how these models can be used in the built environment sector, the focus moved from the model, to the process where models are developed and used, and the meaning of BIM changed to Building Information Modelling, or Building Information Method. Today it is commonly accepted that successful use of BIM can only be understood if BIM is seen as part of a system where interaction among technology, people and the organizational context is taken into consideration. To capture this complexity of the use of BIM, we talk about Building Information Management.

Objectives

The development described above has triggered a need for engineers who have specialist knowledge concerning BIM and GIS, and the implementation of these technologies in the product realization process. The Master Programme in Sustainable Building Information

Management are a response to this need. The objectives of the Master Programme is to develop the knowledge, skills and experience needed to use and manage efficient product realization processes supported by digital technologies, e.g. BIM and GIS, in the built environment sector to create sustainable values. This includes modelling, simulation, analysis, optimization, visualization, sharing, communicating, organizing and managing processes for digitally driven value creation.

The aim is that the graduates from the programme will support businesses and organizations in the built environment sector to integrate the steps in the product and production chain as well as contribute with the expertise needed for companies to remain competitive on both local and global basis.

Post-graduation employment areas

After completing the programme, graduates will be qualified for positions with companies in need of experts who can use and manage modern computing and information technology like BIM and GIS for value creation in the built environment sector. The knowledge, skills and experience that the students develop during the programme will enhance the careers of existing professionals and create new career paths for young professionals, e.g. as a BIM engineer, BIM coordinator and BIM manager. Many of these roles did not exist until recently, but are now considered key positions in many companies.

The programme also serves as a preparation for scientific research qualifying graduates for enrolment as Ph. D. students at universities or institutes. Examples of research areas include all kinds of applications related to BIM and GIS, e.g. organizing and management, modelling, simulation, optimization, virtual reality, augmented reality and additive manufacturing.

Programme Supportive Research

At the School of Engineering at University of Jönköping, the research and second- and third-cycle courses and study programmes are developed within the research profile "Industrial product realisation in cooperation". The scientific research that this programme is based upon is carried out in the research area “Built Environment”.

The research in the area of Built Environment is based on a holistic view of industrial product realization of the complex products forming the built environment, i.e. buildings, lighting systems and water and sewer networks. On the overall level the research concerns the process of creating value for stakeholders in the development and maintenance of the built environment. The research area deals with all aspects of product values and has an excellence concerning visual qualities in the field of lighting design and the organizing of digitally driven change processes in the building and construction industry. The research has a focus on the use of BIM and GIS as instruments to create greater value for users and clients, as well as the processes of organizing digitally driven value creation. As digitalization in the built environment has created the prerequisites for industrialized processes, the focus on BIM and GIS also creates the opportunity to use the other research areas at the School of Engineering as supportive research for this programme, in particular the areas of Product development and Production.

Education concept at the School of Engineering

All degree programmes at the School of Engineering at Jönköping University (JTH) follow an education concept. The concept can be seen as consisting of a number of different aspects that have to be included in the degree programmes in order to guarantee their quality and appeal as well as their ability to produce professionally skilled, in-demand students. The concept places special emphasis on collaboration with industry and internationalisation as two essential tools in developing successful programmes attracting many applicants.

In the concept for the Master's programmes, there are common learning outcomes regarding the areas leadership, project management, internationalisation, and sustainable development. There is also an Industrial Placement Course (IPC) included in all programmes, whereby students put their theoretical knowledge into practice. IPC is a 9 credit course (5 weeks practise at a company), and it is also possible to complete the course abroad.

Internationalisation means that, for example, the opportunity is provided to practise languages and intercultural communication through student exchanges with foreign universities. JTH has around 70 partner universities around the world, and takes part in a number of international student exchange programmes. There is an opportunity to spend part of the study period abroad and to accredit studies abroad towards the degree. All Master's programmes at JTH are given completely in English.

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 (1-9), and also the intended learning outcomes, 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

JTH. prove ability to apply acquired knowledge in practical work

JTH. prove ability to collaborate effectively in teams, especially in the presence of a strong multicultural dimension

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 understanding of future professional engineering roles, including a sound awareness of an engineer's ethical responsibilities towards society and the need for economic, social and ecological sustainable development

JTH. prove ability to embrace interdisciplinary approaches through the application of a system perspective

Programme-specific learning outcomes

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

Knowledge and Understanding

10. display knowledge of sustainable values in the built environment sector
11. display knowledge of different BIM-strategies

Competence and Skills

12. demonstrate ability to independently use modern computing and information technology like BIM and GIS in the built environment sector to create sustainable values
13. demonstrate ability to manage and organize BIM-based building process judgement and approach

Judgement and Approach

14. demonstrate ability to assess the validity of the results from methods and tools in building projects

Contents

Programme Principles

The programme consists of 13 mandatory and one mandatory elective course.
The programme begins with two fundamental courses: *Industrial Product Realization, Process – Methods – Leadership* provides a common understanding of industrial product realization, including leadership, and give the students a broad knowledge of the field. The course *Sustainability, Analyses and Simulations* provides fundamental knowledge and understanding concerning the use of sustainability systems and applicable BIM-uses.

The course *Introduction to Script Programming* gives essential understanding of software programming which is used in several courses, e.g. *Parametric Design and GIS* and *BIM - Requirements and Specifications*. *BIM - Requirements and Specifications* focuses on how to use BIM to achieve goals and values in building projects. This knowledge will be used directly in the course *BIM - Management and Control*, where the students gain competence and skills in management and control of a BIM-based project.

In the course *Implementation of Digital Technologies and the Construction Industry*, students will receive knowledge and understanding of the organizational and managerial aspects of implementing digital technologies in the building industry. The course will also prepare students for the *Industrial Placement Course in Product Development* course, where they use their knowledge and skills at a company.

The courses *Platforms, Configuration and Optimization* and *Advanced Building Information Delivery* focus on the present and future development of BIM and the demands that this development gives concerning the role of engineers and continuous ongoing learning. In the courses *Research Methods, Knowledge-Intensive BIM* and *Final Project Work in Product Development* it is studied how new knowledge is developed in the main field of study.

Programme progression

The programme contains two different lines of progression:
- BIM Strategy
- Knowledge-Intensive BIM

BIM Strategy forms the backbone of the programme. It takes a holistic view of how to use digitalization in the development of the products that make up the built environment. With the theories about product development, that are learned in the course *Industrial Product Realization, Process - Methods – Leadership*, as a foundation, the course *Sustainability, Analyses and Simulations* gives the student knowledge about the different environmental, economic and social aspects that need to be taken into consideration in the design process and the BIM

strategies that are used to accomplish this. In the same way, the course *Parametric Design and GIS* will give the student BIM strategies connected to parametric design and GIS.

With this, the course *BIM - Requirements and Specifications* provides knowledge of requirements and specifications concerning BIM that are suitable and necessary to be able to conduct these BIM strategies and obtain the information needed in the building process. This knowledge will be used directly in the course *BIM - Management and Control*, where the student will gain competence and skills in how to manage and control BIM-based projects. Together with knowledge concerning organizational and management aspects related to implementing BIM strategies in the building industry, received in the course *Implementation of Digital Technologies and the Construction Industry*, the student has the competence to understand and implement the present BIM strategies in the building industry. These skills will be used and evaluated in the *Industrial Placement Course in Product Development*.

The focus of the BIM Strategy line of progress, described above, is to provide the students with the skills and understanding of the present BIM strategies. Development in the area of interest is so strong that some courses will focus on future BIM-uses and the requirements these will bring. These courses are *Platforms, Configuration and Optimization* and *Advanced Building Information Delivery*. The BIM Strategy line of progression ends with the course *Final Project Work in Product Development*, where the student can focus on developing a present or new BIM strategy in a scientific manner.

The other line of progression, Knowledge-Intensive BIM, focuses on the knowledge production needed in an area where new techniques and strategies are introduced all the time. The line begins with the course *Research Methods*, where the student gains basic knowledge concerning research methods. *Knowledge-Intensive BIM* develops this further, focusing on how research methods can be used to produce new knowledge in the area of BIM. The Knowledge-Intensive BIM line of progression ends with the course *Final Project Work in Product Development*, where the student will produce new knowledge and write his or master thesis in collaboration with a company or research organization.

Courses

Mandatory courses

Course Name	Credits	Main field of study	Specialised in	Course Code
Advanced Building Information Delivery	6	Product Development	A1F	TADS28
BIM - Management and Control	4.5	Product Development	A1F	TBMS28
BIM - Requirements and Specifications	6	Product Development	A1F	TBRS27
Final Project Work in Product Development	30	Product Development	A2E	TEUV24
Sustainability, Analyses and Simulations	7.5	Product Development	A1N	THAR27
Implementation of Digital Technologies and the Construction Industry	6	Product Development	A1N	TIDR28
Industrial Product Realization, Process - Methods - Leadership	9	Production Systems, Product Development	A1N	TIFR26
Knowledge Intensive BIM	6	Product Development	A1F	TKBS28

Industrial Placement Course in Product Development	9	Product Development	A1F	TNFS24
Parametric Design and GIS	7.5	Product Development	A1N	TPDR28
Platforms, Configuration and Optimization	9	Product Development	A1F	TPFS28
Research Methods	6	Product Development	A1N	TRMR28
Introduction to Script Programming	7.5	Informatics	G1N	TSTG17

Elective courses

Course Name	Credits	Main field of study	Specialised in	Course Code
Advanced Building Information Modeling[I]	6	Product Development	A1F	TABR28
Mathematical Statistics[I]	6		G1F	TMAK17

Programme overview

Year 1

Semester 1		Semester 2	
Period 1	Period 2	Period 3	Period 4
Industrial Product Realization, Process - Methods - Leadership, 9 credits	BIM - Requirements and Specifications, 6 credits	Parametric Design and GIS, 7.5 credits	Implementation of Digital Technologies and the Construction Industry, 6 credits
Sustainability, Analyses and Simulations, 7.5 credits	Introduction to Script Programming, 7.5 credits	BIM - Management and Control, 4.5 credits	
		Advanced Building Information Modeling [I], 6 credits	Research Methods, 6 credits
		Mathematical Statistics [I], 6 credits	

Year 2

Semester 3		Semester 4	
Period 1	Period 2	Period 3	Period 4
Industrial Placement Course in Product Development, 9 credits	Advanced Building Information Delivery, 6 credits	Final Project Work in Product Development, 30 credits	
Platforms, Configuration and Optimization, 9 credits	Knowledge Intensive BIM, 6 credits		

Teaching and examination

Throughout the academic year, typically, two courses are taken in parallel. Examination forms and grades are given by each course module, respectively. The programme overview shows the programme structure for both years and may be changed during the programme. For updated programme overview visit http://www.ju.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 construction engineering or civil engineering, or equivalent. The bachelor's degree should comprise a minimum of 15 ECTS credits in mathematics. 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 (120 credits) with a major in Product Development, specialisation in Sustainable Building Information Management, 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. Representatives of students and programme managers gather continuously to discuss the recently completed programme courses.
The chairman of students Educational Committee is a regular member in Council of Education.

Other Information

If formal competence is missing, the applicant's substantial competence is tested if the applicant has acquired equivalent knowledge in some other way. The aim is to assess the collective competence and if the applicant has the opportunity to meet selected training. Substantial competence can be about knowledge and experience from working life, long-term mobility or other courses.
Course included in the programme can be read as a separate course, subject to availability. Prerequisites are stated in the syllabus.
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"