JÖNKÖPING UNIVERSITY
School of Engineering

PROGRAMME SYLLABUS

Sustainable Building Information Management (master), 120 credits

Programmestart: Autumn 2024

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PROGRAMME SYLLABUS

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Programme code:	TASB2	**Programmestart:**	Autumn 2024
Confirmed by:	Dean 2022-03-01	**Education Cycle:**	Second-cycle level
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Title of qualification

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

Programme overview

Background

The built environment sector is the largest sector in most countries, and it is responsible for the realization of complex and individualized products that constitute the built environment itself, i.e. urban areas, buildings, lighting systems, infrastructure, etc.

The construction sector is a key factor in the process of creating sustainable value, both for the end-user's wellbeing and for the entire society. The building and construction sector is a key area that has significant impacts on economy and environment. According to recently published research studies, this sector contributes to the economy (about 9% of the EU's Gross Domestic Product (GDP)), provides direct and indirect job opportunities (18 million direct jobs at the EU) and satisfies the people's needs for buildings and facilities. Moreover, this sector is one of the main consumers of resources such as raw materials, and energy.

Digitalization in the built environment has boosted major developments and new applications such as Building Information Models (BIM), Parametric Design, Digital Twins and Geographic Information Systems (GIS) have created the prerequisites for an industrialized construction process. The industrialized, digital, and therefore optimized process will lead to sustainability by, among the others, reducing time, costs, optimizing the use material and energy consumption. Moreover, in the era of digitalization, much of the product development is done on digital models that, through analysis and simulations, enable elaborate predictions of the product's behaviour in all phases of its life cycle. Digitalization has led to both optimized products with better performances and shorter development times yet reducing the environmental impact and still allowing products' customization to better meet the end-user's needs.

Traditionally, BIM has been an acronym for Building Information Model (or Modelling). However, with the increase of awareness about the use of the embedded information's potential, the focus moved from the model to the process where models are developed and used, and the meaning of BIM changed from Building Information Model or Building Information Method to Building Information Management. Today it is commonly accepted that successful use of BIM can only be understood if it is part of a system where interactions among technology, people and

the organizational context are considered.

Objectives

The above-described development has triggered a need for engineers who have specialist knowledge concerning the complexity of the built environment, and the implementation of digital technologies in the construction and product realization process. The master's programme in Sustainable Building Information Management (SUS BIM) aims to provide a response to this need. The objective of the program is to provide the students with knowledge, skills and experience needed to develop, use and manage efficient product realization processes supported by digital technologies for the built environment sector. This includes modelling, simulation, analysis, optimization, visualization, sharing, communicating, organizing, and managing processes for digitally driven (sustainable-) value creation.

Graduates from the SUS BIM programme will enable changes and support businesses and organizations in integrating the different product and production chain's steps as well as supply the companies with expertise and strategies to be competitive both locally and globally.

Post-graduation employment areas

After completing the SUS BIM programme, graduates will be qualified for strategic positions in private and public companies involved at any stage of the construction sector. Graduates' knowledge, skills, and experiences in the digital management of built environment's related information and process will enhance existing and create new career paths for young professionals, e.g., as a BIM engineer, BIM coordinator and BIM manager, Change manager, Digital coach. Many of these new roles are now considered key positions at several companies.

The programme also serves as a preparation for scientific research, qualifying graduates for enrolment as Ph. D. students at universities or research institutes. Suitable research areas include applications related to the different aspects of the Built Environment, BIM, GIS, Parametric Design, organization and management, modelling, simulation, optimization, virtual reality, augmented reality, product development, additive manufacturing, Smart buildings and cities, etc.

Programme Supportive Research

With the establishment of the areas of excellence *Well-being and performance in buildings through lighting* and *Digitally driven development and the built environment sector*, the department of Construction Engineering and Lighting Science claimed the need of a new field of study for both 2nd and 3rd cycle education.

Research in the subject area *Built Environment* includes methods and techniques for an integrated view of the (industrial) product realisation of complex products and services. The research within the area focusses on utilisation and maintenance of the built environment to increase socio-technological value for stakeholders including health and well-being and sustainable development. Within this subject area, digital support of various kinds, such as simulation, optimisation, and planning, as well as environmental psychology assessment, are essential for the (virtual) development and verification of products and services. Considering the extended lifespan and the high individuality of the product or service, interaction with a digital version of the product as well as digital transformation of the field can be cost-effective, behaviour-revealing, and sustainable. Challenges to be faced throughout this revolution are digital disruptions or change processes due to the role of digitalization in collaborative innovations that transform business relationships in construction.

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 consists of several aspects that must be included in the programmes in order to guarantee quality and appeal as well as their ability to create professionally skilled, in-demand students. The concept places special emphasis on collaboration with industry and internationalisation as two essential tools to develop successful programmes and to attract national and international applicants. Furthermore, all the master's programmes offered by the School of Engineering follow common guidelines that indicate the number of credits per each course (7,5, 15 or 30), the need of cross disciplines courses, and the Industrial Placement Course as mandatory or elective.

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 outcome, 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

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 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
12. demonstrate an understanding of the basic concepts and theorems in the differential and integral calculus in several variables
13. display knowledge of common terms and concepts used in object-oriented programming

Competence and skills

14. demonstrate the ability to independently use modern computing and information technology in the built environment sector to create sustainable values
15. demonstrate the ability to manage BIM-based building process

16. demonstrate the ability to assess the validity of the results from (digital) methods and tools in building projects

Judgement and Approach

17. demonstrate the ability to assess the validity of the results from (digital) methods and tools in building projects
18. demonstrate skills in proposing and evaluating modularization of products
19. demonstrate an understanding of the relation between platforms and product lifecycle management
20. demonstrate the ability to develop and implement simple programs and algorithms in a high-level programming language

Contents

Programme principles

The programme consists of 11 mandatory and 4 elective courses. The programme begins with two fundamental courses: *Scientific Introduction to BIM and Sustainability* provides with scientific basis within the two main programme's concepts and prepare the students for the scientific approach promoting academic reading and writing. The course *Analyses, Simulations and Assessment systems* provides fundamental knowledge and understanding concerning the use of sustainability systems and applicable BIM-tools.

The course *Introduction to Script Programming* gives essential understanding of programming language/s used in parallel and following courses, such as *Parametric Design* and *BIM - Requirements and Specifications*. *BIM - Requirements and Specifications* focuses on the use of BIM to achieve goals and values in building projects. The outcome knowledge will be used in the course *BIM Management, Control and Evaluation*, where the students gain competences and skills in manage, control, and evaluate BIM-based projects. 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. This course will be open for practitioners' applicants. It will also prepare students for the elective *Industrial Placement Course in Built Environment* course, where students can challenge the gained knowledge and skills at relevant companies. The courses *Parametric Design* and *Product and Production Platforms* prepare the students with knowledge regarding automatized technic for design and automatization and their industrial applications. *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. The course *Research Methods for the Built Environment* prepares the students with scientific approaches and knowledge about the research methods relevant in the field of study and to be applied in the *Final Project Work in Built Environment*.

Programme progression

The programme contains two different lines of progression:

- *BIM Strategy*
- *Scientific approach for the Built Environment*

BIM Strategy constitutes the core of the programme promoting a holistic view on the use of digitalization in the development of the products for the built environment. Product development theories provide the students with knowledge about different environmental, economic, and social aspects that must be taken into consideration in all stages of the construction process; BIM strategies are used to accomplish this.

Other courses provide knowledge of requirements and specifications concerning BIM that are necessary to drive BIM strategies and to obtain the information needed in the construction

process. This knowledge will be used directly in the course such as *BIM – Management, Control and Evaluation*, where the students will gain competences and skills in how to manage, control and evaluate BIM-based projects. Together with knowledge concerning organizational and management aspects related to BIM strategies' implementation, in courses as *Implementation of Digital Technologies and the Construction Industry* the students understand and learn how to implement the current BIM strategies in the construction industry.

Courses such as *Parametric Design* and *Product and Production Platform* promote a different use of embedded information. The first aims to teach the students tools and procedure to optimize buildings' design and performances; the second uses digital model to enhance the industrial production of buildings and building components.

The BIM Strategy line of progression ends with the course *Final Project Work in Built Environment*, where the students can focus on developing new BIM strategies applying scientific approaches.

The Scientific approach for the Built Environment line begins with the course *Scientific Introduction to BIM and Sustainability*, where the students use research methods to gain basic knowledge concerning the major topics addressed in the programme and further used the acquired knowledge to evaluate BIM based projects in the course *BIM- Management, Control, and Evaluation. Research methods for the Built Environment* develops this further, focusing on how research methods can be used to produce new knowledge in Built Environment subject and in particular in the two department's areas of excellence: *Well-being and performance in buildings through lighting*, and *Barriers and drivers for a digitally driven development of the built environment sector.*

Courses

Mandatory courses

Course Name	Credits	Main field of study	Specialised in	Course Code
Advanced Building Information Delivery	7.5	Built Environment	A1F	TADS23
Analyses, Simulations and Assessment systems	7.5	Built Environment	A1N	TASR22
BIM - Management, Control and Evaluation	7.5	Built Environment	A1F	TBMS23
BIM - Requirements and Specifications	7.5	Built Environment	A1N	TBRR22
Final Project Work in Built Environment	30	Built Environment	A2E	TEBV24
Implementation of Digital Technologies and the Construction Industry	7.5	Built Environment	A1N	TIDR23
Parametric Design	7.5	Built Environment	A1N	TPDR23
Product and Production Platforms	7.5	Production Systems, Product Development	A1F	TPDS22
Research Methods for the Built Environment	7.5	Built Environment	A1F	TRBS23
Scientific Introduction to BIM and Sustainability	7.5	Built Environment	A1N	TSIR22
Introduction to Script Programming	7.5	Informatics	G1N	TSTG17

Elective courses

Course Name	Credits	Main field of study	Specialised in	Course Code
Change Management[I]	7.5	Built Environment	A1N	TCMR23
Multivariable Calculus[I]	7.5		G1F	TFVK17
Industrial Placement Course in Built Environment[I]	15	Built Environment	A1F	TIBS23
Industrial Placement Course in Built Environment[I]	7.5	Built Environment	A1F	TIES24

Programme overview

Year 1

Semester 1		Semester 2	
Period 1	Period 2	Period 3	Period 4
Analyses, Simulations and Assessment systems, 7.5 credits	BIM - Requirements and Specifications, 7.5 credits	Product and Production Platforms, 7.5 credits	Parametric Design, 7.5 credits
Scientific Introduction to BIM and Sustainability, 7.5 credits	Introduction to Script Programming, 7.5 credits	BIM - Management, Control and Evaluation, 7.5 credits	
		Implementation of Digital Technologies and the Construction Industry, 7.5 credits	

Year 2

Semester 3		Semester 4	
Period 1	Period 2	Period 3	Period 4
Change Management [I], 7.5 credits	Advanced Building Information Delivery, 7.5 credits	Final Project Work in Built Environment, 30 credits	
Industrial Placement Course in Built Environment [I], 15 credits	Research Methods for the Built Environment, 7.5 credits		
Industrial Placement Course in Built Environment [I], 7.5 credits			
Multivariable Calculus [I], 7.5 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 credits in construction engineering, civil engineering, built environment, architecture engineering, product development (with relevant courses in lighting design) or equivalent. The bachelor's degree should comprise a minimum of 15 credits in mathematics and 7,5 credits in BIM or CAD 3D, or equivalent. 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 Built Environment,

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 Built Environment 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 University"