

MSc in Civil Engineering (Cycle 2, level 4)

Specialization: Construction Management

MSc in Civil Engineering with specialization in Construction Management is a 2 year full-time graduate study program of 120 ECTS credits (4 semesters, 30 ECTS each semester). Students generally take 90 ECTS in specialized courses and a 30 ECTS thesis. In exceptional cases they may take 60 ECTS in courses and a 60 ECTS thesis with a stronger research focus.

The aim of the program is to prepare students for careers in the management of projects or major components of projects, with emphasis on engineering solutions relevant to the construction industry. There is emphasis on assimilating a broad scope of diverse disciplines - i.e. construction engineering, business, law, human relations and management disciplines - through interdisciplinary, practically oriented project work. An integrating project connects learning in adjacent subject areas and provides a practical context for academic study, bridging the gap between theory and practice. There is a large contribution to the program from visiting professors and invited lecturers who are leading specialists in their respective fields. The research emphasis is on applied research in cooperation with the industry.

The program leading to the MSc degree in Civil Engineering with specialization in Construction Management runs parallel to a program leading to a MSc degree in Construction Management. Reykjavik University offers MSc programs in four different fields of specialization within Civil Engineering: Construction Management, Transport and Urban Planning, Structural Design and Concrete Technology. Emphasis is on interdisciplinary cooperation between these programs, where appropriate. In the case of specialization in Construction Management, students are encouraged to take elective courses from the Transport and Urban Planning program.

Admission requirements are a BSc degree in engineering. Minimum requirements in applied sciences (i.e. mathematics, physics) and in basic subjects fundamental to civil engineering (i.e. mechanics, materials science) have to be fulfilled.

After successful completion of the program the student is awarded the degree Master of Science in Civil Engineering with specialization in Construction Management. The program is designed to meet the curriculum requirements for the professional title of Chartered Engineer (Icelandic: verkfræðingur), as defined by the Ministry of Industry and the Association of Chartered Engineers in Iceland.

On the completion of the MSc program in addition to relevant undergraduate studies, the following criteria shall be fulfilled, in addition to the criteria fulfilled at former levels. For further information, i.e. learning outcomes for each course, see the Course Catalog www.ru.is

KNOWLEDGE AND UNDERSTANDING

The program draws on science, engineering, social sciences and the humanities to create a knowledge-base that equips students to deal with a range of problems and challenges characterized by increasing interdisciplinary, international and cross-cultural working. The student must combine broad knowledge with a deep understanding of the core discipline of Construction Management. A substantial part of the knowledge imparted to the student is transferable across many types of projects, organizations and teams.

The subjects in which students take courses are Strategic Project Management, Scheduling, Production Engineering & Management, Risk Analysis & Management, Finance in Projects; Cost Engineering & Management; Value Engineering & Management; Procurement Methods; Contractual & Tendering Law; Facilities Management; Supply Chain Management & Logistics; Process Management; Organizational Psychology; Human Resource Management; Decision Analysis; Research Methods; as well as having the option of taking elective courses in other engineering disciplines within the School of Science and Engineering, the School of Business or the School of Law.

On completion of the MSc program the student should possess the following systematic generalized understanding and knowledge:

- Knowledge and understanding of the basic principles and the more important theories relevant to the field of Construction Management and their application.
- Knowledge and understanding of specific features of the subject of each specialized course taken, as seen in relation to the field of construction management.
- Integrated knowledge of the subject matter of all specialized courses taken and the application of that knowledge to the field of construction management.
- Advanced knowledge of recognized conventions and best practice in the planning, implementing, managing and analyzing of construction projects; also large and complicated construction projects.
- Advanced knowledge of a broad range of analytical and modelling methodologies and tools commonly used in construction management and project management.
- Advanced knowledge of the professional methods and recognized conventions that are relevant to operation and problem-solving in the different stages of a construction project.
- Knowledge of how projects arise and the different stages in the life-cycle of a project.
- Knowledge of the main methodologies and tools used to gather, analyze and interpret data.
- Working knowledge of a range of modern mathematical methods and tools used in the development and analysis of engineering systems generally and construction projects specifically.
- Knowledge of the main methodologies and tools used to formulate and analyze design solutions in various engineering contexts, especially in civil and construction engineering.
- Understanding and knowledge of basic research and development principles and practices relevant to engineering generally and the construction industry specifically.
- Understanding of the role of the engineer as an important professional in society and the duties, responsibilities, professional and ethical role and liabilities of experts such as civil engineers, construction managers, architects and other parties in a construction project.
- Knowledge of key professional, safety and ethical issues arising in

- modern engineering and construction industry.
- Knowledge of time-management and work planning issues related to the organization, implementation and successful completion and reporting of an individual Master's level research project.
 - Research methodology, including the fundamentals of scientific writing, literature search, how to give a scientific presentation, how to evaluate a scientific paper, and research ethics.

TYPE OF KNOWLEDGE

The program touches on many diverse disciplines with the aim of teaching the student to assimilate and integrate knowledge from many sources, to some extent building on the student's basic knowledge of subjects fundamental to engineering generally.

On completion of the MSc program, the student should have developed advanced knowledge and understanding of all of the following fundamental engineering subjects and should be able to make use of that knowledge in exercising engineering methodology and judgement in all tasks:

- Mathematics: Calculus in one and more dimensions, statistics, linear algebra and geometry, ordinary differential equations, numerical analysis.
- Physical sciences: Statics, dynamics, hydraulics, thermodynamics, electronics, chemical sciences, materials science, structural mechanics, soil mechanics.
- Technology: Programming, computer aided design, numerical modelling, design according to codes and standards, project management.

Most of the above the student will have acquired in previous studies but some of it the student will acquire in the MSc program.

On completion of the MSc program, the student shall possess specific, advanced knowledge and understanding of the following topics and their context within the broad field of Construction Management:

- Project management & scheduling; Strategic organization in projects; Construction site management; Risk analysis & management; Finance in projects; Production engineering; Cost engineering & management; Value Engineering & Management; Design management; Procurement methods; Contractual & tendering law; Facilities management; Supply chain management & logistics; Process management; Organizational psychology; Human Resource Management; Decision analysis.

On completion of the MSc program, the student shall possess the following significant, in-depth knowledge and understanding of the research leading to his or her MSc thesis:

- The theories introduced in the specialized courses and the application of these to analyzing and solving problems in the field of construction management.
- The background and theoretical base in the chosen research area.
- State-of-the-art knowledge in the chosen research area.
- The student will have established knowledge and be competent in applications of techniques developed within the chosen area of research.

PRACTICAL SKILLS

On completion of the MSc program the student should be able to:

- Analyze complex real-world problems and devise efficient and well-documented computer-based solutions for those. Use mathematical models and their associated analysis techniques in the design and evaluation of solutions.
- Plan, manage, analyze and deploy construction projects, also large and complicated construction projects, using recognized conventions as well as current best-practice methods.
 - Plan a project in regard to construction method, resource and time constraints.
 - Analyse a project using the work breakdown structure (WBS) and the product breakdown structure (PBS).
 - Apply the critical path method to projects and the line of balance method to repetitive work.
 - Perform a time-cost-performance- trade-off.
 - Plan the setting up of site operations for a range of project types and plan on-site production in accordance with the contract and quality plan.
 - Plan the on-site and off-site logistical support needed for a construction project.
 - Prepare a project execution plan (PEP) for a range of project types.
 - Determine appropriate levels of manpower and supervisory staff for a given project.
 - Undertake a risk and hazard assessment and take steps to mitigate identified risks.
- Set the agenda for teamwork, work effectively in a team and provide leadership for a team of individuals in the practice of construction management.
- Plan the work in advance, estimate required resources and comply with project deadlines.
- Work collaboratively with other disciplines in the spirit of teamwork, having regard for their needs and relationship with one's own work.
- Adapt quickly to new problems and challenges arising in the context of construction projects.
- Use advanced engineering software in the planning, managing and analysis of projects.
- Propose, plan, structure and manage well defined research projects involving a team of individuals. Prioritise, organise and schedule work activities effectively.
- Undertake research and the development of new methods within the broad field of construction management, recognising their roles in the innovation process.
- Interpret and critically assess existing theories, models, methods and results, both qualitatively and quantitatively, within a broad engineering framework and specifically within the field of civil engineering and construction management..
- Recognize and appreciate problems inherent in a given engineering system or approach, and be able to synthesise, and propose evaluation methods or develop alternative solution strategies.
- Have the ability to assess engineering projects, identify the key factors in a given situation, and develop an approach to a solution.
- Apply engineering techniques, taking account of a range of commercial and industrial constraints.

- Use decision analysis to deal with external and internal uncertainties.
- Appreciate the meaning and importance of professionalism, including integrity and adherence to independent, informed judgement.

THEORETICAL SKILLS

The student is exposed to established theory in all subjects and is required to question and apply that in his studies. Effort is concentrated on developing the student's critical faculties for thinking strategically and for interpreting and applying understanding to real world problems and contexts. The program develops intellectual capacity with which to engage in philosophical discussion with peers, tutors and industry managers. Independent learning and thought is encouraged and the student is required to apply himself in an environment that is multidisciplinary and ever-changing. A research approach is needed in most assignments, necessitating independent enquiry and adherence to ethical work practices.

On completion of the MSc program, the student should have sufficient, comprehensive understanding to be able to:

- Assimilate and integrate their knowledge, make assessments and utilize their knowledge and understanding in solving relevant problems in the field of civil engineering generally and construction management specifically.
- Identify, adapt and develop models appropriate to the study of a wide-range of different systems, processes and products involving civil engineering generally and construction management specifically.
- Apply standard scientific principles and theories to develop engineering solutions to a range of practical problems.

COMMUNICATION SKILLS AND INFORMATION LITERACY

On completion of the MSc program, the student should be able to:

- Work as a part of an inter-disciplinary planning, design or research team.
- Communicate effectively and professionally and formulate sound arguments, both in writing and by means of presentations, using appropriate technical language.
- Find information that is relevant to research using search engines, on line libraries and repositories. Effectively utilize modern information resources and technologies.
- Design and execute experiments for gathering data in the workplace; design a survey and questionnaire for data capture. Select and apply the most appropriate statistical technique for analysing data. Analyze and communicate statistical data.
- Select and apply appropriate methods and ICT-based tools to create and maintain knowledge bases to support a range of applications relating to construction projects, developing best practice through learning from experience.
- Plan, conduct and write up case studies.
- Report on one's own work, and that of others, both to a specialist and a general audience.
- Work with and recognize the importance of a range of different stakeholders and interests, being able to report on a project's progress from both a client and contractor perspective.

- Report on a research project and execute a research report.
- Discuss ethical issues in research work with their peers in an informed and reasoned fashion and apply an ethical approach to all work.
- Understand the use of technical literature and other information sources.

LEARNING SKILLS

On completion of the MSc program, the student should be able to:

- Use engineering judgement in the planning, implementation, management and analysis of projects.
- Solve non-trivial problems independently using the acquired skills or knowledge.
- Ask new questions based on available information and knowledge and use known facts to create new ones.
- Make creative use of known information, methods, concepts and theories in new situations.
- Generalize from a collection of specific instances. Infer possible causes from the available data, discovering patterns in the available information.
- Interpret facts by comparing them and contrasting them with one another, drawing conclusions and predicting possible outcomes.
- Make choices based on reasoned arguments, and evaluate the outcomes of those choices by comparing them with alternative solutions.
- Know how to assess one's own work against accepted standards of performance. Appreciate the factors that evaluators look for when considering proposals, including proposals for research work.
- Understand the need for, and the basis of, peer-group assessment. Understand how performance in a research project is judged and the basis of the criteria for judgement.
- Recognise and apply different approaches to learning.
- Appreciate the importance of continuing education and lifelong learning and undertake the study required to maintain and expand professional competence and keep up with evolving technology.
- Continue studies within this field towards an advanced degree i.e. at PhD level, having developed the necessary personal autonomy and knowledge to do so.