

## **MSc in Civil Engineering (Cycle 2, level 4)**

### Specialisation: Structural Design

MSc in Civil Engineering with specialization in Structural Design is a 2 year full-time graduate study program of 120 ECTS credits (4 semesters, 30 ECTS each semester). Students can either take 90 ECTS in specialized courses and a 30 ECTS MSc thesis, or 60 ECTS in courses and a 60 ECTS MSc thesis with a stronger research focus.

The programme focuses on both practical and theoretical aspects of structural analysis and design. Emphasis is also on the interaction of building materials and design, as well as specialized aspects of the physics of buildings. There is a major emphasis on innovation in the search for technical solutions and the development of new methods in the design of structures and in the use of building materials. The research emphasis is on applied research in cooperation with the industry.

Reykjavik University offers programs leading to the MSc degree in Civil Engineering in four different fields of specialization: Structural Design, Construction Management, Concrete Technology and Traffic and Urban Planning. Emphasis is on interdisciplinary cooperation between these MSc. Civil Engineering programs. In the case of specialization in Structural Design, students are encouraged to take elective courses from the programs specializing in Concrete Technology and Construction Management.

Admission requirements are a BSc degree in engineering. Minimum requirements in applied sciences (i.e. mathematics, physics) have to be fulfilled. Minimum requirements in basic subjects fundamental to Civil Engineering generally (i.e. mechanics, material science, etc.) as well as to Structural Engineering specifically have to be fulfilled.

After successful completion of the programme the student is awarded the degree Master of Science in Civil Engineering with specialization in Structural Design. The programme 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 programme 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](http://www.ru.is)

### **KNOWLEDGE AND UNDERSTANDING**

On completion of the MSc program, the student shall possess a systematic generalized understanding and knowledge of the following topics:

- Basic principles and more important theories relevant to structural engineering and their application.
- Behaviour of both structures and structural members and the design of these with different structural materials.
- Advanced calculation methods used in structural engineering for modelling and analyzing structures.
- The loads and actions considered in the design of structures, including

<p>earthquake loading.</p> <ul style="list-style-type: none"> <li>• Structural material behaviour including non-linear behaviour and knowledge using and selecting appropriate mathematical material models representing this.</li> <li>• Current codes and relevant structural design guidelines.</li> <li>• Different aspects of the physics of building.</li> <li>• Basic research and development principles and practices relevant to the building industry.</li> <li>• Role of the structural engineer as an important professional in society and the building environment and the interaction of the structural engineer with other professions.</li> <li>• Key professional, safety and ethical issues arising in modern engineering industry.</li> <li>• Time-management and work planning issues related to the organization, implementation and successful completion and reporting of an individual Masters level research project.</li> <li>• 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.</li> </ul>
<b>TYPE OF KNOWLEDGE</b>
<p>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 judgment in all tasks:</p> <ul style="list-style-type: none"> <li>• Mathematics: Calculus in one and more dimensions, statistics, linear algebra and geometry, ordinary differential equations, numerical analysis.</li> <li>• Physical sciences: Statics, dynamics, hydraulics, thermodynamics, electronics, chemical sciences, materials science, structural mechanics, soil mechanics.</li> <li>• Technology: Programming, computer aided design, numerical modelling, design according to standards, project management.</li> </ul>
<p>Most of the above the student will have acquired in previous studies but some of it the student will acquire in the MSc program.</p>
<p>On completion of the MSc program, the student shall possess specific, advanced knowledge and understanding of the following topics:</p> <ul style="list-style-type: none"> <li>• Structural design and modelling, Structural dynamics; Seismic analysis and design; Plasticity and limit analysis (non-linear structural behaviour); Building physics.</li> </ul>
<p>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:</p> <ul style="list-style-type: none"> <li>• The theories introduced during the specialized courses and the application of these to analyzing and solving problems in the field of structural engineering.</li> <li>• The background and theoretical base in the chosen research area .</li> <li>• State-of-the-art knowledge in the chosen research area.</li> <li>• The student will have established knowledge and be competent in applications of techniques developed within the chosen area of research.</li> </ul>

**PRACTICAL SKILLS**

On completing the programme students 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 for problems.
- Analyze, model and design structures and structural members.
- Complete structural design projects according to current codes and relevant regulations.
- Use advanced structural engineering software in the analysis and design of structures.
- Propose, plan and manage well defined research and design projects involving a team of individuals.
- Prioritise, organise and schedule work activities effectively and comply with project deadlines.
- Work effectively in a team of individuals.
- Interpret and critically assess existing theories, models, methods and results, both qualitatively and quantitatively, within a broad engineering and physical science framework.
- 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.
- Work with technical uncertainty.
- Appreciate the meaning and importance of professionalism, including integrity and adherence to independent informed judgement.

**THEORETICAL SKILLS**

On completion of the MSc program, the students shall 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 structural engineering specifically.
- Identify, adapt and develop models appropriate to the study of a wide-range of different structural engineering problems.
- 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 a design 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.
- Analyze and communicate statistical data.
- Report on their work, and that of others, both to a specialist and a general audience.
- 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 both analysis and design of structures.
- 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 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.