

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

Mechanical Engineering MSc is a 2 year full-time graduate study program of 120 ECTS credits (4 semesters, 30 ECTS each semester). All students are required to complete a 32 ECTS Integrated Project Course, composed of a 18 ECTS design project, one 6 ECTS and two 4 ECTS supporting courses. 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.

Admission requirements are a BSc degree in engineering. Minimum requirements in applied sciences (i.e. mathematics, physics) and in basic subjects fundamental to Mechanical Engineering (i.e. mechanics, design, thermal fluids) have to be fulfilled.

The degree Master of Science in Mechanical Engineering provides education equivalent to the 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](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:

- An advanced knowledge of a broad range of modelling methodologies, and underlying mechanical science, commonly used in the development and analysis of mechanical engineering systems
- Knowledge of fundamental design issues relevant to mechanical engineering, and an understanding of how to formulate and analyse design solutions in various engineering contexts.
- Working knowledge of a range of modern mathematical methods and tools used in the development and analysis of mechanical engineering systems.
- In-depth knowledge of one or more of the following general themes: specific engineering systems, design methods, modelling techniques, mathematical and/or numerical techniques.
- Understanding and knowledge of basic research and development principles and practices relevant to mainstream engineering industry.
- Knowledge of key professional, safety and ethical issues arising in modern engineering industry.
- Knowledge of time-management and work planning issues related to the organization, implementation and successful completion and reporting of an individual Masters 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**

On completion of the MSc program, the student shall possess specific knowledge and understanding in all of the following topics, most of which the student will have acquired in previous studies and some of which the student will acquire in the MSc program:

- General knowledge in all the following subjects:
  - Mathematics: Calculus in one and more dimensions, linear algebra and geometry, ordinary differential equations, numerical analysis.
  - Physical subjects: Mechanics, electronics, electromagnetics, dynamics, statics, materials science, chemical sciences, thermodynamics, heat transfer and fluid mechanics.
  - Technology: Programming, machine components, mechatronics, computer aided design, project management, control theory.
- On completion of the MSc program, the student shall possess in depth knowledge of two or more of the following, depending on selected specialization courses: specific engineering systems, design methods, modelling techniques, engineering optimization methods, mathematical and/or numerical techniques.
- and of two or more of the following topics depending on the line of specialization: Mechatronics, thermal fluids and modelling, materials science and engineering, mechanical design and modelling, engineering optimisation.

### **PRACTICAL SKILLS**

On completing the programme students should be able to:

- Propose, plan and manage well defined research projects involving a team of individuals. Prioritise, organise and schedule work activities effectively. 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.
- 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.
- 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.
- Apply engineering techniques taking account of a range of commercial and industrial constraints.

### **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:

- Identify, adapt and develop models appropriate to the study of a wide-range of different mechanical engineering type systems, processes and products.
- Apply standard scientific principles 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:

- Communicate effectively and professionally 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.
- Discuss ethical issues in research work with their peers in an informed and reasoned fashion. Understand use of technical literature and other information sources.

### **LEARNING SKILLS**

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

- 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.
- Interpret facts by comparing them and contrasting them with one another, drawing conclusions and predicting possible outcomes.
- Infer possible causes from the available data, discovering patterns in the available information.
- Make choices based on reasoned arguments, and evaluate the outcomes of those choices by comparing them with alternative solutions.
- To undertake the self study required to 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.