MSc program in Mechatronics Engineering (Cycle 2,2)

The program leading to an MSc degree in Mechatronics Engineering is a 5 year full time graduate study program of 300 ECTS credits (10 semesters, 30 ECTS each semester), which can be divided into a 180 ECTS BSc degree and a 120 ECTS MSc degree. Students will receive the MSc degree in Mechatronic Engineering upon completion of the program.

The degree Master of Science in Mechatronic 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 Catalogue www.ru.is

The Mechatronic Engineering program draws on the principles of engineering, the physical sciences to create a broad knowledge base that equips students to deal with a range problems and challenges in mechatronic engineering, including the design, analysis, operation and maintenance of robots, and intelligent machines.

Students must have a firm understanding of core concepts including electronics, machine elements, signals, control and dynamical systems, computer organisation and programming, computation and modelling. The student must be able to apply these to the design and analysis of various intelligent computer architecture and mechatronic systems.

1. KNOWLEDGE

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

1.1.   In the basic principles of multivariable calculus, including differentiation, integration and differential equations.

1.2.   Basic principles of linear algebra, vectors, matrices, determinants, eigenvalues, eigenvectors and solving systems linear equations.

1.3.   Complex numbers, complex exponentials, Laplace and Fourier transform and their applications in solving dynamical systems.

1.4.   Basic probability and statistics, data analysis and error estimates.

1.5.   Basic numerical methods relevant to engineering.

1.6.   Physics, common to most engineering disciplines, including a practical foundation in classical dynamics, electromagnetism, and solid-state materials.

1.7. Basic understanding of engineering programming in common languages, such as Matlab and C++, and spreadsheet applications.

1.8. Basic theory and application of signal processing concepts, methods and algorithms

1.9. Basic knowledge of modern communication systems.

1.10. Basic theory of dynamical systems and identification.

1.11. Main areas of control engineering and design.

1.12. General area of power electronics, electric machines and power systems.

1.13. Analysis of signals and design of signal processing algorithms.

1.14. Computer organization and architecture.

1.15. Electronics and instrumentation.

1.16. Computer vision and audio processing.

1.17. Management principles and ethical issues for electrical engineers.

1.18. Sustainability, environmental impact and life cycle assessment of electrical engineering works.

2. DISCIPLINARY SKILLS

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

2.1. Apply methods from physics, mathematics and computer science to model systems in electrical, electronic and electrical power engineering.

2.2. Use mathematical methods and tools to analyze and develop electrical and electronic engineering systems including electrical power engineering systems.

2.3. Use computational tools and packages in electrical design, process and electrical system design and planning

2.4. Plan, manage and analyze projects, using current best-practice methods.

2.5. Devise lab experiments, collect and analyze data from physical and simulated test systems and use the results to solve technical problems.

2.6. Design signal processing system elements and control system or processes to meet or exceed a set of performance specifications, standards and codes.

2.7. Analyze and design pattern analysis systems or processes to meet or exceed a set of performance specifications, standards and codes.

2.8.   Use lab equipment effectively and safely to analyze electrical circuits, instrumentation, computer processors and actuators.

2.9.   Use computers effectively and safely to analyze signal- and pattern properties and performance of signal processing algorithms and systems.

2.10.   Carry out risk assessment as an integral part of the design process

2.11.   Analyze and communicate statistical data.

2.12.   Apply project management methods to the planning of projects and apply business administration methods.

2.13.   Apply standard scientific principles to develop engineering solutions to range of practical problems.

2.14.   Carry out cost estimate for a design solution and understand the uncertainties associated with the cost estimation process

3.   PERSONAL SKILLS

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

3.1.   Communicate in English and Icelandic (written and spoken) effectively and professionally and be able to present results using graphs, illustrations and simulations.

3.2.   Use time-management and work planning related to the organization, implementation and successful completion and reporting of a project.

3.3.   Interpret and critically assess existing theories, models, methods and results, both qualitatively and quantitatively, within a broad engineering and physical sciences framework.

3.4.   Make choices based on reasoned arguments, and evaluate the outcomes of those choices by comparing them with alternative solutions.

3.5.   Propose, plan and manage well defined research projects involving a team of individuals. Prioritise, organise and schedule work activities effectively.

3.6.   Realize the limits of his/hers expertise and know when it is necessary and appropriate to seek specialist advice.

4.   INTERPERSONAL SKILLS

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

4.1.   Communicate effectively and professionally and formulate sound arguments, both in writing and by means of presentations, using appropriate scientific and technical language.

4.2.   Present ideas in an organized manner, and deliver presentations to peers and advisors from the industry.

4.3.   Propose, plan, structure and manage well-defined projects involving a team of individuals. Prioritise, organise and schedule work activities effectively.

4.4.   Recognize the interdisciplinary nature of technical problems and can apply other areas of knowledge to the solution, and work with other professions to arrive at a solution for complex engineering problems.

4.5.   Give an oral scientific presentation, report on a research project and produce a research report.

4.6.   Be an effective team member and contribute to the management of team projects.

5.   COMPETENCE

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

5.1.   Solve specific technical problems covering all phases of the CDIO (Conceive, Design, Implement, Operate) from problem identification, idea generation and requirements specification, through design, optimization and implementation to actual production and commissioning

5.2.   Analyze a problem specification, compare alternative designs, processes, and products and make improvements.

5.3.   Evaluate existing designs/processes/products and propose improved realizations.

5.4.   Use design standards and safety codes as an integral part of the design and building process for machine parts and systems.

5.5.   Appreciate the duties, responsibilities, role and liabilities of experts such as engineers, designers and other stakeholders in projects, companies and society.

5.6.   Appreciate the meaning and importance of professionalism, including ethics, integrity and adherence to independent, informed judgement.

5.7.   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.