BSc in Applied Mechanical & Energy Engineering – a 210 ECTS programme; LO (Learning outcomes) 7. Jan 2016

The programme leading to a BSc degree in Applied Mechanical and Energy Engineering is 210 ECTS credits. Students take 54 ECTS credits in fundamental courses that are the same for all 3.5 year BSc programmes in applied engineering. They take 120 ECTS credits in courses that are specific to their chosen discipline (Applied Mechanical and Energy Engineering); of these, students of applied mechanical and energy engineering students are encouraged to take 24 ECTS credits in courses that comprise a "specialisation package" in mechanical design or energy processes. Other elective courses comprise 12 ECTS credits. Students conclude their studies with a final project of 24 ECTS credits, most often in collaboration with a firm in the relevant industry. There is an emphasis on practical, hands-on engineering skills and on preparing students for a career in industry after graduation.

The students are provided with knowledge and skills in selected areas of mechanical design, energy technology and management. Emphasis is placed on practical, hands-on engineering skills and on projects that expose the students to real world problems. Emphasis is placed on producing graduates with the practical knowledge and competence that enable them to make an immediate contribution and pursue careers in the industry directly upon graduation.

The aim of the programme is to educate capable mechanical engineers for careers in industry, with a well-defined and strong set of skills as is internationally expected of mechanical engineers.
Upon completion of the BSc programme, the following criteria shall be fulfilled.

1. Knowledge

1.1 Basic principles of multivariable calculus, including differentiation, integration and differential equations.

1.2 Laplace and Fourier transform, complex exponentials and applying them to solve differential equations.

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

1.4 Probability and statistics, data analysis and error estimates.

1.5 Numerical methods relevant to engineering.

1.6 Physics common to most engineering disciplines, including a practical foundation in classical dynamics, electromagnetism, fluid mechanics and thermodynamics.

1.7 Basic principles of engineering programming using Matlab and spreadsheet applications.

1.8 Main areas of material science and manufacturing processes.

1.9 Structural analysis and the safety of structures.

1.10 Fundamentals of fluid statics and fluid flow.

1.11 Design of machine elements and machine design using computer-aided design software.

1.12 Electric circuits, automation, control systems and electrical machines.

1.13 Sustainability, environmental impact and life cycle assessment of mechanical engineering works.

1.14 Management principles and ethical issues for mechanical engineers.

Skills

2. Disciplinary skills

2.1 Apply methods from physics, mechanics and materials science to model systems in mechanical and energy engineering.

2.2 Extract relevant physical properties from the Laplace transforms of differential equations.

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

2.4 Design machine elements and machine systems or processes to meet or exceed a set of performance specifications, standards and codes.

2.5 Use lab equipment effectively and safely to analyse material and mechanical properties of machine elements and machines.

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

2.7 Use computational tools and packages in mechanical design, process design and planning, including 3D CAD and FEM software.

2.8 Use common machine shop tools safely to build and test prototypes of own design.

2.9 Solve common, technical problems in the design of smaller machine elements and machines and analysis of energy processes and be able to seek specialist advice as needed for more complicated problems.

2.10 Identify the process of innovation and the main factors of entrepreneurship and creative thinking and apply methods of product development.

2.11 Plan and supervise industrial processes.

2.12 Analyse fluid and energy systems with respect to fundamental principles.

2.13 Apply project management methods to the planning of projects. Plan, manage and analyse projects, using current best-practice methods.

2.14 Apply business administration methods to the running of industrial enterprises.

2.15 Design basic pipe and HVAC systems (heating, ventilating, and air conditioning).

2.16 Set up, monitor and maintain machine parts and machine systems.

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

3. Personal skills

3.1 Think and work independently and in a self-critical manner

3.2 Express themselves in English and Icelandic (written and spoken) effectively and professionally, and be able to present results using appropriate technical language and presentation tools i.e. graphs, illustrations and simulations.

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

3.4 Find information that is relevant to engineering as well as research and development work and effectively utilize modern information resources and technologies.

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

3.6 Work in and lead a multidisciplinary project group, where it is necessary to formulate and solve open problems.

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

4. Interpersonal skills

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 using the latest presentation tools.

4.3 Propose, plan, structure and manage well defined projects involving a team of individuals.

4.4 Prioritise, organise and schedule work activities effectively.

4.5 Recognize the interdisciplinary nature of technical problems, apply other areas of knowledge to the solution, and work with other professionals to arrive at a solution to complex engineering problems.

4.6 Give an oral scientific presentation, report on a research or design project, and execute a research or design report.

4.7 Participate as a member of a team and contribute to the management of team projects.

5. Competence

5.1 Solve specific technical problems covering all phases of 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 Define and structure complex, real-world problems in order to analyse and develop relevant solutions.

5.3 Analyse a problem specification, compare alternative designs, processes, and products and make improvements.

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

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

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

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

5.8 Undertake further study, both self-study as required to keep up with evolving technology and formal study towards a more advanced degree.