## *BSc in Electrical Power Engineering*

The program leading to a BSc degree in Electrical Power Engineering is a 3 year full time undergraduate study program of 180 ECTS credits (6 semesters, 30 ECTS each semester); cycle 1.2. Students will receive the BSc degree in Electrical Power Engineering upon completion of the program.

Students take 84 ECTS credits in fundamental courses that are the same for all three-year BSc engineering programs, 60 ECTS credits in courses that are specific to their chosen discipline (Electrical Power Engineering), a 12 ECTS capstone project course and 24 ECTS credits in elective courses. The main aim of the program is to prepare students for studies in engineering at the MSc level.

The program in electrical power engineering draws on the principles of engineering, and the physical sciences to create a broad knowledge base that equips students to deal with a range problems and challenges in electrical engineering, including the design, analysis, operation and maintenance of electrical systems and electrical power systems.

Students must have a firm understanding of the core concepts including electrical circuits, power electronics, signal processing, control systems, dynamical systems, computer programming, computation and modelling, and apply these to the design and analysis of various electrical equipment and electrical systems including electrical power systems.

On the completion of the BSc program, the following criteria shall be fulfilled:

## 1. KNOWLEDGE

On completion of the BSc 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. Main areas of applied chemistry, including phases og matter, reactions and equilibrium, and introduction to bio- and organic chemistry.

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

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

1.9. Basic theory of dynamical systems and identification. Properties of electric circuits, circuit theorems, passive components, operational amplifiers, time response of RC, RL and RCL circuits, phasor and steady state analysis.

1.10. Properties of electric circuits, circuit theorems, passive components, operational amplifiers, time response of RC, RL and RCL circuits, phasor and steady state analysis.

1.11. Fundamentals of instrumentation and measurement, applications and limitations of measurement systems, data acquisition and handling, common sensor technologies, treatment of uncertainty and error analysis.

1.12. Main areas of control engineering and design.

1.13. Basic knowledge of electric machines. Synchronous and asynchronous generators and motors; power low through impedances; single phase, linear induction and stepper motors.

1.14. Basic theory and practice of electrical power systems.

1.15. Basic theory and practice of electronics and power electronics.

1.16. Management principles and ethical issues for electrical engineers.

1.17. Basic project management methods, how projects arise and the different stages in the life-cycle of a project.

1.18. Basic understanding of innovation and entrepreneurship, techniques of idea generation, launching a new company and business plans.

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

## 2. DISCIPLINARY SKILLS

On completion of the BSc 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 analyse 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 power system design and planning.

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

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

2.6. Analyse and control electrical power system elements and electrical power system or processes to meet or exceed a set of performance specifications, standards and codes.

2.7. Use lab equipment effectively and safely to analyse electrical circuits, instrumentation and actuators.

2.8. Use lab equipment effectively and safely to analyse material and electrical properties and performance of electric power components and systems.

2.9. Analyse and communicate experimental, numerical and statistical data.

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

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

## 3. PERSONAL SKILLS

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

3.1. Communicate 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.

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

## 5. COMPETENCE

On completion of the BSc 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. Use design standards and safety codes as an integral part of the design and building process for electrical parts and power systems.

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

5.4. Continue studies within this field towards an advanced degree, i.e. at MSc level, having developed the necessary personal autonomy and knowledge to do so.