Learning outcomes (LO) for BSc in Applied Civil Engineering

The programme leading to a BSc degree in Applied Civil 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 Civil Engineering); of these, students of applied civil engineering are encouraged to take 24 ECTS credits in courses that comprise a "specialisation package" in structural design, installations or construction. 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 programme combines traditional theory in civil and construction engineering with good practice in design and project management applied to technically demanding 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.

At the end of the programme, students specialising in structural design should be capable of designing traditional structures in timber, steel and reinforced concrete. Students specialising in installation systems should be capable of designing traditional systems in water supply, wastewater, heating and ventilation. Students specialising in construction should be capable of planning traditional construction projects and manage supervision and inspection on a building site.

Upon completion of the BSc programme, the following criteria shall be fulfilled.

KNOWLEDGE

Upon completion of the BSc programme, the student should possess general knowledge and understanding of the following:

- The basic principles of mathematics that are fundamental to analysis, design and optimization in civil engineering, including:
  - The basic principles of calculus, differentiation and integration.
  - Vectors, matrices, determinants, eigenvalues, eigenvectors and solving systems linear equations.
  - 1st and 2nd degree differential equations and their general solution form and methods using Fourier and Laplace transform, complex numbers and complex exponentials.
  - Probability and statistics, data analysis and error estimates.
  - Numerical methods.
- The basic principles of physics which are fundamental to analysis, design and optimization in civil engineering, including a practical foundation in classical mechanics, dynamics and thermodynamics.
- The basic principles of engineering programming using Matlab and Excel.
- Statics, dynamics, continuum mechanics, soil mechanics, hydraulics and materials science.
- Building physics and building technology.
- Structural analysis and the safety of structures.
- Structural design in reinforced concrete, timber and steel.

- Soil mechanics, geology and geotechnical design.
- Road design and road construction.
- Surveying and laboratory measuring techniques.
- Project management and business management methods.
- Planning and supervision of construction projects.
- Installations for water supply, wastewater, heating and ventilation.
- Computer software for analysis and design in civil engineering.
- Sustainability, environmental impact and life cycle assessment of civil engineering works.
- Occupational health, safety and environmental management.
- Management principles and ethical issues for civil and construction engineers.

SKILLS

Upon completion of the BSc programme, the student should possess skills to be able to:

Disciplinary skills

- Analyse and solve practical problems using their knowledge in math, physics, mechanics and materials science.
- Describe the nature of sustainability and the principles of environmental protection and apply these to the solutions of technical problems.
- Use lab equipment effectively and safely to measure the mechanical properties of building materials and to test structural behaviour and validate the design of structural elements.
- Use common computational tools and software packages in structural design, installation design, road design and construction planning.
- Use design standards and safety codes as an integral part of infrastructure design.
- Analyse and solve common design specifications or technical problems in structural design, installation systems, road construction, construction planning and management.
- Apply construction management methods to the planning and preparation of construction projects.
- Carry out a cost estimate for a structural design solution and/or construction project and understand the uncertainties associated with the cost estimation process.

Personal skills

- Think and work independently and in self-critical manner.
- Express themselves effectively and professionally both in writing and by means of presentations, using appropriate technical language and presentation tools.
- Utilize time-management and work planning related to the organization, implementation and successful completion and reporting of a project.
- Find, evaluate and utilize information and data that is relevant to the task at hand, using modern information resources and technologies based on variety of sources including existing designs, books, journal papers and other information accessible on- or off-line.
- Realize the limits of his/hers expertise and know when it is necessary and appropriate to seek specialist advice.

Interpersonal skills

- Recognize the interdisciplinary nature of technical problems and be able to work with other professions to arrive at a solution for engineering problems.
- Participate as a member of a team and contribute to the management of team projects.
- Propose, plan, structure and manage engineering projects involving a team of individuals.
- Prioritise, organise and schedule work activities effectively.
- Present ideas to peers and advisors from industry in an effective and organized manner using sound argumentation, by means written or oral presentations, in an appropriate scientific and technical language and presentation tools.

COMPETENCE

Upon completion of the BSc programme, the student should be able to utilise the knowledge and skills he/she has acquired to:

- Apply analytical skills and modelling methodologies to recognize, analyse, synthesise and implement operational solutions to engineering problems.
- Apply judgement, professional methods and recognized conventions that are relevant for solving civil engineering problems.
- Analyse and solve a technical problem specification, compare alternative designs, processes, and products.
- Optimize the design of a structural element, system or process to meet a set of performance specifications, such as those defined by national codes, design guidelines or stakeholders.
- Evaluate existing designs/processes/products and propose improved realizations.
- Make choices based on reasoned arguments, and evaluate the outcomes of those choices by comparing them with alternative solutions.
- Appreciate the duties, responsibilities, role and liabilities of experts such as engineers, designers and other stakeholders in projects, companies and society.
- Appreciate the meaning and importance of professionalism, including ethics, integrity and adherence to independent, informed judgement.
- Undertake further study, both self-study as required to keep up with evolving technology and formal study towards a more advance degree.