

Competences imparted: MSc program in Civil Engineering

Competence Profile (MSc)

A graduate from the Technical University of Denmark (DTU) has a research-based education at a high technological level that qualifies the graduate to take on specialized business functions and participate in scientific development. A master's degree in Engineering also gives access to further education within research (e.g. research positions or a PhD).

The graduate has:

- basic understanding and knowledge of the natural sciences and technological principles. The graduate can use this knowledge for innovative purposes such as solving technological problems in business or societal contexts.
- extensive technological expertise within a specific area and knowledge of current trends and opportunities within this area.
- a clear professional profile which includes elements of current research at an international level. The graduate has the ability to use this knowledge in developing new ideas and solving new problems.
- a thorough understanding of how elements of a technological problem interact. The graduate is able to develop relevant models, systems and processes to solve the problem in question using creative analysis and modeling.
- the ability to assess and delimit complex issues, put them into a broad professional and societal context, and, on this basis, propose relevant courses of action.
- the ability to combine technological expertise with knowledge of economics, management, organization and project work. The graduate is able to examine technological solutions in a business and societal perspective.

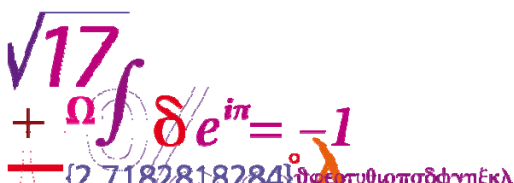
General competences (MSc)

The graduate:

- is proficient in both oral and written communication, and is able to present professional results in a convincing manner
- commands technical problem solving at a high level, primarily through project-related approaches. The graduate is able to handle all phases of a project, including the drafting of project timelines, design and solution proposals, and documentation
- can use and assess technological solutions, while applying principles of ethics and sustainability
- has experimental experience and is familiar with lab culture within his/her professional sphere.

Formal conditions (MSc)

- Admission requirements: BSc Eng (180 ECTS points)
- Program duration: The master's program covers two years of full-time study (equal to 120 ECTS). This framework ensures that all graduates acquire professional core competencies through technological specialization (minimum 30 ECTS) and a master's thesis (minimum 30 ECTS). Program participants also acquire specialized knowledge through elective courses (minimum 30 ECTS). The program also includes 30 elective ECTS credit points.
- Title: Master of Science in Engineering, cand. polyt.
- Further education: Research, PhD (3 years)
- Executive order: The master's program complies with executive order BEK 338 dated May 6, 2004 (and subsequent amendments) issued by the Danish Ministry of Science, Technology and Innovation.



PROFESSIONAL COMPETENCE OBJECTIVES (MSc)

The MSc program in Civil Engineering

Civil engineering comprises the development, planning, design, and construction of buildings and facilities and their services. Graduates can apply advanced mathematical models and computer simulations for design. They have in-depth knowledge of physical principles, construction materials, structural behavior and response, design of services, and overall principles for planning and design of buildings and cities. Four specialized study-lines are offered:

Building Structures, Building Services, Soil and Water Mechanics and Urban and Construction Management.

In each study line, a multitude of special competences is available (it is also possible to become a MSc in Civil Engineering without a study line). The subjects include roads and rails, bridges and tunnels, buildings and halls with load-bearing structures, facades, services for heating, water supply, sewers and lighting, and acoustics, fire safety and urban management.

The graduate can:

- set up engineering models, and is conscious of their presumptions and limitations
- undertake a building design process including: sketching, project proposal, preliminary project and main project with relevant documentation
- coordinate all the requirements for a building: economic, aesthetic, functionality, durability and safety (lives and property)
- apply porous building materials including concrete, wood, brick and insulation materials for dead and live loads, taking into account moisture and fire exposure
- assess dead and live loads from wind, snow and ice, waves and current and extreme loads from fire, explosion, and earthquakes and other natural phenomena
- take part in project and construction management based on a minimum knowledge of law, management and logistics in the building sector and manage resources
- carry out operation- and maintenance-projects in relation to buildings and facilities
- participate in planning and management of towns, buildings, and technical infrastructure

Facts about DTU

The Technical University of Denmark (DTU) is one of the largest Northern European research and education institutions in the engineering field. DTU educates more than 750 Masters and 300 Bachelors of Engineering and 150 PhDs a year. On January 2007 DTU merged with 5 sectorial research institutions becoming a broad-based technical university and center of excellence. The university has more than 6,000 students and over 4100 employees.

DTU offers a 3½-year business-oriented Bachelor of Engineering, a 3-year Bachelor of Science in Engineering and a 2-year Master of Science in Engineering, MSc Eng. DTU also offers a 2-year Master of Science and Technology (MSc Techn) for Bachelors of Science and a Bachelor and Master's program in Food Science in collaboration with the University of Copenhagen.



PROFESSIONAL COMPETENCE OBJECTIVES (MSc)

The MSc program in Civil Engineering – Building Structures

Graduates of the Building Structures study-line are competent in the design of buildings, including dimensioning of load-bearing and non-load-bearing structures and foundations in houses, halls and bridges for dead loads, service loads, and loads from snow, ice, waves, wind, fire and earthquake. In addition, the specialization covers the design of floor plans and rooms with regard to acoustics and lives- and properties-safety and the erection and maintenance of the buildings.

The graduate can:

- design buildings, make general layouts and undertake a total optimization of components with respect to functional requirements for safety, economy, resources, environment, durability and application
- assess extreme loads e.g. from wind, ice, earthquake, collision, fire and terror
- find the significant stress resultants in columns, plates, and walls and can design these in wood, steel, and concrete with slack reinforcement
- design cross-loaded columns, frames, shear walls and pre-stressed and partly pre-stressed structures
- design buildings and structures like houses, halls, masts, bridges, and tunnels ensuring safety for lives and properties at relevant loads including dead and live load, snow, wind, mass load and fire.
- use non-linear and time-dependent material properties and dynamic effects in analyses of structures
- design stabilizing systems for buildings and assess stability of complex structures
- design common foundation structures, including the solving of flow, stability and soil-pressure problems and the designing of walls and piles
- design a building envelope: roofs, facades, windows, including heat insulation, energy consumption, moisture, condensation, applicability, durability and safety for lives and properties
- take part in planning and erection and design of erection site and provisional structures

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PROFESSIONAL COMPETENCE OBJECTIVES (MSc)

The MSc program in Civil Engineering – Building Services

The Building Services study-line covers all technical services and installations in buildings including heating, ventilation, air-conditioning, water supply, drains, electricity, telecommunications, alarms, fire-extinguishing and fire-ventilation systems, and renewable energy systems such as solar heat and heat pumps. It also includes design of building envelopes, the total energy balance of buildings and how this affects building design, manufacturing and operation.

The graduate can:

- undertake advanced integrated design and optimization of buildings with respect to indoor climate, energy consumption, moisture conditions, durability and economy
- perform integrated performance analysis and construction of building envelopes and services for special buildings
- take part in formulation of a function-based fire strategy for a building project and assess evacuation conditions
- formulate advanced requirements for indoor climate
- design channel and pipe constructions
- incorporate technical infrastructure (water supply, sewages, district heating) into a building design
- calculate and assess mass and energy flow in buildings, envelopes and services
- make dynamic analyses of energy and indoor climate
- conduct performance assessment and product development for heating, ventilation and air-conditioning systems including integrated applications as fire ventilation
- design sprinkler systems, alarm systems and smoke-ventilation based on fire dynamics
- incorporate energy-supply systems into building design
- design active and passive solar-heating systems
- undertake basic construction of an active solar-heating system

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PROFESSIONAL COMPETENCE OBJECTIVES (MSc)

The MSc program in Civil Engineering – Soil and Water Mechanics

The Soil and Water Mechanics study-line covers the design and erection of landscape-related structures such as erection sites, excavations, foundations, retaining walls, dams, roads, railways, airports, harbors, canals, tunnels, coastal protection, offshore structures and energy plant, sewages, purifying plants, and manufacturing, production and extraction plants.

The graduate can:

- design foundation structures and solve problems concerning flow, stability, and soil pressure, and design walls and pile structures
- demonstrate advanced knowledge of concrete as a building material in practical applications
- design dams, pits, harbors, channels, fairways, bridges, tunnels, roads, sewages, cable and pipe lines
- organize erection sites, design ground strengthening, and provisional structures
- assess extreme loads from e.g. wind, waves, currents, ice, earthquake, collision, fire and terror
- use prestressed concrete structures
- plan and implement methods for repair and maintenance of buildings
- assess consequences for the surroundings of lowering a water table
- evaluate basic sewage technology
- make basic assessments of transport of sediments, wave mechanics, hydrodynamics, wave load, flow in channels and open waters, morphology and coastal protection
- manage basic logistics and cooperation with suppliers for the building industry
- manage basic contracts and construction-related law

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PROFESSIONAL COMPETENCE OBJECTIVES (MSc)

The MSc program in Civil Engineering – Urban and Construction Management

Urban and Construction Management covers the planning and management of building projects and building processes (including the interplay between client, production, suppliers, and the erection site) and town planning and urban management (ensuring the ordering and coordination of the many different functions in a city, town or built-up area so as to ensure the quality of the entire built environment).

The graduate can:

- can work with town plans, region- and landscape plans, urban management, traffic and traffic technology, planning of roads, railroads and airports, water supply, sewages, waste flow, communication, safety, and fire- and civil defense
- can optimize technical infrastructure and building projects for cost-, resource- and energy efficiency, consumer requirements and general planning
- can apply infrastructure theory, site analyses, knowledge of project development, building technology, environmental technology, traffic management, and town planning to plan a holistic enlargement or reorganization of a technical infrastructure in interaction with buildings and users
- can organize, plan and manage production processes of the building industry from idea to operation including identifying strategies and methods for technical and economical optimization and applying modern management-, organization- and production-concepts
- can play a part in innovation- and transformation-processes in complex projects and organizations, e.g. in strategic and cross-disciplinary partnerships between companies and project teams
- can apply knowledge of advanced methods for cooperation between public and private parties in processes for enlargement, regulation, and operation of technical infrastructure and buildings related to town development
- can make a basic plan for construction of roads, railroads and airports and of grids for water supply, sewages, electricity, district heating and communications
- can assess building lifecycles and their dynamic interplay with society and commerce
- can incorporate considerations on building operation into the planning of building projects including application of overall economic assessments

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