



# The Engineering Education in Arctic Technology



Arctic Technology is a 4-year civil engineering programme at the Technical University of Denmark with special focus on working in the Arctic.

An Arctic Engineer has a deep understanding of conditions in the arctic region with respect to nature and society, exemplified by the situation in Greenland.

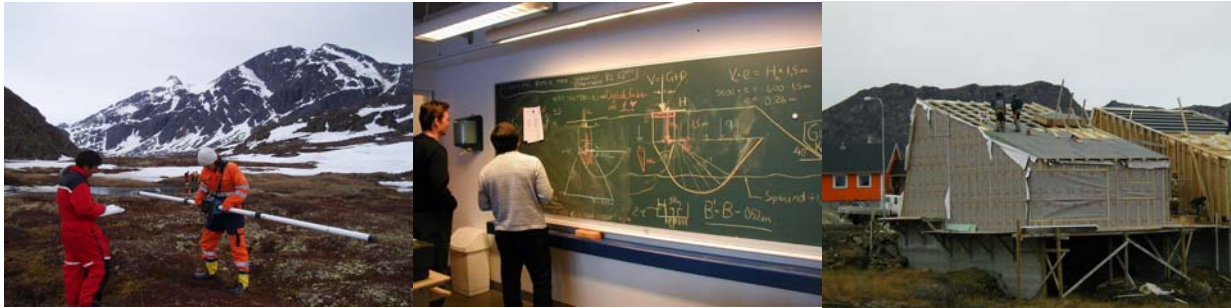
An Arctic Engineer has high competence with respect to the use of technological knowledge and engineering skills, and has a professional attitude to identify, analyse and solve complex engineering problems in relation to developing and maintaining a sustainable economic foundation, an adapted infrastructure and up-to-date living conditions in the Arctic.

## The Engineering Education in Arctic Technology

An Arctic Engineer will typically work as a specialist in the Arctic, but will also be able to work outside the arctic region using her/his general engineering competence.

**Three study lines: Building & Construction, Environment & Planning and Geology & Natural Resources.**

All Arctic Technology students are given a common foundation to create sustainable living conditions in the arctic region. e.g. an Arctic Engineer learns how to design the necessary buildings and installations and to plan an infrastructure to assure supplies, exchange of people, goods and information, and proper disposal of waste.



## Competences

### Common

An Arctic Engineer will be able to

- perform site investigations in an arctic environment
- model arctic problems and estimate whether there is a proper technological solution
- specify houses, installations and infrastructure based on user-needs, technical possibilities and society requirements in the arctic region
- conceive, design, construct, maintain, dismantle and remove innovative houses, installations and infrastructures
- estimate the impact from houses, installations and infrastructures on society and the environment
- support the economic development based on arctic resources
- take part in management, cooperation and communication in a multi-cultural environment
- show ethical responsibility in an understanding of social conditions, regulations and local traditions

### Building & Construction

A Building & Construction specialist will be able to

- design foundations for constructions on rock and permafrost and load-bearing constructions in timber, steel and concrete
- plan and construct buildings adapted to arctic conditions
- design water supply and sewerage systems in isolated communities
- construct roads with bridges and tunnels, hydroelectric plans with dams and pipelines, ports and airports

### Environment & Planning

An Environmental & Planning specialist will be able to

- perform environmental investigations and life cycle analysis
- be in charge of waste management in an arctic environment
- design sustainable buildings with focus on renewable energy
- carry out sustainable urban and infrastructure development in sparsely populated regions with isolated communities

### Geology & Resources

A Geology & Natural Resource specialist will be able to

- perform geological investigations and geophysical measurements
- plan and organise mineral and oil exploration
- take part in the construction and running of open and underground mines and offshore installations
- be in charge of logistics for isolated production facilities and assure training, safety and a good social and working environment

## Study programme structure

Arctic Technology is structured such that students spend time in Greenland (and maybe other places in the Arctic) and Denmark (and for some also Norway).

year	sem	General study structure			
1	1	Arctic courses at Arctic Technology Centre in Sisimiut			
	2				
2	3			Mandatory engineering courses at DTU	
	4				
3	5				
	6			Selected courses in Denmark or special semester at NTNU	
4	7	Individual course	Final project		
	8				

### 1<sup>st</sup> – 3<sup>rd</sup> semesters

The first three semesters are at the Arctic Technology Centre at Sanaartornermik Ilinniarfik (Building and Construction School) in Sisimiut, Greenland, and are divided into three phases:

#### 1. The arctic starting point

This phase deals with Greenland nature and how to create living conditions in the arctic environment. You learn how to collect geographical, geological, environmental and climatic data in preparation for building activities, infrastructure development and utilization of natural resources, but also how to protect the vulnerable arctic environment and create a foundation for sustainable development.

#### 2. The engineering challenge

This phase is concerned with individual constructions in the arctic region – such as a house or an installation involving hydroelectrical, offshore or mining facilities. What is the need of the users, what is the need of society, and within which frames will it be possible to fulfil these needs? And how to ensure a good indoor climate, a sound working environment and efficient production under these conditions?

#### 2. Social considerations

This phase deals with the interaction between individual constructions and society in a sparsely populated arctic region. It involves development of infrastructure dealing with travel and transport of goods, with the production of energy and consumer products, with distribution of water, electricity and heating and with removal of waste. It also considers strategic planning at both local and global levels.



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Each phase is build around one or more large interdisciplinary courses. In the 1<sup>st</sup> phase the courses are the same for all students. In the 2<sup>nd</sup> and 3<sup>rd</sup> phases most courses are still the same for all, although students choose assignments and projects in relation to their line of study.

The interdisciplinary courses are each based on a case from the local area. Teaching is given by staff from DTU and external specialists who stay in Sisimiut for some weeks to give intensive lectures and tutoring in collaboration with teachers from Sanaar-tornermik Ilinniarfik and local experts.

In Sisimiut the students carry out a considerable amount of field work, so that they experience the arctic climatic and social conditions relevant for their education.



### 4<sup>th</sup> & 5<sup>th</sup> semesters

Students take mandatory courses depending on the chosen specialisation at DTU in Copenhagen. At DTU the focus is not on the Arctic, but on general engineering competences relevant for arctic conditions.

### 6<sup>th</sup> semester

During this semester the students are in engineering practice in places similar to those where they are likely to work later: an engineering company, a consultant firm, a surveying organisation, a production facility or public administration in the Arctic.

### 7<sup>th</sup> semester

Students follow selected courses at DTU or another university. For the specialisation in *Geology & Natural Resources* students have to spend this semester at the Norwegian University of Science and Technology (NTNU) in Trondheim to learn about mining.

### 8<sup>th</sup> semester

The last semester concentrates on individual assignments for the students. The semester is completed with a final project that deals with an arctic problem.

## Masters degrees



An Arctic Engineer with *Building & Construction* specialisation can take a masters degree in Civil Engineering at DTU.

An Arctic Engineer with *Environment & Planning* specialisation can take a masters degree in Environmental Engineering at DTU.

An Arctic Engineer with *Geology & Natural Resources* specialisation can take a masters degree in Petroleum Engineering at DTU or study geology or mining.