



# Programme syllabus

Master's Programme, Naval Architecture, 120 credits

Masterprogram, marina system

*120.0 credits*

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*Valid for students admitted to the education from autumn 12 (HT - Autumn term; VT - Spring term).*

This is a translation of the Swedish, legally binding, programme syllabus.

## Programme objectives

The main objective of this program is to educate skilled engineers for industry and research institutions. The subject is multi-disciplinary with strong emphasis on systems engineering. A naval architect needs knowledge about the complete processes of design, implementation and operation of marine vessels which can be very large and complex systems, as well as deep understanding in subjects such as structural and fluid mechanics and related applications. The program further enables specialization within the different profile areas *Lightweight Structures*, *Fluid Mechanics*, *Sound & Vibration*, *Management*, and *Sustainable Development*. The education is hence relevant for students devoted to work in the maritime sector as well as for careers in other fields of engineering.

## Knowledge and understanding

A Master of Science in Naval Architecture will:

- have the knowledge and understanding of the topic enough to be employable as a Naval Architect and in other fields of engineering in Sweden and internationally,
- possess a systems perspective on engineering,
- have confidence in hers/his base of engineering fundamentals,
- be aware of the general professional conditions in the industry,
- be familiar with the needs and conditions for sustainable development.

## Skills and abilities

A Master of Science in Naval Architecture will:

- have the ability to independently and creatively formulate and critically and systematically handle and analyze complex problems and situations, using relevant modern methods and tools,
- have the ability to *Conceive*, *Design*, *Implement* and *Operate* boats, ships and complex value-added naval systems in modern team-based environments,

- have the ability to, both orally and in writing, communicate and discuss conclusions and the underlying theory and argumentation,
- have good individual and group interactions abilities, such as, teamwork, leadership, and communication skills,
- be able to follow and participate in research and development work in the field of naval architecture.

## **Ability to make judgements and adopt a standpoint**

A Master of Science in Naval Architecture will:

- have the ability to in the field of naval architecture make decisions regarding research and development work based on relevant scientific, societal and ethical aspects,
- show insight regarding the possibilities and limitations of engineering science and its role in the society,
- have ability to identify the need for further knowledge in the field and take responsibility for keeping their personal knowledge up to date.

Complete information on the degree requirements can be found at the local degree policy of KTH, see <http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/examina/1.27227>

## **Extent and content of the programme**

Naval Architecture at KTH is a two-year (120 university credits) master program on the advanced level (second cycle) starting every year in late August. The instruction language is English. The program contains a naval architecture specific core, which covers the international understanding of the theoretical contents of a master program in naval architecture. In addition to the core each student also choose one out of five different tracks – *Lightweight Structures*, *Fluid Mechanics*, *Sound & Vibration*, *Management*, and *Sustainable Development*. There are also a large set of elective courses, which enables complementation or further specialization in naval architecture theory and application and in the profile areas or generalization and broadening of the education depending on the preferences of the individual student.

## **Eligibility and selection**

### ***Basic eligibility requirements***

A completed Bachelor's degree, equivalent to a Swedish Bachelor's degree (180 university credits), from a university recognized by government or accredited by other recognized organization. A good knowledge of written and spoken English. Applicants must provide proof of their proficiency in English.

### ***Specific eligibility requirements***

A completed Bachelor's degree in vehicle engineering, mechanical engineering or similar is required.

### ***Selection process***

The selection process is based on a total evaluation of the following criteria: University, Grade Point Average (GPA), and motivation letter. Courses on relevant topics such as fluid mechanics, structure

mechanics, complex analysis, partial differential equations, and control theory are considered an additional qualification. Complete information on the eligibility requirements can be found at the local admission policy of KTH, see <http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/antagning/1.27186>

## **Implementation of the education**

### **Structure of the education**

The academic year at KTH is divided into four periods. Each period lasts approximately seven weeks with at least 33 days of study. Each period is followed by an exam period. In addition to the four regular exam periods, there are three additional re-examination periods: after Christmas, after May and immediately preceding the first study period of the academic year. The academic year has a duration of 40 weeks. Teaching activities may, if necessary, be scheduled outside the academic year. The first three quarters of the program (90 university credits) is course based, while the last half year (30 university credits) is devoted to the degree project.

### **Courses**

The programme is course-based. Lists of courses are included in [appendix 1](#).

The programme consists of a set of Core courses, a Track (there is a choice of five different tracks to follow) and optional courses. The Core (approx. 40 credits) contains the programme-mandatory courses. In addition to this, the student must select a track (approx. 40 credits) with track-mandatory courses. As a student in the programme you have a good opportunity to set your individual profile on your education.

The degree project, which corresponds to the final 30 credits, you can choose to do either in naval architecture or within the field of the chosen track area

### **Grading system**

Courses in the first and the second cycle are graded on a scale from A to F. A-E are passing grades, A is the highest grade. The grades pass (P) and fail (F) are used for courses under certain circumstances.

### **Conditions for participation in the programme**

No later than November 15 and May 15 each academic year, respectively, the students are required to make a study registration and course selection for the coming term. At least 45 university credits have to be completed during the first academic year (including the re-examination period in August) in order for the student to be promoted to the second year of the program. New students have to make a decision about their *Profile* in the very beginning of the program.

### **Recognition of previous academic studies**

Under certain circumstances, and in agreement with the program director, credits for previous studies can be received according to the local policy of KTH, see <http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/prestationer/1.27200>

### **Degree project**

Students admitted to the program are required to perform an independent study in the form of a thesis project corresponding to 30 university credits. To begin the thesis project, a student must have completed at least 60 university credits of the total course work including at least two of the three compulsory courses in the chosen profile. The purpose of the thesis project is that the student should demonstrate the ability to perform independent project work, using and developing the knowledge and skills obtained from the courses in the program. The thesis project can either be performed at a university or, more commonly, at a company in the naval architecture sector or in the sector of the chosen profile with suitable infrastructure to provide sufficient supervision and resources for the project. The student must actively search for a suitable thesis project in industry; however KTH will provide some assistance with information on suitable points of contact. Exchange students are recommended to find a thesis project in their country of permanent residence or in the country where they intend to start their professional careers. More information on the KTH policy on the degree project can be found at <http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/examensarbete/1.27212>

## **Degree**

Students who fulfill all the requirements will be awarded a Degree of Master of Science (two years). Students must apply for the degree and also show proof of their basic degree (Bachelor's or similar). Complete information on the degree requirements can be found in the local degree policy of KTH, see <http://intra.kth.se/regelverk/utbildning-forskning/grundutbildning/examina/1.27227>

[Appendix 1 - Course list](#)

[Appendix 2 - Programme syllabus descriptions](#)



# Appendix 1: Course list

Programme syllabus for studies starting in autumn 2012, Master's Programme, Naval Architecture, 120 credits (TMRSM)

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## General courses

### Year 1

#### Mandatory courses (42.5 Credits)

Code	Name	Credits	Edu. level
<a href="#">AK2036</a>	<a href="#">Theory and Methodology of Science with Applications (Natural and Technological Science)</a>	7.5 hp	Second cycle
<a href="#">SD2411</a>	<a href="#">Lightweight Structures and FEM</a>	8.0 hp	Second cycle
<a href="#">SD2703</a>	<a href="#">Marine Dynamics</a>	8.0 hp	Second cycle
<a href="#">SD2707</a>	<a href="#">Marine Innovation</a>	5.0 hp	Second cycle
<a href="#">SD2708</a>	<a href="#">Hull Structural Design</a>	6.0 hp	Second cycle
	<a href="#">Initial Ship Design</a>		
<a href="#">SD2710</a>	<i>For students who has not done Degree project, first level, in Naval Architecture</i>	8.0 hp	Second cycle

#### Optional courses

Code	Name	Credits	Edu. level
<a href="#">ME2034</a>	<a href="#">Management of New Technology and Industrial Creativity</a>	6.0 hp	Second cycle
<a href="#">ME2800</a>	<a href="#">Ideation - Creating a Business Idea</a>	7.5 hp	Second cycle
<a href="#">MJ2680</a>	<a href="#">Environmental Systems Analysis</a>	6.0 hp	Second cycle
<a href="#">MJ2693</a>	<a href="#">Sustainable Development in Theory and Practice</a>	6.0 hp	Second cycle
<a href="#">SD2140</a>	<a href="#">Vibro Acoustics</a>	8.0 hp	Second cycle
<a href="#">SD2155</a>	<a href="#">Flow Acoustics</a>	6.0 hp	Second cycle
<a href="#">SE2123</a>	<a href="#">Testing Techniques in Solid Mechanics</a>	6.0 hp	Second cycle
<a href="#">SG2211</a>	<a href="#">Vehicle Aerodynamics</a>	6.0 hp	Second cycle

**Recommended courses**

Code	Name	Credits	Edu. level
<a href="#">SD2702</a>	<a href="#">Naval Design</a> <i>10 cr are studied during the second term and 10 cr during the third term.</i>	20.0 hp	Second cycle
<a href="#">SD2706</a>	<a href="#">Sailing for Performance</a>	6.0 hp	Second cycle

**Supplementary information**

Compulsory courses + tracks-courses 75 cr.

AK2036 is studied during the first or second year.

**Year 2****Mandatory courses (7.5 Credits)**

Code	Name	Credits	Edu. level
<a href="#">AK2036</a>	<a href="#">Theory and Methodology of Science with Applications (Natural and Technological Science)</a>	7.5 hp	Second cycle

**Optional courses**

Code	Name	Credits	Edu. level
<a href="#">ME2034</a>	<a href="#">Management of New Technology and Industrial Creativity</a>	6.0 hp	Second cycle
<a href="#">ME2800</a>	<a href="#">Ideation - Creating a Business Idea</a>	7.5 hp	Second cycle
<a href="#">MJ2682</a>	<a href="#">Applied Environmental System Analysis</a>	6.0 hp	Second cycle

**Recommended courses**

Code	Name	Credits	Edu. level
<a href="#">FSD3705</a>	<a href="#">High-speed Craft Structural Design</a>	6.0 hp	Third cycle
<a href="#">SD2702</a>	<a href="#">Naval Design</a> <i>10 cr are studied during the second term and 10 cr during the third term.</i>	20.0 hp	Second cycle
<a href="#">SD2706</a>	<a href="#">Sailing for Performance</a>	6.0 hp	Second cycle

**Supplementary information**

Compulsory courses + tracks-courses + conditionally elective courses 75 cr.

**Track, Lightweight Structures (MRSA)**

## Year 1

### Mandatory courses (18.0 Credits)

Code	Name	Credits	Edu. level
<a href="#">SD2413</a>	<a href="#">Fibre Composites - Analysis and Design</a>	6.0 hp	Second cycle
<a href="#">SD2414</a>	<a href="#">Fibre Composites - Materials and Manufacturing</a>	6.0 hp	Second cycle
<a href="#">SD2416</a>	<a href="#">Structural Optimisation and Sandwich Design</a>	6.0 hp	Second cycle

## Year 2

### Mandatory courses (6.0 Credits)

Code	Name	Credits	Edu. level
<a href="#">SD2416</a>	<a href="#">Structural Optimisation and Sandwich Design</a>	6.0 hp	Second cycle

## Track, Fluid Mechanics (MRSB)

### Year 1

#### Mandatory courses (20.0 Credits)

Code	Name	Credits	Edu. level
<a href="#">SG2212</a>	<a href="#">Computational Fluid Dynamics</a>	7.5 hp	Second cycle
<a href="#">SG2214</a>	<a href="#">Fluid Mechanics</a>	7.5 hp	Second cycle
<a href="#">SG2224</a>	<a href="#">Applied Computational Fluid Dynamics</a>	5.0 hp	Second cycle

## Track, Sound and Vibrations (MRSC)

### Year 1

#### Mandatory courses (24.0 Credits)

Code	Name	Credits	Edu. level
<a href="#">SD2125</a>	<a href="#">Signals and Mechanical Systems</a>	6.0 hp	Second cycle
<a href="#">SD2150</a>	<a href="#">Experimental Structure Dynamics, Project Course</a>	9.0 hp	Second cycle
<a href="#">SD2175</a>	<a href="#">Numerical Methods for Acoustics and Vibration</a>	9.0 hp	Second cycle

### Year 2

#### Mandatory courses (6.0 Credits)

Code	Name	Credits	Edu. level
<a href="#">SD2125</a>	<a href="#">Signals and Mechanical Systems</a>	6.0 hp	Second cycle

# Track, Management (MRSD)

## Year 1

### Mandatory courses (13.5 Credits)

Code	Name	Credits	Edu. level
<a href="#">EH2010</a>	<a href="#">Management of Technology</a>	7.5 hp	Second cycle
<a href="#">ME1003</a>	<a href="#">Industrial Management, Basic Course</a>	6.0 hp	First cycle

### Conditionally elective courses

Code	Name	Credits	Edu. level
<a href="#">ME2053</a>	<a href="#">Logistics &amp; Supply Chain Management</a> *	6.0 hp	Second cycle
<a href="#">ME2054</a>	<a href="#">Purchasing &amp; Supply Chain Management</a> *	6.0 hp	Second cycle

### Supplementary information

\*One of ME2053 and ME2054 has to be studied

## Year 2

### Mandatory courses (13.5 Credits)

Code	Name	Credits	Edu. level
<a href="#">EH2010</a>	<a href="#">Management of Technology</a>	7.5 hp	Second cycle
<a href="#">ME1003</a>	<a href="#">Industrial Management, Basic Course</a>	6.0 hp	First cycle

# Track, Sustainable Development (MRSE)

## Year 1

### Mandatory courses (18.0 Credits)

Code	Name	Credits	Edu. level
<a href="#">MJ2663</a>	<a href="#">Environmental Management</a>	6.0 hp	Second cycle
<a href="#">MJ2664</a>	<a href="#">Environmental Management II, Advanced Course</a>	6.0 hp	Second cycle
<a href="#">MJ2691</a>	<a href="#">Technology and Sustainable Development</a>	6.0 hp	Second cycle

## Year 2

### Mandatory courses (6.0 Credits)



<b>Code</b>	<b>Name</b>	<b>Credits</b>	<b>Edu. level</b>
<a href="#">MJ2691</a>	<a href="#">Technology and Sustainable Development</a>	6.0 hp	Second cycle



## Appendix 2: Specialisations

Programme syllabus for studies starting in autumn 2012, Master's Programme, Naval Architecture, 120 credits (TMRSM)

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### **Track, Lightweight Structures (MRSA)**

Marine vessels are in general lightweight structures built as stiffened shells in hierarchical arrangement. The dominating material in shipbuilding is still conventional steel but it is likely that the use of composite materials will increase, for example to decrease weight and thereby increase the ships energy efficiency. Internationally leading research is conducted at KTH Lightweight Structures which has supported the Swedish industry to apply fibre reinforced composite and sandwich material concepts in large vessels. A significant example is the 70 metre all carbon fibre Visby class corvette. Students studying naval architecture at KTH have the opportunity to combine fundamental principles of naval architecture with knowledge about modern materials and related design principles and manufacturing methods.

Contact person for the profile Lightweight Structures is Dan Zenkert, danz@kth.se, 08-7906435.

### **Track, Fluid Mechanics (MRSB)**

Since ships and other naval systems operate in water a good understanding of fluid dynamics is crucial for any naval architect when studying e.g. seakeeping, resistance, propulsion and appendages. This profile is intended to give fundamental understanding as well as working skills in incompressible fluid mechanics which is the basis for the flow around naval systems. In the courses, the governing set of partial differential equations, the Navier-Stokes equations, are derived, dissected, simplified and solved. The characteristics of boundary layers are investigated. The profile also includes modules concerning modern computational tools (CFD) for solving for the flow patterns in more complex situations. The fundamental mathematical principles of CFD is covered as well as hands-on projects where modelling and solving of real problems are done.

Contact person for the profile Fluid Mechanics is Erik Lindborg, erikl@mech.kth.se, 08-7906801.

### **Track, Sound and Vibrations (MRSC)**

Issues related to sound and vibrations are numerous in ship design. For example in passenger ships, both acoustic and vibration criteria are increasingly important as demands for comfort increases. There are many sources of vibration in ships. The major sources are the engine and fluctuating pressure pulses and cavitation from the propeller which hits the hull. Many other systems and appliances also cause sound and vibration such as ventilation installations, external waves hitting the ship and various pumps. The profile in Sound & Vibration treats the topic from many aspects ranging from analytical understanding of the phenomena, numerical methods of modelling and solving complex dynamic problems as well as

experimental investigations by modal analysis. An engineer with this profile will be able to work with both details regarding generation as well as propagation and reduction of sound and vibration in complex structures.

Contact person for the profile Sound & Vibration is Hans Bodén, hansbod@kth.se, 08-7904962.

## **Track, Management (MRSD)**

As an Engineer in the Naval Architecture field, your work will not only include purely technical activities. It is also important to understand the way businesses are made and the way the industry changes. Managerial issues will almost always be intertwined with the technical tasks that you have to face. In the profile Management, you will learn how to deal with the interface between marine technology, shipping, management, and industry development. This profile focuses on the problems in industries of this kind, how the companies produce different types of products and services that are important in the field, and how this type of companies, often project-based and cooperating with suppliers and customers, can be managed. The profile aims at providing in-depth knowledge of the financial, organizational and management aspects of a company in the maritime field. Emphasis is on the ability to manage and control projects in these contexts, the connection between business strategy and the management, and the risks and opportunities associated with globalization with respect to the industry. It gives a good foundation for an employment as a manager for companies and projects within the industry as well as a general knowledge about these roles in other types of industries. It also prepares for starting and managing a smaller company in the field, e.g. a consulting firm in the Naval Architecture field.

Contact person for the profile Management is Håkan Kullvén, hakan.kullven@indek.kth.se, 08-7906052.

## **Track, Sustainable Development (MRSE)**

Shipping is, and will continue to be, one very important driving force in the development of most parts of the world and will therefore also be a part of development of new technologies to reach a sustainable global usage of the limited resources of the earth. The profile in sustainable development is based on the concept of Industrial Ecology with focus on the understanding of interactions between technical, economical, social and ecological systems and processes, a very important aspect for shipping, on global, national and company level. The profile will lead to understanding of the concepts of sustainable development from an environmental, social and economical viewpoint as well as the ecological prerequisites. The profile studies will include strategies for sustainable development and the role of technology, ecosystems' long-term sustainability, material and energy flows within industry and society, tools and methods to work with sustainable development in industry and society with an emphasis on systems analysis methods.

Contact person for the profile Sustainable Development is Nils Brandt, nilsb@kth.se, 08-7908059.