



# 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 20 (HT - Autumn term; VT - Spring term).*

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

## Programme objectives

The overall objective with the Master of Science Program in Naval Architecture is to educate skillful, creative, independent and conscious engineers, who through their knowledge and skills, working methods and approach, can contribute to a sustainable development of the society. Naval Architecture is a multidisciplinary subject with a strong emphasis on systems engineering and engineering design. As an engineer graduated with a Master of Science in Naval Architecture from KTH you will possess knowledge and experience of the complete processes of conception, design, modeling, implementation and operation of boats, ships, marine installations and other complex systems, along with deep theoretical knowledge in related topics such as lightweight structures, fluid mechanics and management. The program is characterized by a progressive learning environment with the student in focus and has a reputation of educating creative and skillful engineers that are attractive in the maritime sector as well as in other branches of engineering both in Sweden and internationally.

## Knowledge and understanding

To qualify for the degree of Master of Science in Naval Architecture the student shall be able to:

- demonstrate broad knowledge and understanding of the scientific basis and proven experience of naval architecture and deeper insight into current research and development work;
- give an account of the international shipping markets and the corresponding stakeholders, goods flow paths, and ship types;
- demonstrate broad general knowledge and understanding in mathematics and mechanics, as well as substantially deeper methodological knowledge and understanding in marine technology and the chosen area of specialization (lightweight structures, fluid mechanics or management)

## Skills and abilities

- demonstrate ability to, from a holistic perspective, critically, independently and creatively identify, formulate and deal with complex issues and situations in naval architecture, mechanical engineering and engineering design;
- demonstrate ability to create, analyze and critically evaluate different technical solutions for ships and other complex technical systems;
- demonstrate ability to plan and carry out advanced engineering tasks within given frames using appropriate methods and to evaluate this work;
- demonstrate the skills required to participate in research and development work or to work independently in other advanced contexts so as to contribute to the development of knowledge;
- demonstrate ability to critically and systematically integrate knowledge;
- demonstrate ability to model, simulate, predict and evaluate the technical characteristics of ships, their components, and related phenomena, even on the basis of limited information;
- demonstrate ability to design ships and other technical systems and related processes taking into account people's situations and needs, and the society's objectives for economically, socially and ecologically sustainable development;
- demonstrate ability to engage and contribute in teamwork and cooperation in groups of varying composition;
- demonstrate ability to clearly present and discuss engineering conclusions and the knowledge and arguments behind them, in dialogue with different groups, orally and in writing, in national and international contexts;

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

- demonstrate ability to make sound judgements in the design and assessment of ships and other technical systems, taking into account relevant scientific, social, ethical, economic and environmental aspects;
- demonstrate awareness of and insight in the potential and limitations of technology and science, its role in society and people's responsibility for how it is used;
- demonstrate ability to identify their need for further knowledge and to take responsibility for continuously upgrading personal knowledge and capabilities.

Complete information on the degree requirements can be found at the local degree policy of KTH, [www.kth.se](http://www.kth.se).

## **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 programme consists of a core and three optional tracks. In the core you develop your general knowledge and skills in systems engineering and ship design and a theoretical foundation in ship hydrostatics and stability, resistance and propulsion, wave modeling, seakeeping, maneuvering, and ship structures.

By choosing one of the tracks you have the opportunity to develop deeper understanding and skills in lightweight structures, fluid mechanics and management. There is also a set of elective courses where you have the opportunity to broaden your education or specialize in high-speed craft, underwater technology or in other areas suitable for your interests and career goals. One for this program specific course is Naval Design where the students as members of a development team during a whole year conceive, design, build and operate a boat or some other technical system for marine applications. Some more details about the core and the tracks are given in Appendix 1.

# Eligibility and selection

## General eligibility requirements

- A completed Bachelor's degree, corresponding to a Swedish Bachelor's degree (180 ECTS), or equivalent academic qualifications from an internationally recognised university. Students in their final year of undergraduate education may also apply to KTH and if qualified, receive a conditional acceptance.
- English language proficiency equivalent to (the Swedish upper secondary school) English course B /6. There are different ways to fulfill the English language requirements, see: [www.kth.se](http://www.kth.se)

## Specific eligibility requirements

A Bachelor's degree, or equivalent, corresponding to 180 ECTS credits, with courses in

*Mathematics and Programming*: must include (i) differential and integral calculus in several variables, (ii) linear algebra, (iii) numerical analysis, (iv) ordinary and partial differential equations and integral transforms, (v) mathematical statistics, (vi) and basics of programming in a higher programming language equivalent to at least 25 ECTS credits in total.

*Applied mechanics*: must include (i) rigid body mechanics, and (ii) solid mechanics, equivalent to at least 12 ECTS credits in total.

## Selection process

The selection process is based on the following selection criteria: University ranking and study performance from previous University studies. The evaluation scale is 1-75. The applicant will get a lower evaluation score if the mandatory program-specific summary sheet is missing from the application documents, which also applies to Swedish applicants.

# 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 four additional re-examination periods: before Christmas, in April 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](#).

## 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.

The grades pass (P) and fail (F) are used for thesis work.

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

For students starting their education from the autumn semester 2018, previous promotion requirements have been replaced with special admission requirements to each course. Admission requirements are specified in the course syllabus.

### **Course application**

As a student at KTH programmes you have to apply for semester courses. The application is done via [www.universityadmissions.se](http://www.universityadmissions.se)

### **Course registration**

Students admitted to an educational programme at KTH must register for the courses they intend to study. Course registration is required for the examination and means that the student is active.

## **Recognition of previous academic studies**

Under certain circumstances, and in agreement with the programme director, credits for previous studies can be received according to the local policy of KTH.

## **Studies abroad**

Students have the opportunity to spend one semester at one of KTH's partner universities abroad.

For more information and recommendation on the appropriate semester for exchange studies refer to the International coordinator.

## **Degree project**

A 30-credit Master's degree project is carried out at the end of the educational programme and may begin when special admission requirements for the course are fulfilled.

The purpose of the project is to let the student study a problem in more depth than is possible in the courses. The project may be carried out in an academic or industrial environment in Sweden or abroad.

The choice of project must be approved by the programme director.

The Degree project is graded with P/F.

## **Degree**

In order to earn a Degree of Master of Science, passing grades in all courses which are included in the student's study plan are required. The study plan must comprise 120 higher education credits which include a degree project consisting of 30 higher education credits, in the second cycle.

KTH's local degree ordinance can be found at KTH's website, [www.kth.se](http://www.kth.se).

### **Application for degree certificate**

When the studies at KTH are completed a degree certificate can be applied for. Application is done by the "personal menu" at [www.kth.se](http://www.kth.se)

[Appendix 1 - Course list](#)

[Appendix 2 - Programme syllabus descriptions](#)



# Appendix 1: Course list

Programme syllabus for studies starting in autumn 2020, Master's Programme, Naval Architecture, 120 credits (TMRSM)

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## General courses

### Year 1

#### Conditionally elective courses

Code	Name	Credits	Edu. level
<a href="#">ME1003</a>	<a href="#">Industrial Management, Basic Course</a>	6.0 hp	First cycle
<a href="#">MF2047</a>	<a href="#">Internal Combustion Engines 1</a>	6.0 hp	Second cycle
<a href="#">MG1010</a>	<a href="#">Introductory Welding Technology, General Course</a>	6.0 hp	First cycle
<a href="#">SD2411</a>	<a href="#">Lightweight Structures and FEM</a>	8.0 hp	Second cycle
<a href="#">SD2420</a>	<a href="#">Advanced design of welded structures</a>	6.0 hp	Second cycle
<a href="#">SD2705</a>	<a href="#">High-Speed Craft</a>	6.0 hp	Second cycle
<a href="#">SG2218</a>	<a href="#">Turbulence</a>	7.5 hp	Second cycle

#### Supplementary information

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

Students who are planning to study abroad the second year has to take AK2036 the first year. All other students should take this course in the autumn semester the second year.

Also the course MO1002 Oceanography, Introductory course, 7,5 cr, given by Stockholm University can be taken as elective by Swedish citizens.

### Year 2

#### Conditionally elective courses

Code	Name	Credits	Edu. level
<a href="#">ME1003</a>	<a href="#">Industrial Management, Basic Course</a>	6.0 hp	First cycle
<a href="#">MF2047</a>	<a href="#">Internal Combustion Engines 1</a>	6.0 hp	Second cycle
<a href="#">SD2709</a>	<a href="#">Underwater Technology</a>	7.5 hp	Second cycle
<a href="#">SG2218</a>	<a href="#">Turbulence</a>	7.5 hp	Second cycle

## Supplementary information

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

Students who are planning to study abroad the second year has to take AK2036 the first year. All other students should take this course in the autumn semester the second year.

Also the course MO1002 Oceanography, Introductory course, 7,5 cr, given by Stockholm University can be taken as elective by Swedish citizens.

## Track, Lightweight Structures (MRSA)

### Year 1

#### Mandatory courses (36.0 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="#">SD2721</a>	<a href="#">Ship Design</a>	9.0 hp	Second cycle
<a href="#">SD2722</a>	<a href="#">Marine Structures</a>	7.5 hp	Second cycle
<a href="#">SD2723</a>	<a href="#">Marine Hydromechanics</a>	7.5 hp	Second cycle

#### Conditionally elective 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="#">SD2709</a>	<a href="#">Underwater Technology</a>	7.5 hp	Second cycle

### Year 2

#### Mandatory courses (13.5 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="#">SD2416</a>	<a href="#">Structural Optimisation and Sandwich Design</a>	6.0 hp	Second cycle

#### Conditionally elective courses

Code	Name	Credits	Edu. level
<a href="#">SD2702</a>	<a href="#">Naval Design</a>	20.0 hp	Second cycle

[SD2705 High-Speed Craft](#) 6.0 hp Second cycle  
[SD2709 Underwater Technology](#) 7.5 hp Second cycle

## Track, Fluid Mechanics (MRSB)

### Year 1

#### Mandatory courses (44.0 Credits)

Code	Name	Credits	Edu. level
<a href="#">SD2721</a>	<a href="#">Ship Design</a>	9.0 hp	Second cycle
<a href="#">SD2722</a>	<a href="#">Marine Structures</a>	7.5 hp	Second cycle
<a href="#">SD2723</a>	<a href="#">Marine Hydromechanics</a>	7.5 hp	Second cycle
<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

#### Conditionally elective 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="#">SD2709</a>	<a href="#">Underwater Technology</a>	7.5 hp	Second cycle

### 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

#### Conditionally elective courses

Code	Name	Credits	Edu. level
<a href="#">SD2702</a>	<a href="#">Naval Design</a>	20.0 hp	Second cycle
<a href="#">SD2705</a>	<a href="#">High-Speed Craft</a>	6.0 hp	Second cycle
<a href="#">SD2709</a>	<a href="#">Underwater Technology</a>	7.5 hp	Second cycle

## Track, Management (MRSB)

### Year 1



## Mandatory courses (39.0 Credits)

Code	Name	Credits	Edu. level
<a href="#">AL2160</a>	<a href="#">Environmental Management</a>	7.5 hp	Second cycle
<a href="#">EH2720</a>	<a href="#">Management of Projects</a>	7.5 hp	Second cycle
<a href="#">SD2721</a>	<a href="#">Ship Design</a>	9.0 hp	Second cycle
<a href="#">SD2722</a>	<a href="#">Marine Structures</a>	7.5 hp	Second cycle
<a href="#">SD2723</a>	<a href="#">Marine Hydromechanics</a>	7.5 hp	Second cycle

## Conditionally elective 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="#">SD2709</a>	<a href="#">Underwater Technology</a>	7.5 hp	Second cycle

## Year 2

### Mandatory courses (15.0 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="#">AL2181</a>	<a href="#">Environmental System Analysis and Decision making</a>	7.5 hp	Second cycle

## Conditionally elective courses

Code	Name	Credits	Edu. level
<a href="#">SD2705</a>	<a href="#">High-Speed Craft</a>	6.0 hp	Second cycle
<a href="#">SD2709</a>	<a href="#">Underwater Technology</a>	7.5 hp	Second cycle



## Appendix 2: Specialisations

Programme syllabus for studies starting in autumn 2020, Master's Programme, Naval Architecture, 120 credits (TMRSM)

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

In this track you have the opportunity to combine fundamental principles of naval architecture with knowledge about modern composite materials and sandwich structures and related design principles and manufacturing methods. Sweden has been a fore runner in the application of such material concepts in large ship structures and KTH has internationally leading research in this area. What you learn in this track is useful for working with ship structures as well as with aerospace, automotive and other kinds of lightweight structures.

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

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

This track develops your fundamental understanding and working skills in incompressible fluid mechanics, which is the basis for the flow around ships, boats and marine installations. The governing set of partial differential equations, the Navier-Stokes equations, are derived, dissected, simplified and solved. The fundamental principles of computational fluid dynamics (CFD) and modern computational tools are introduced. In hands-on projects you will work with modelling and solving real fluid mechanics problems. The knowledge you gain in this track is applicable in ship hydromechanics as well as in general fluid mechanics problems.

Contact person for the profile Fluid Mechanics track is Luca Brandt, luca@mech.kth.se, 08-7906870.

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

This track gives you the opportunity to complement your technical skills with knowledge of financial, organizational and managerial aspects, and develop your understanding of the concepts of sustainable development from environmental, social and economic viewpoints. Emphasis is on the ability to manage and control projects, strategies for sustainable development, and management tools and systems analysis methods. The track gives a good foundation for employment as a manager for companies and projects within the maritime sector as well as in other sectors.

Contact person for the Management track is Monika Olsson, monika@kth.se, 08-7906150.