HSB
Hochschule Bremen
City University of Applied Sciences


# Module Booklet

## NAVAL ARCHITECTURE AND OCEAN ENGINEERING, M.ENG.

| *Version (Datum)* | *Document* | *Author (Name)* | *Checked (Name, Date)* | *Approved (Name, Date)* |
|---|---|---|---|---|
| *1.3 e 17.12.2021* | *Module Booklet Naval Architecture and Ocean Engineering, M.Eng.* | *Kraus* | | |

# CONTENTS

## Module Structure

### Curriculum

| Semester | ECTS | Module 1 | Module 2 | Module 3 | Module 4 | Module 5 |
|---|---|---|---|---|---|---|
| **S1** | **30** | Applied Mathematics | Scientific Computing in Naval Architecture | Computer-Aided Techniques in Ship Design | Ship Safety | Advanced Materials Mechanics |
| **S2** | **30** | Design Project | | Advanced Ocean Engineering | Compulsory Elective Module | Special Ship Structural Analysis |
| **S3** | **30** | Master Thesis | | | | |

# 1ST SEMESTER

## M 1.1 Applied Mathematics

| Module Code | 1.1 |
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| Semester | 1st Semester |
| Module responsibility | Udo Meyer |
| Learning outcomes | After completing the module, students are able to:<br>• apply vector analysis, in particular vector-valued functions, differential operators and integral theorems<br>• numerically calculate partial differential equations |
| Course contents | Vector analysis<br>Partial differential equations<br>Numerics |
| Type of module | Compulsory module |
| Teaching and learning methods | Seminar |
| Examination format and duration(Requirement for the award of credit points) | Written examination (90 min.) or Portfolio |
| Prerequisites for participation | None |
| Recognition | All Master programs in engineering |
| Student workload | 60 + 120 |
| Contact hours | 60 |
| Independent study | 120 |
| ECTS credits | 6 |
| Duration and frequency of offering | Once each academic year/ 15 meetings |
| Language of instruction | English |

| Literature | To be distributed at beginning of semester. |
|---|---|

*Courses*

| *Lecturer* | *Course title* | *SCH* |
|---|---|---|

| **Lehrveranstaltungen** | | |
|---|---|---|
| **Dozent(in)** | **Titel der Lehrveranstaltung** | **SWS** |
| Meyer | Applied Mathematics | 4 |

## M 1.2 Scientific Computing in Naval Architecture

| Module Code | 1.2 |
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|---|---|
| Semester | 1st Semester |
| Module responsibility | Prof. Dr.-Ing. Andreas Kraus |
| Learning outcomes | After completing the module, students are able to:<br>• analyse, program and apply mathematical algorithms<br>• explain the basic principles of geometric data processing<br>• select, adapt and develop display techniques according to requirements<br>• assess the limits and possibilities of commercial CAD software |
| Course contents | The module deals with the following:<br>• Programming of algorithms: Understanding of numerical methods on the computer with application examples from shipbuilding and marine technology<br>• Geometric data processing: Fundamentals and application examples of parameter curves (cubic spline, Hermite curve and spline, Bezier curve, B-spline, NURBS) and surfaces (Coons patches, Bezier surfaces, B-spline surfaces) |
| Type of module | Compulsory module |
| Teaching and learning methods | Seminar |
| Examination format and duration(Requirement for the award of credit points) | Written examination 90 min. oder Portfolio |
| Prerequisites for participation | Basic knowledge of differential and integral calculus is recommended |
| Recognition | - |
| Student workload | 60 + 120 |
| Contact hours | 60 |
| Independent study | 120 |

| | |
|---|---|
| ECTS credits | 6 |
| Duration and frequency of offering | Once each academic year/ 15 meetings |
| Language of instruction | English |
| Literature | • Script<br>• Hoschek, Josef ; Lasser, Dieter: Grundlagen der geometrischen Datenverarbeitung. Teubner, 1992.<br>• Knorrenschild, Michael: Numerische Mathematik - Eine beispielorientierte Einführung. Carl Hanser Verlag, 2013.<br>• Zurmühl, Rudolf: Praktische Mathematik für Ingenieure und Physiker. Springer, 1965. |

*Courses*

*Lecturer* *Course title* *SCH*

| **Lehrveranstaltungen** | | |
|---|---|---|
| **Dozent(in)** | **Titel der Lehrveranstaltung** | **SWS** |
| Kraus | Programming of Algorithms | 2 |
| Kraus | Geometric Data Processing | 2 |

## M 1.3 Computer-Aided Techniques for Ship Design

| Module Code | 1.3 |
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|---|---|
| Semester | 1st Semester |
| Module responsibility | Prof. Dr. Gudenschwager |
| Learning outcomes des Moduls | After completing the module, students are able to:<br>• classify computer hardware<br>• evaluate interfaces of CAD/CAE systems and run them by adapted procedures<br>• evaluate the basics of CAD/CAE systems<br>• calculate and evaluate ship wave pattern by means of potential theoretical methods<br>• apply RANSE solvers and assess the results of the calculations |
| Course contents | The sub-module "Interfaces of CAD/CAE Systems", deals with the interrelationships of operational modes of CAD/CAE systems and their data transfer methods. This includes the following topics:<br>• Structure of computers and operating systems<br>• Basic principles of programming languages<br>• Data management in CAD/CAE systems<br>• Data exchange and interfacing methods<br>The sub-module "Numerical Flow Analysis CFD" deepens students' knowledge of the basics of numerical fluid mechanics and applies different CFD methods. This includes the following topics:<br>• Conservation equations<br>• Potential theory, panel methods<br>• RANSE and solution methods<br>• Turbulence models<br>• Application examples from shipbuilding and ocean engineering |
| Type of module | Compulsory module |
| Teaching and learning methods | Seminar |

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|---|---|
| Examination format and duration(Requirement for the award of credit points) | Interfaces of CAD/CAE systems:<br>Seminar paper<br>Numerical Flow Analysis CFD:<br>Written examination 90 min. or Portfolio |
| Prerequisites for participation | None |
| Recognition | - |
| Student workload | 60 + 120 |
| Contact hours | 60 |
| Independent study | 120 |
| ECTS credits | 6 |
| Duration and frequency of offering | Once each academic year/ 15 meetings |
| Language of instruction | English |
| Literature | Interfaces of CAD/CAE systems:<br>• Current literature lists are distributed at the beginning of the semester.<br>Numerical Flow Analysis CFD:<br>• Ferziger, Joel H. ; Perić, Milovan: Numerische Strömungsmechanik. Springer, 2008.<br>• Katz, Joseph ; Plotkin, Allen: Low-speed aerodynamics. Cambridgee Univ. Press, 2001<br>• Shipflow Manuals, Flowtech, Göteborg. |

*Courses*

*Lecturer* *Course title* *SCH*

| **Lehrveranstaltungen** | | |
|---|---|---|
| **Dozent(in)** | **Titel der Lehrveranstaltung** | **SWS** |
| Gudenschwager | Interfaces of CAD/CAE Systems | 2 |
| Kraus | Numerical Flow Analysis CFD | 2 |

## M 1.4 Ship Safety

| Module Code | 1.4 |
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|---|---|
| Semester | 1st Semester |
| Module responsibility | Prof. Dipl.-Ing. Gregor Schellenberger |
| Learning outcomes | After completing the module, students are able to:<br>• identify and select the relevant international rules for stability analyses of different types of ships<br>• prepare and perform complex stability calculations for different types of ships in accordance with applicable regulations<br>• analyse the results of stability calculations and optimise them with regard to increasing the safety level / probability of survival<br>• estimate the eigenperiods of the rigid body movements of the ship<br>• calculate the ship's motion behaviour in a seaway with the aid of suitable programs and assess the results<br>• predict possible hazards when sailing in rough seas and to work out constructive or operational consequences |

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|---|---|
| Course contents | The following course contents are taught in the sub-module "Stability, Survivability ":<br>• Analysis and calculation of stability scenarios regarding the safety of intact and damaged ships as well as floating offshore structures<br>• Deterministic damage stability calculations: theoretical principles, international regulations (MARPOL, IBC, IGC, etc.) , practical implementation (using the example of a tanker) and documentation<br>• Probabilistic damage stability analysis: theoretical principles, international regulation (SOLAS), practical implementation (using the example of a passenger ship), optimisation of subdivision and documentation<br>• Laboratory: tests on damage stability and comparison with theoretical calculations<br><br>The following course contents are taught in the sub-module "Sea Keeping":<br>• Equations of motion<br>• Strip methods, 3D methods<br>• Creation/evaluation of polar diagrams<br>• Determination of probabilities of failure<br>• Parametric rolling<br>• Laboratory: sea trials, comparison with calculations |
| Type of module | Compulsory module |
| Teaching and learning methods | Seminar, Laboratory |
| Examination format and duration(Requirement for the award of credit points) | Sub-module “Stability, Survivability“: Seminar paper or Portfolio<br>Sub-module “Sea Keeping“:<br>Written examination 90 min or Portfolio |
| Prerequisites for participation | Basic knowledge on intact and damage stability as well as on calculation methods is recommended |
| Recognition | - |
| Student workload | 60 + 120 |
| Contact hours | 60 |
| Independent study | 120 |
| ECTS credits | 6 |

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|---|---|
| Duration and frequency of offering | Once each academic year/ 15 meetings |
| Language of instruction | English |
| Literature | Sub-module “Stability, Survivability“:<br>• Script (contains literature list)<br>• Diverse regulations (SOLAS, IGC, MODU-Code) with explanatory texts<br>Sub-module “Sea Keeping”:<br>• Faltinsen, O. M.: Sea Loads on Ships and Offshore Structures. Cambridge Univ. Press, 1998.<br>• Journée, J. M. J.: Theoretical Manual of SEAWAY. Delft University of Technology, Report 1216a, 2001.<br>• OCTOPUS Seaway User Manuals, AMARCON BV, Dalfsen.<br>• Price, W. G.; Bishop, R. E. D.: Probabilistic Theory of Ship Dynamics. Chapman and Hall, 1974. |

*Courses*

| *Lecturer* | *Course title* | *SCH* |
|---|---|---|

| **Lehrveranstaltungen** | | |
|---|---|---|
| **Dozent(in)** | **Titel der Lehrveranstaltung** | **SWS** |
| Schellenber-ger | Stability, Survivability | 2 |
| Kraus | Sea Keeping | 2 |

## M 1.5 Advanced Materials Mechanics

| Module Code | 1.5 |
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|---|---|
| Semester | 1st Semester |
| Module responsibility | Prof. Dipl.-Ing. Olaf Springer |
| Learning outcomes | After completing the module, students are able to:<br>• apply the principles and special fields of elasticity and plasticity theory to the linear and non-linear behaviour of steel, aluminium and fibre composite materials.<br>• apply scientific methods in structural analysis in the linear and plastic range in shipbuilding and marine engineering to solve complex problems.<br>• assess the fundamentals of load-bearing methods, dynamic analyses of structures including fracture mechanics and failure criteria and to develop solutions for technical applications.<br>• apply and assess measurement technology in experimental structural analysis in shipbuilding and marine technology. |
| Course contents | • Kinematics and statics of the continuum<br>• Equations of Matter<br>• Elastic and plastic behaviour of isotropic and anisotropic materials,<br>• Principles of variation<br>• Elastic and plastic behaviour of bending beams, discs, shells and plates<br>• Applications for steel, aluminium and fibre composites.<br>• Introduction to measurement technology<br>• Measurement of strains on specimens to determine material characteristics and experimental determination of stress curves. |
| Type of module | Compulsory module |
| Teaching and learning methods | Seminar, Laboratory |

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|---|---|
| Examination format and duration(Requirement for the award of credit points) | Written examination (90 min.) |
| Prerequisites for participation | |
| Recognition | - |
| Student workload | 60 + 120 |
| Contact hours | 60 |
| Independent study | 120 |
| ECTS credits | 6 |
| Duration and frequency of offering | Once each academic year/ 15 meetings |
| Language of instruction | English |
| Literature | Current literature lists are distributed at the beginning of the semester. |

*Courses*

*Lecturer* *Course title* *SCH*

| **Lehrveranstaltungen** | | |
|---|---|---|
| **Dozent(in)** | **Titel der Lehrveranstaltung** | **SWS** |
| Springer | Advanced Materials Mechanics | 4 |

# 2ND SEMESTER

## M 2.1 Design Project

| Module Code | 2.1 |
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|---|---|
| Semester | 2nd Semester |
| Module responsibility | Prof. Dr. H. Gudenschwager |
| Learning outcomes | After completing the module, students are able to:<br>• make, evaluate and present scientifically profound decisions<br>• work on an independent project in a team, taking into account the knowledge of methods<br>• present and discuss project results in English<br>• integrate sustainable aspects into a project design |
| Course contents | This includes the following topics:<br>• Preparation of a project plan according to given general conditions<br>• Organising the distribution of tasks<br>• Application of known and new methods to solve the project task<br>• Presentation and discussion of project status<br>• Preparation of a specification |
| Type of module | Compulsory module |
| Teaching and learning methods | Project |
| Examination format and duration(Requirement for the award of credit points) | Portfolio |
| Prerequisites for participation | Participation in modules 1.1 – 1.5 is recommended |
| Recognition | |
| Student workload | 120+240 |
| Contact hours | 120 |
| Independent study | 240 |

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|---|---|
| ECTS credits | 12 |
| Duration and frequency of offering | Once each academic year/ 15 meetings |
| Language of instruction | English |
| Literature | Current literature lists are distributed at the beginning of the semester. |

*Courses*

*Lecturer* *Course title* *SCH*

| **Lehrveranstaltungen** | | |
|---|---|---|
| **Dozent(in)** | **Titel der Lehrveranstaltung** | **SWS** |
| Gudenschwa-ger | Design Project | 8 |

## M 2.2 Advanced Ocean Engineering

| Module Code | 2.2 |
|---|---|

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|---|---|
| Semester | 2nd Semester |
| Module responsibility | Prof. Dr.-Ing. Andreas Kraus |
| Learning outcomes | After completing the module, students are able to:<br>• assess the scope of wave theories<br>• apply a complex program for the calculation of sea keeping<br>• interpret results of numerical calculations and model tests<br>• calculate anchor forces |
| Course contents | • Higher order wave theories, basics and calculation examples of nonlinear wave theories<br>• Panel method, theoretical background of potential theory, calculation tools, application of a current tool<br>• Down-Time Analysis<br>• Anchor forces, theoretical principles and consideration in sea keeping analysis<br>• Model test: Validation of calculations by model tests |
| Type of module | Compulsory module |
| Teaching and learning methods | Seminar, Laboratory |
| Examination format and duration(Requirement for the award of credit points) | Written examination 90 min or Portfolio |
| Prerequisites for participation | Basic knowledge of wave theory and sea state statistics recommended |
| Recognition | - |
| Student workload | 60 + 120 |
| Contact hours | 60 |

| | |
|---|---|
| Independent study | 120 |
| ECTS credits | 6 |
| Duration and frequency of offering | Once each academic year/ 15 meetings |
| Language of instruction | English |
| Literature | • Chakrabarti, Subrata K.: Hydrodynamics of offshore structures. Computational Mechanics Publ., 1987.<br>• Chakrabarti, Subrata K.: Handbook of offshore engineering. Elsevier, 2005.<br>• Falnes, Johannes: Ocean waves and oscillating systems. Cambridge Univ. Press, 2002.<br>• Faltinsen, O. M.: Sea Loads on Ships and Offshore Structures. Cambridge Univ. Press, 1998.<br>• Rahman, M.: Hydrodynamics of waves and tides, with applications.. Computational Mechanics Publ., 1988.<br>• Vorschriften und Richtlinien von DNV GL. |

*Courses*

| *Lecturer* | *Course title* | *SCH* |
|---|---|---|

| **Lehrveranstaltungen** | | |
|---|---|---|
| **Dozent(in)** | **Titel der Lehrveranstaltung** | **SWS** |
| Kraus | Advanced Ocean Engineering | 4 |

## M 2.3 Compulsory elective module

| Module Code | 2.3 |
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|---|---|
| Semester | 2nd Semester |
| Module responsibility | Dependent on the selected compulsory elective module |
| Learning outcomes | Dependent on the selected compulsory elective module |
| Course contents | Dependent on the selected compulsory elective module |
| Type of module | Compulsory elective module |
| Teaching and learning methods | Dependent on the selected compulsory elective module |
| Examination format and duration(Requirement for the award of credit points) | Dependent on the selected compulsory elective module |
| Prerequisites for participation | Dependent on the selected compulsory elective module |
| Recognition | Dependent on the selected compulsory elective module |
| Student workload | 60 + 120 |
| Contact hours | 60 |
| Independent study | 120 |
| ECTS credits | 6 |
| Duration and frequency of offering | Once each academic year/ 15 meetings |
| Language of instruction | English |
| Literature | Dependent on the selected compulsory elective module |

*Courses*

*Lecturer* *Course title* *SCH*

| **Lehrveranstaltungen** | | |
|---|---|---|
| **Dozent(in)** | **Titel der Lehrveranstaltung** | **SWS** |
| | Dependent on the selected compulsory elective module | |

## M 2.4 Special Ship Structural Analysis

| Module Code | 2.4 |
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|---|---|
| Semester | 2nd Semester |
| Module responsibility | Prof. Dipl.-Ing. Olaf Springer |
| Learning outcomes | After completing the module, students are able to:<br>• apply analytical and approximation methods for the dimensioning of global structures of ships and structures in marine technology for elastic-plastic material behaviour<br>• apply load-bearing methods for beams and panels for different materials.<br>• develop and evaluate structural analyses and dimensioning of global steel/aluminium components.<br>• develop and apply theoretical and experimental methods in structural analysis in ship and marine technology. |
| Course contents | • Dome force and mixed torsion,<br>• Torsion of multiple closed cross sections, transverse force absorption of multiple closed cross sections,<br>• Load-bearing behaviour of ship structures and floating structures in marine technology for bending beams and plates,<br>• Stability of shipbuilding structures.<br>• Notch stresses,<br>• Materials behaviour in shipbuilding and marine technology<br>• Application of measuring points on selected components.<br>• Experimental investigations to determine notch stresses and strains. |
| Type of module | Compulsory module |
| Teaching and learning methods | Seminar, Laboratory |
| Examination format and duration(Requirement for the award of credit points) | Written examination (90 min.) |

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|---|---|
| Prerequisites for participation | Participation in module 1.5 recommended |
| Recognition | - |
| Student workload | 60 + 120 |
| Contact hours | 60 |
| Independent study | 120 |
| ECTS credits | 6 |
| Duration and frequency of offering | Once each academic year/ 15 meetings |
| Language of instruction | English |
| Literature | Current literature lists are distributed at the beginning of the semester. |

*Courses*

| *Lecturer* | *Course title* | *SCH* |
|---|---|---|

| **Lehrveranstaltungen** | | |
|---|---|---|
| **Dozent(in)** | **Titel der Lehrveranstaltung** | **SWS** |
| Springer | Special Ship Structural Analysis | 4 |

# COMPULSORY ELECTIVE MODULE IN 2ND SEMESTER

| | |
|---|---|
| 2.5 | Special Ship Structure Design I |
| 2.6 | Special Ship Structure - ConsolidationI |
| 2.7 | Special Simulation Techniques |

## M 2.5 Special Ship Structural Design

| Module Code | 2.5 |
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|---|---|
| Semester | 2nd Semester |
| Module responsibility | Prof. Dipl.-Ing. Olaf Springer |
| Learning outcomes | After completing the module, students are able to:<br>• develop the structural design of special types of ships and build up methodological competence.<br>• carry out the dimensioning and construction design of special ship types.<br>• apply and carry out direct structural analyses with numerical methods regarding strength and vibration behaviour for special ship types |
| Course contents | • Introduction to structural design of special types of ships<br>• General Cargo Ships<br>• Container Ships<br>• Cruise ships<br>• Ferry and RO/RO vessels<br>• Bulk carriers<br>• Tankers<br>• Fast ships<br>• Naval vessels<br>• Yachts<br>• Numerical structural analysis of special ship types. |
| Type of module | Compulsory elective module |
| Teaching and learning methods | Seminar |
| Examination format and duration(Requirement for the award of credit points) | Seminar paper |
| Prerequisites for participation | Participation in 1.5 recommended |
| Recognition | - |

| | |
|---|---|
| Student workload | 60 + 120 |
| Contact hours | 60 |
| Independent study | 120 |
| ECTS credits | 6 |
| Duration and frequency of offering | Once each academic year/ 15 meetings |
| Language of instruction | English |
| Literature | Current literature lists are distributed at the beginning of the semester. |

*Courses*

| *Lecturer* | *Course title* | *SCH* |
|---|---|---|

| **Lehrveranstaltungen** | | |
|---|---|---|
| **Dozent(in)** | **Titel der Lehrveranstaltung** | **SWS** |
| N.N. | Special Ship Structural Design | 4 |

## M 2.6 Ship Structural Analysis - Consolidation

| Module Code | 2.6 |
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|---|---|
| Semester | 2. Semester |
| Module responsibility | Prof. Dipl.-Ing. Olaf Springer |
| Learning outcomes | After completing the module, students are able to:<br>• perform and evaluate numerical and experimental analyses of vibrations on ships<br>• perform calculations of forced vibrations<br>perform vibration analyses for local and global components<br>• perform analyses and to assess the fatigue strength of complex components and welded structures in the ship's structure according to different concepts<br>• evaluate and apply fracture mechanics concepts for the prediction of fatigue strength |
| Course contents | **Special Ship Vibrations:**<br>• Ship Hull Vibrations<br>• Rules and regulations.<br>• Evaluation of vibrations<br>• Numerical and experimental vibration studies<br>**Spec.: Ship Operational Strength:**<br>• Fatigue strength verification<br>• Stress analyses and concepts of fracture mechanics<br>• Component design<br>• Welded joints<br>• |
| Type of module | Compulsory elective module |
| Teaching and learning methods | Seminar, Laboratory |
| Examination format and duration(Requirement for the award of credit points) | Seminar paper |
| Prerequisites for participation | Participation in module 1.5 recommended |
| Recognition | - |

| | |
|---|---|
| Student workload | 60 + 120 |
| Contact hours | 60 |
| Independent study | 120 |
| ECTS credits | 6 |
| Duration and frequency of offering | Once each academic year/ 15 meetings |
| Language of instruction | English |
| Literature | Current literature lists are distributed at the beginning of the semester. |

*Courses*

*Lecturer* *Course title* *SCH*

| **Lehrveranstaltungen** | | |
|---|---|---|
| **Dozent(in)** | **Titel der Lehrveranstaltung** | **SWS** |
| N.N. | Ship Structural Analysis - Consolidation | 4 |

## M 2.7 Special Simulation Techniques

| Module Code | 2.7 |
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|---|---|
| Semester | 2nd Semester |
| Module responsibility | Prof. Dipl.-Ing. Gregor Schellenberger |
| Learning outcomes | After completing the module, students are able to:<br>• safely apply selected simulation methods relating to the design and safety of ships and marine structures on the basis of applicable international regulations and specify the limits of the methods<br>• independently develop simple simulation models and implement them in programs<br>• carry out concept studies of designs with the aid of suitable, commercial simulation methods and, if necessary, optimise them with regard to ship safety |
| Course contents | Within the framework of the module, students select a simulation method from the field of ship safety (e.g. flooding simulation of damaged ships, evacuation simulation of passenger ships or optimisation of the oil outflow probability of tankers).<br><br>The module "Special simulation methods" deals with the following topics:<br>• Overview of common simulation methods in shipbuilding<br>• Mathematical/physical principles of the selected simulation method, modelling approaches and limits of the method<br>• Analysis of the regulatory situation and implementation within the framework of the simulation process<br>• Example analysis and, if necessary, comparison with lab tests<br>• Practical implementation of simulations and evaluation of the results; if necessary, derivation of general recommendations for action in respect of the design |
| Type of module | Compulsory elective module |
| Teaching and learning methods | Seminar, Laboratory (if applicable), |

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|---|---|
| Examination format and duration(Requirement for the award of credit points) | Seminar paper or Portfolio |
| Prerequisites for participation | Knowledge in the calculation of the stability of intact and damaged floating bodies as well as in the design of ships and marine structures is recommended |
| Recognition | - |
| Student workload | 60 + 120 |
| Contact hours | 60 |
| Independent study | 120 |
| ECTS credits | 6 |
| Duration and frequency of offering | Once each academic year/ 15 meetings |
| Language of instruction | English |
| Literature | • International regulations (SOLAS, MARPOL, MSC Circ. 1533, etc.) with explanatory notes<br>• Current publications on simulation methods and their practical application<br>• NAPA Manual, NAPA Oy<br>• CAESES Manual, FRIENDSHIP Systems GmbH<br>• AENEAS Manual, TraffGo HT GmbH |

*Courses*

| *Lecturer* | *Course title* | *SCH* |
|---|---|---|

| **Lehrveranstaltungen** | | |
|---|---|---|
| **Dozent(in)** | **Titel der Lehrveranstaltung** | **SWS** |
| Schellenberger | Special Simulation Techniques | 4 |

# 3RD SEMESTER

## 3.1 Master Thesis

| Module Code | 3.1 |
|---|---|

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|---|---|
| Semester | 3rd Semester |
| Module responsibility | Professor Dr.-Ing. Andreas Kraus |
| Learning outcomes | After completing the module, students are able to:<br>• deal with a more extensive problem independently, scientifically and methodically within a given period of time<br>• select and apply appropriate methods for dealing with the problem<br>• place the findings in a multidisciplinary context<br>• evaluate results with regard to technical, economic and ecological consequences<br>• document the work results in written form according to scientific and technical standards and to present and explain them in a colloquium |
| Course contents | The actual course contents of the thesis result from the topics chosen by the students |
| Type of module | Compulsory module |
| Teaching and learning methods | Guided independent study and literature research, scientific work and development, report, and presentation |
| Examination format and duration(Requirement for the award of credit points) | Master's thesis and colloquium with 30-minute presentation open to members of the university |
| Prerequisites for participation | see Master Examination Regulations Article 3 (2) [MPO §3 (2)]:<br>Without prejudice to the other requirements according to the AT-MPO, the application for approval of the topic of the Master's thesis can only be granted if at least 48 credit points have been earned from the number of credits to be earned by the end of the penultimate semester of the standard period of study |
| Recognition | |
| Student workload | 900 |

| | |
|---|---|
| Contact hours | 120 |
| Independent study | 780 |
| ECTS credits | 30 |
| Duration and frequency of offering | Work on the thesis can begin as soon as the formal requirements laid down in the examination regulations have been met. |
| Language of instruction | English |
| Literature | According to independent literature research on the topic of the thesis |

*Courses*

| *Lecturer* | *Course title* | *SCH* |
|---|---|---|

| **Lehrveranstaltungen** | | |
|---|---|---|
| **Dozent(in)** | **Titel der Lehrveranstaltung** | **SWS** |
| Supervising proffessors. | Master Thesis | 8 |