Annex D - EMSHIP List of Lectures (short abstracts)

Sem 3a: **Master 2 at URO**

LIST OF LECTURES (in **Ship Technology – Ocean Engineering**), 30 Credits

Universität Rostock Traditio et Innovatio

Course title	**ECTS**
Type of courses: 4 Elective courses plus the Team project (compulsory): 30 ECTS	
Design of offshore systems **Course contents**: Loads and motions of ships and offshore structures. Marine environment. Wave-induced loads and motions of floating structures. Numerical methods for prediction of linear wave-induced loads and motions of hydro-dynamically compact floating structures. **Learning outcomes**: Students acquire general knowledge about technical developments in ocean engineering, for harvesting renewable energies, marine seafood production, offshore structures for oil and gas exploration and production, for marine aquaculture as well as for underwater applications.	6
Selected topics for the analysis of marine structures **Course contents**: Introduction to selected topics of structural design and analysis. Shear force distribution in thin-walled structures with several cells. Warping torsion. Elastic foundation. Analysis under seismic loads. Selected advanced finite element formulations. Non-linear solution methods. Ultimate strength analyses. **Learning outcomes**: Students will be able to assess the behavior of marine structures under special and extreme loads. Students will know the background of the relevant methods so that they can apply them correctly and efficiently.	6
Mathematical models in ship theory **Course contents**: Differential equation of motion of arbitrary objects in different media. Equations of ship manoeuvring. Determination of added mass. Steady manoeuvring forces. Calculation of steady manoeuvring forces using slender body theory. Experimental study of the manoeuvrability. Influence of different factors on the manoeuvrability. Application of CFD for manoeuvrability problems. Dynamics of offshore structures. **Learning outcomes**: Students will be familiar with a general overview of mathematical models used in ship dynamics, ship maneuverability and offshore structures dynamics. They will be able to demonstrate knowledge and understanding of ship and offshore structures motion at different operational conditions.	6
Ship life cycle digitalization **Course contents**: Process analysis in ship design, production and operation. Fundamentals in mathematical curve, surface and shape modelling in CAD tools. Process and Product modelling techniques, examples from shipbuilding processes product modelling, focus on different ship product data sets for different views in interdisciplinary tasks. Optimization processes: fundamentals, selected methods. The role of CAx in the ship production process. Digitalization of ship operation: data sources, challenges in data analysis, performance assessment, digital twins **Learning outcomes**: Students will understand the fundamentals and mathematical modelling techniques implemented in modern CAD tools. They will be able to formulate target functions and set up an optimization procedure in the ship design process.	6
Safety of maritime systems **Course contents**: Repetition of the principles of ship intact stability in calm water. Principles of ship intact stability in waves. Second generation intact stability criteria: dead ship, excessive accelerations, pure loss of stability, parametric rolling, surf-riding/broaching-to. Lost buoyancy and added weight methods to calculate the floating condition after a damage. Deterministic damage stability: Floodable length curve, freeboard and stability criteria, compartmentalization. Probabilistic damage stability: side damages, bottom damages, bow damages, subdivision survivability, SOLAS. Safe marine operations: operational limitations, safety criteria, ship motion reduction **Learning outcomes**: Having successfully completed the module, the student will be able to demonstrate knowledge and understanding of the physics of floating objects like ships and offshore structures taking into account a damaged condition.	6
Ocean research technologies **Course contents**: Measurement and sampling procedures and methods in marine science and underwater monitoring. System theory and life assessment concepts. Methods for data storage and transfer. Autonomously and manually operated underwater vehicles. Research platforms and research vessels. **Learning outcomes**: Students will be enabled to recognize and understand relevant issues of in situ working disciplines and general principles of natural scientific marine research.	6
Large engines, energy converters and fuels for climate neutral marine applications **Course contents**: Theoretical background, how large engines and energy converters work, ideal processes, turbocharging, engine parameters, scavenging, modes of operation. Categorization and design of modern large engines On-board installation, integration into ships' propulsion and energy systems, specific requirements on marine engines. Marine fuel cells and marine battery technologies and their integration. Marine fuels and energy carriers. Emissions; Gas and dual-fuel large engines and their operation; Future trends. **Learning outcomes**: Students gain specific knowledge about large engines, energy converters and specific fuels for marine applications and detailed information regarding their use for shipping and power generation. Students learn about the demands of the maritime energy transition, solutions for CO2 reduction and how to evaluate these.	6
Team project **Course contents**: This module is strictly linked to any course to be taken at URO. Depending on the topics of the selected course, a problem will have to be solved in a team. Students can select the course for the teamwork project according to their preference. **Learning outcomes**: Students will be able to demonstrate initiative and originality in problem solving, can act autonomously in planning and implementing tasks at a professional level while making decisions in complex and unpredictable situations. They will develop a comprehensive understanding of techniques and methodologies applicable to their own work.	6

Design of Offshore Systems (bisher: Theorie und Entwerfen schwimmender und gegründeter Offshore-Systeme 15510180)

Category/Kategorie	Content/Inhalt
Module name (Englisch)/ *Modulbezeichnung (Deutsch)*	Design of Offshore Systems/ *Theorie und Entwurf von Offshoresystemen*
Credits/ *Leistungspunkte*	6
Responsibility/ *Modulverantwortlich*	MSF/Lehrstuhl Meerestechnik
Contact/ *Ansprechpartner:innen*	Prof. Dr.-Ing. Sascha Kosleck
Language/ *Sprache*	English/ *Englisch*
Limitation/ *Zulassungsbeschränkung*	None/ *Keine*
Level/ *Modulniveau*	Master of Science - advanced/ *Masterstudiengang - weiterführend*
Mandatory prerequisite(s)/ *Zwingende Teilnahmevoraussetzung*	None/ *Keine*
Nice to have/ *Empfohlene Teilnahmevoraussetzung*	- Basics of Fluid Mechanics/ *Grundlagen der Strömungsmechanik* - Mathematics for Engineers 2: Linear Algebra and Geometry / *Mathematik für Ingenieurwissenschaften 2: Lineare Algebra und Geometrie* - Mathematics for Engineers 3: Differential Equations and Multivariable Calculus / *Mathematik für Ingenieurwissenschaften 3: Differenzialgleichungen und mehrdimensionale Analysis*
Curricula	M.Sc. Sustainable Maritime Engineering Weitere ???
Duration/ *Dauer des Moduls*	1 semester/ *1 Semester*
Starts when?/ *Angebotsturnus*	Winter semester/ *Wintersemester*
Learning outcomes/ *Lern- und Qualifikationsziele*	Students will get acquainted with different types of maritime structures, their function, installation procedures and sub-systems. They will learn to understand the physical and mathematical modelling of maritime systems exposed to a marine environment including waves, wind and ocean currents. These models are the basis for the of hydrodynamic and aerodynamic loads on ships and marine structures as well as their wave, wind and current induced motions. Furthermore, students gain in-depth knowledge of linear and nonlinear mathematical models as well as experimental methods. They will be able to predict loads and movements of maritime structures, floating and fixed, selecting and applying the most suitable methods according to the specific technical task. Furthermore, students will be able to quantify the buoyancy and stability of marine structures. Finally, they will be able to evaluate and synthesize the results of theoretical and experimental analyses in a professional and qualified manner.
Content/ *Lehrinhalte*	• The marine environment: wind, surface waves, statistical representation of wind driven waves and swells, ocean currents, general ocean knowledge • Introduction of offshore structures, their definition, tasks and hydrodynamic classification • Selected topics of fluid mechanics: basics laws for the conservation of mass or continuity, velocity potential, Laplace's differential equation, Euler's equations of

Category/Kategorie	Content/Inhalt
	motion, Bernoulli's equation, momentum and angular momentum theorem for incompressible fluids • Linear wave theory according to AIRY • Representation of natural sea states • Hydrodynamically transparent vs. compact structure • The semi-submersible • Wave induced loads and motions of floating structures, added mass, the Froude-Krylov-Force, linearised damping, potential damping, equation of motions for floating structures, natural frequencies, response amplitude operators and the magnification function • Morison equation - constituents and scope, Keulegan-Carpenter number, stripe theory and its application • Energy of advancing waves • A short introduction to the nonlinear wave theory according to Stokes, wave drift forces
Literature/ *Literatur*	• Lecture handouts/ Vorlesungsunterlagen • Presentations/ Präsentationen • Faltinsen, O.: Sea Loads on Ships and Offshore Structures • Clauss, G.F.: Offshore Structures, Vol. 1 • Chakrabarti, S.K.: Hydrodynamics of Offshore Structures • Journée, J.M.J., Massie, W.W.: Offshore Hydromechanics, First Edition
Type of course/ *Lehrveranstaltungen*	Tutorial/ *Übung* 2,0 SWS Lecture/ *Vorlesung* 2,0 SWS Total 4,0 SWS
Types of activities/ *Lernformen*	Presentations, discussions, literature study, exercise,self-study, experiments, field trips / *Präsentationen, Diskussionsrunden, Literaturstudium, Lösen von Übungsaufgaben, Selbststudium, Laborexperimente, Exkursion*
Learning hours/ *Arbeitsaufwand für Studierende*	Attendance/ *Präsenzzeit* 60 Std Preparation/ *Vor- und Nachbereitung der Präsenzzeit* 20 Std Self study/ *Selbststudium* 50 Std Exercise & Labs/ (wie war das mit dem Team project?) *Übungsaufgaben & Laborversuche* 20 Std Assessed coursework and preparation for exam/ *Prüfungsvorleistung, Prüfungsvorbereitung, Prüfung* 30 Std Total/ *Gesamtarbeitsaufwand* 180 Std
Requirements for admission to examination/ *Prüfungsvorleistungen*	Lab protocol or report (appr. 15 pages)/ *Versuchprotokoll oder Belegarbeit (ca. 15 Seiten)*
Examination/ *Prüfungsleistungen* *Voraussetzungen für einen erfolgreichen Modulabschluss*	Oral examination (30 minutes)/ *mündliche Prüfung (30 Minuten)*

Category/Kategorie	Content/Inhalt
Examination schedule/ *Regelprüfungstermin*	Regular examination date in accordance with the applicable course-specific examination and study regulations/ *Regelprüfungstermin gemäß jeweils gültiger Studiengangsspezifischer Prüfungs- und Studienordnung*
Assessment/ *Bewertung*	Assessment in accordance with the applicable course-specific examination and study regulations/ *Bewertung gemäß jeweils gültiger Studiengangsspezifischer Prüfungs- und Studienordnung*
Comments/ *Hinweise*	None/ *keine*
Module number/ *Modulnummer*	1551080
Part of the EMSHIP-Programme?/ *Teil des EMSHIP-Programmes*	Yes/ *Ja*

Category	Content
Module denotation	Selected Topics of the Analysis of Marine Structures
Subtitle	MSF 3 099
Module denotation (German)	Ausgewählte Kapitel der Berechnung maritimer Strukturen
Credit points and amount of work	6 180 hours
Responsible for module	Faculty of Mechanical Engineering and Marine Technology Chair of Ship Structures
Contact	Employees at Chair of Ship Structures
Language	English
Admission restriction	Non

Module level	Master
Mandatory participation restriction	Non
Recommended participation restriction	Engineering Mechanics, Mathematics, Basics of Offshore and Ship Structures, Fundamentals of the Analysis of Marine Structures, Finite Element Method for the Analysis of Marine Structures

Assignment (Curricula)	M.Sc. Ship and Offshore Engineering
Relationship to other professional modules	

Duration of module	1 Semester
Term of module	Every winter semester

Educational objectives (expertise)	Students will understand the fundamentals of different methods to analyse marine structures and to judge upon its structural behaviour. The theory of shear force application and the warping torsion theory will be introduces especially for thin-walled closed frame structures. The knowledge of the fundamentals is very important to perform structural analyses of marine structures efficiently. It is also the basis to improve structural systems or to develop new design variants. The students will apply the Finite Element Method (FEM) as a feasible tool to analyse various structural systems. Different element types will be introduced and its applicability will be investigated. To perform nonlinear Finite Element Analyses (FEA) successfully the knowledge of appropriate solution methods is very imported. In frame of this course different solution methods implemented commonly in finite element software packages will be presented. Finally, the students will develop a more comprehensive understanding to perform structural analyses of complex systems.
Content	1. General Review of the Analysis and Design of Marine Structures 2. Theory of Shear Force Application 3. Warping Torsion Theory 4. Elastic Foundation 5. Response Spectrum Analysis 6. Beam Element Formulations 7. Newton-Raphson Schemes 8. Arc-Length Method 9. Displacement Control 10. Introduction to Ultimate Strength
Literature	- Lecture Notes

Lecture hours per week per semester (SWS)	Lecture 2 SWS Seminar 2 SWS Total 4 SWS ** If no further information is given, read the notes carefully.*	
Lecture 1	Lecture / Selected Topics of the Analysis of Marine Structures (1. Part of Semster)	(LSF)
Lecture 2	Seminar / Selected Topics of the Analysis of Marine Structures (1. Part of Semster)	(LSF)
Lecture 3	Lecture / Advanced Analysis of Marine Structures (2. Part of Semester)	(LSF)
Lecture 4	Seminar / Advanced Analysis of Marine Structures (2. Part of Semester)	(LSF)
Learning	Study of subject related literature, Exercises, Recapitulation of lecture notes	
Amount of work for students	Attendence 42 hrs. Preparation for lecture notes and seminars 28 hrs. Recapitulation of lecture notes 59 hrs. Exercises 21 hrs. Preparation for exam 30 hrs. Total 180 hrs. ** If no further information is given, read the notes carefully.*	

Prerequisites for exam	Exercises for exam
Examination/Requirement for successful termination of the module (type and duration)	Oral exam (30 Minutes)
Appointment for exam	Appointment for exam as given by specific study and examination regulations.
Assessment of exam	Assessment of exam as given by specific study and examination regulations.

Notes	Non

Date of latest modifications	
Editor	
System number	1551190
Status	Development phase
Version	Alpha

Title: MATHEMATICAL MODELS IN SHIP THEORY

6 credits

Ref (URO): 1551360
Prof. Nikolai Kornev

EMship+: M2- URO-3
Teaching Period: October – January

Link:
http://bookboon.com/de/lectures-on-ship-manoeuvrability-ebook

Course contents

Differential equation of motion of arbitrary objects in different media. Equations of ship manoeuvring. Determination of added mass. Steady manoeuvring forces. Determination of steady manoeuvring forces using measurements. Forces on ship rudders and propeller. Yaw stability. Manoeuvrability Diagram. Experimental study of the manoeuvrability. Ship oscillations equations. Free oscillations. Oscillations in regular and irregular waves. Experimental study of ship oscillations.

More detailed information on course content can be taken from the textbook "Lectures on ship manoeuvrability" which can be downloaded from http://bookboon.com/de/lectures-on-ship-manoeuvrability-ebook

Learning outcomes of the course

The main objective is to give a general overview of mathematical models used in ship dynamics, ship maneuverability and ship dynamics in waves. Having successfully completed the module, the student will be able to demonstrate knowledge and understanding of ship and offshore structures motion at different operational conditions.

Prerequisites

Students must have a Bachelor degree in Engineering. They must have knowledge in mechanical engineering, naval architecture, marine or offshore engineering, aerospace engineering, or similar.

Ship Life Cycle Digitalisation

Category/Kategorie	Content/Inhalt
Module name (Englisch)/ *Modulbezeichnung (Deutsch)*	Ship Life Cycle Digitalisation / *Rechnergestützte Entwicklungsmethoden in der Schiffs- und Meerestechnik*
Credits/ *Leistungspunkte*	6
Responsibility/ *Modulverantwortlich*	MSF/Lehrstuhl Schiffbau
Contact/ *Ansprechpartner:innen*	Prof. Dr.-Ing. Florian Sprenger
Language/ *Sprache*	English/ *Englisch*
Limitation/ *Zulassungsbeschränkung*	None/ *keine*
Level/ *Modulniveau*	Master of Science/ *Masterstudiengang*
Mandatory prerequisite(s)/ *Zwingende Teilnahmevoraussetzung*	None/ *keine*
Nice to have/ *Empfohlene Teilnahmevoraussetzung*	- Ship Design/ *Entwerfen von Schiffen*
Curricula	M.Sc. Sustainable Maritime Engineering
Duration/ *Dauer des Moduls*	1 semester/ *1 Semester*
Starts when?/ *Angebotsturnus*	Winter semester/ *Wintersemester*
Learning outcomes/ *Lern- und Qualifikationsziele*	Students will understand the fundamentals and mathematical modelling techniques implemented in modern CAD tools. They will be able to formulate target functions and set up an optimization procedure in the ship design process. The understood necessity of an efficient information exchange between partners and tasks involved leads to the knowledge of suitable information exchange methods and tools. Process and product modeling techniques as a prerequisite for a successful information exchange can be applied by the students in specific exchange scenarios of ship product model data. The students will understand the role and potential of IT in the ship production process. Based on selected examples of operational data from a real ship, they will explore the potential and experience the challenges and of heterogenous big data resources collected from multiple sources during ship operation by an introduction to selected data science techniques.
Content/ *Lehrinhalte*	• Product life cycle, process modelling, product data • Digitalisation of ship design: tools and methods • Fundamentals of shape defintion • Fundamentals of curve and surface modelling • Digitalisation of the ship production process • Digitalisation of ship operation: tools and methods • Sensors, data evaluation and processing • Decision support systems, automatisation
Literature/ *Literatur*	• Lecture Notes / *Vorlesungsunterlagen* • Piegl, L. and Tiller, W.: The NURBS Book • Nocedal, J. and Wright, S. L.: Numerical Optimization • Booch, G. et al.: Object-Oriented Analysis and Design with Applications • Halpin, T. A.: Information Modeling and Relational Databases

Category/Kategorie	Content/Inhalt	
Type of course/ *Lehrveranstaltungen*	Tutorial/ *Übung*	2,0 SWS
	Lecture/ *Vorlesung*	2,0 SWS
	Total	4,0 SWS
Types of activities/ *Lernformen*	Discussions, literature study, exercises, self-study, field trips / *Diskussionsrunden, Literaturstudium, Lösen von Übungsaufgaben, Selbststudium, Exkursionen*	
Learning hours/ *Arbeitsaufwand für Studierende*	Attendance/ *Präsenzzeit*	60 Std
	Preparation/ *Vor- und Nachbereitung der Präsenzzeit*	20 Std
	Self-study / *Selbststudium*	49 Std
	Exercise/ *Übungsaufgaben*	21 Std
	Assessed coursework and preparation for exam/ *Prüfungsvorleistung, Prüfungsvorbereitung, Prüfung*	30 Std
	Total/ *Gesamtarbeitsaufwand*	180 Std
Requirements for admission to examination/ *Prüfungsvorleistungen*	Passing the exercises / *Bestehen der gestellten Übungsaufgaben*	
Examination/ *Prüfungsleistungen* *Voraussetzungen für einen erfolgreichen Modulabschluss*	Oral examination (30 minutes)/ *mündliche Prüfung (30 Minuten)*	
Examination schedule/ *Regelprüfungstermin*	Regular examination date in accordance with the applicable course-specific examination and study regulations/ *Regelprüfungstermin gemäß jeweils gültiger Studiengangsspezifischer Prüfungs- und Studienordnung*	
Assessment/ *Bewertung*	Assessment in accordance with the applicable course-specific examination and study regulations/ *Bewertung gemäß jeweils gültiger Studiengangsspezifischer Prüfungs- und Studienordnung*	
Comments/ *Hinweise*	None/ *keine*	
Module number/ *Modulnummer*	1550940	

Safety of Maritime Systems

Category/Kategorie	Content/Inhalt
Module name (Englisch)/ *Modulbezeichnung (Deutsch)*	Safety of Maritime Systems / *Leckstabilität und Kentersicherheit*
Credits/ *Leistungspunkte*	6
Responsibility/ *Modulverantwortlich*	MSF/Lehrstuhl Schiffbau
Contact/ *Ansprechpartner:innen*	Prof. Dr.-Ing. Florian Sprenger
Language/ *Sprache*	English/ *Englisch*
Limitation/ *Zulassungsbeschränkung*	None/ *keine*
Level/ *Modulniveau*	Master of Science/ *Masterstudiengang*
Mandatory prerequisite(s)/ *Zwingende Teilnahmevoraussetzung*	None/ *keine*
Nice to have/ *Empfohlene Teilnahmevoraussetzung*	- Ship Design/ *Entwerfen von Schiffen* - Fundamentals of Ship Technology / *Grundlagen der Schiffstechnik*
Curricula	M.Sc. Sustainable Maritime Engineering
Duration/ *Dauer des Moduls*	1 semester/ *1 Semester*
Starts when?/ *Angebotsturnus*	Winter semester/ *Wintersemester*
Learning outcomes/ *Lern- und Qualifikationsziele*	The first focus of this module is on the intact stability of ships in calm water as well as waves. The students learn how to derive the metacentric height, righting lever and KN-curves for a given ship design and loading condition. They are further qualified to assess the risk of capsizing in waves, define risk mitigation strategies and to discuss the failure modes related to the second generation intact stability criteria. The second topic of the module is damage stability in calm water. The students learn how to assess the safety of ships and offshore structures after damage with water ingress. They know the deterministic and probabilistic approach for damage stability assessment and can critically review and discuss the different methods in the context of ship design.
Content/ *Lehrinhalte*	• Intact stability in calm water • Intact stability in waves • IMO codes and intact stability criteria • Assessment of floating position and stability after hull damage • Floodable length, compartmentalisation • Deterministic assessment of damage stability for tankers and bulkers • Probabilistic assessment of damage stability according to SOLAS
Literature/ *Literatur*	• Lecture Notes / *Vorlesungsunterlagen* • IMO: Intact Stability Code, International Load Lines Convention, SOLAS • Kobylinski, L. K. and Kastner, S.: Stability and Safety of Ships • Barras B. and Derrett, D. R.: Ship Stability for Master and Mates • Biran, A.B.: Ship Hydrostatics and Stability

Category/Kategorie	Content/Inhalt		
	• Neves, M. A. S. et al.: Contemporary Ideas on Ship Stability and Capsizing in Waves • Lewis, E. V.: Principles of Naval Architecture (Volume I)		
Type of course/ *Lehrveranstaltungen*	Tutorial/ *Übung*	2,0 SWS	
	Lecture/ *Vorlesung*	2,0 SWS	
	Total	4,0 SWS	
Types of activities/ *Lernformen*	Discussions, literature study, exercises, self-study, field trips / *Diskussionsrunden, Literaturstudium, Lösen von Übungsaufgaben, Selbststudium, Exkursionen*		
Learning hours/ *Arbeitsaufwand für Studierende*	Attendance/ *Präsenzzeit*	60 Std	
	Preparation/ *Vor- und Nachbereitung der Präsenzzeit*	20 Std	
	Self study/ *Selbststudium*	49 Std	
	Exercise/ *Übungsaufgaben*	21 Std	
	Assessed coursework and preparation for exam/ *Prüfungsvorleistung, Prüfungsvorbereitung, Prüfung*	30 Std	
	Total/ *Gesamtarbeitsaufwand*	180 Std	
Requirements for admission to examination/ *Prüfungsvorleistungen*	Passing the exercises / *Bestehen der gestellten Übungsaufgaben*		
Examination/ *Prüfungsleistungen* *Voraussetzungen für einen erfolgreichen Modulabschluss*	Oral examination (30 minutes)/ *mündliche Prüfung (30 Minuten)*		
Examination schedule/ *Regelprüfungstermin*	Regular examination date in accordance with the applicable course-specific examination and study regulations/ *Regelprüfungstermin gemäß jeweils gültiger Studiengangsspezifischer Prüfungs- und Studienordnung*		
Assessment/ *Bewertung*	Assessment in accordance with the applicable course-specific examination and study regulations/ *Bewertung gemäß jeweils gültiger Studiengangsspezifischer Prüfungs- und Studienordnung*		
Comments/ *Hinweise*	None/ *keine*		
Module number/ *Modulnummer*	1551230		

Ocean Research Technology (bisher: Meeresforschungstechnik 1552220)

Category/Kategorie	Content/Inhalt
Module name (Englisch)/ *Modulbezeichnung (Deutsch)*	Ocean Research Technologies/ *Meeresforschungstechnik*
Credits/ *Leistungspunkte*	6
Responsibility/ *Modulverantwortlich*	MSF/Lehrstuhl Meerestechnik
Contact/ *Ansprechpartner:innen*	Prof. Dr.-Ing. Sascha Kosleck
Language/ *Sprache*	English/ *Englisch*
Limitation/ *Zulassungsbeschränkung*	None/ *keine*
Level/ *Modulniveau*	Master of Science - advanced/ *Masterstudiengang - weiterführend*
Mandatory prerequisite(s)/ *Zwingende Teilnahmevoraussetzung*	None/ *keine*
Nice to have/ *Empfohlene Teilnahmevoraussetzung*	- Basics of Fluid Mechanics/ *Grundlagen der Strömungsmechanik* - Mechanical Principles 1 – statics/ *Technische Mechanik 1* - Mechanical Principles 3 – dynamics/ *Technische Mechanik 3*
Curricula	M.Sc. Sustainable Maritime Engineering Weitere ???
Duration/ *Dauer des Moduls*	1 semester/ *1 Semester*
Starts when?/ *Angebotsturnus*	Winter semester/ *Wintersemester*
Learning outcomes/ *Lern- und Qualifikationsziele*	During this module a variety of measurement, observation and sampling methods for marine research are presented and discussed. Students will learn to understand relevant issues of in situ and lab work. Based on this knowledge they will learn to communicate essential requirements and modes of operation including operating principles and accuracy. They can evaluate possible interactions between the object to measure, the research instrumentation and the observer. Thus, they are able to identify and develop optimised concepts for equipment and processes for special tasks in marine research.
Content/ *Lehrinhalte*	Measuring, observation and sampling methods for marine research: • Fundamental basics or measurements and measurement campaigns in ocean research • Environmental conditions • Selected principles and their technical applications • Hydro acoustics for sub-surface applications • performance and limitations of individual methods, reproducibility of test conditions and accuracy considerations • Theoretical/mathematical models for numerical simulation of selected application scenarios • Autonomously operating and manually controlled underwater systems • Research platforms and vessels

Literature/ *Literatur*	• Lecture handouts/ Vorlesungsunterlagen • Presentations/ Präsentationen		
Type of course/ *Lehrveranstaltungen*	Tutorial/ *Übung*	2,0 SWS	
	Lecture/ V*orlesung*	2,0 SWS	
	Total	4,0 SWS	
Types of activities/ *Lernformen*	Presentations, discussions, literature study, exercise,self-study, experiments, field trips / *Präsentationen, Diskussionsrunden, Literaturstudium, Lösen von Übungsaufgaben, Selbststudium, Laborexperimente, Exkursion*		
Learning hours/ *Arbeitsaufwand für Studierende*	Attendance/ *Präsenzzeit*	60 Std	
	Preparation/ *Vor- und Nachbereitung der Präsenzzeit*	20 Std	
	Self study/ *Selbststudium*	50 Std	
	Exercise & Labs/ *Übungsaufgaben & Laborversuche*	20 Std	
	Assessed coursework and preparation for exam/ *Prüfungsvorleistung, Prüfungsvorbereitung, Prüfung*	30 Std	
	Total/ *Gesamtarbeitsaufwand*	180 Std	
Requirements for admission to examination/ *Prüfungsvorleistungen*	Lab protocol (appr. 15 pages) and presentation (20 min)/ *Versuchsprotokoll (ca. 15 Seiten) und ggfs. Präsentation (20 min)*		
Examination/ *Prüfungsleistungen* *Voraussetzungen für einen erfolgreichen Modulabschluss*	Oral examination (30 minutes)/ *mündliche Prüfung (30 Minuten)*		
Examination schedule/ *Regelprüfungstermin*	Regular examination date in accordance with the applicable course-specific examination and study regulations/ *Regelprüfungstermin gemäß jeweils gültiger Studiengangsspezifischer Prüfungs- und Studienordnung*		
Assessment/ *Bewertung*	Assessment in accordance with the applicable course-specific examination and study regulations/ *Bewertung gemäß jeweils gültiger Studiengangsspezifischer Prüfungs- und Studienordnung*		
Comments/ *Hinweise*	None/ *keine*		
Module number/ *Modulnummer*	1552220		
Part of the EMSHIP-Programme?/ *Teil des EMSHIP-Programmes*	Yes/ *Ja*		

Large Engines, Energy Converters and Fuels for climate neutral marine applications

Kategorie	Inhalt
Modulbezeichnung (englisch)	Large Engines, Energy Converters and Fuels for climate neutral marine applications
Leistungspunkte	6
Modulverantwortlich	MSF/LKV Maschinenbau
Ansprechpartnerinnen/ Ansprechpartner	Prof. Dr. Bert Buchholz
Sprache	Englisch
Zulassungsbeschränkung	keine
Modulniveau	Masterstudiengang - anwendungsorientiert
Zwingende Teilnahmevoraussetzung	keine
Empfohlene Teilnahmevoraussetzung	Grundlagen der Thermodynamik Kraft- und Arbeitsmaschinen - Energiemaschinen
Zuordnung zu Curricula	M.Sc. Maschinenbau M.Sc. Schiffs- und Meerestechnik M.Sc. Sustainable Maritime Engineering
Dauer des Moduls	1 Semester
Beginn/ Angebotsturnus	Sommersemester
Lern- und Qualifikationsziele	Students gain specific knowledge of energy converters for maritime applications and power generation, such as large engines, large gas engines, gas turbines and fuel cells. Physical and chemical properties of relevant energy carriers (existing fossil and future climate-neutral fuels) are taught. The students know about the relationships between fuel properties and their storage and usage aboard of ships and other marine structures. The consequences of fuel choice, design and operation on efficiency, emissions and greenhouse gas balances of energy converters are discussed. The students learn about the design and operational specifics of maritime energy converters and differences to engines for on-highway applications. The students are enabled to consider and calculate the requirements from the operation of ships and other marine structures and their impact on design, operation and emission behaviour of engines and energy converters. Strong focus is given to considerations of the environmental and climate effects. The students know about special measures to reduce emissions in ship operation and onshore applications. The requirements of the maritime energy transition and solution strategies for the necessary comprehensive CO2 reduction are explained, students are able to evaluate advantages and risks of different solutions.
Lehrinhalte	The following main topics are covered in the lecture and exercise: - Theoretical basics, functionality and energy balances of energy converters for maritime applications: combustion engines for liquid and gaseous fuels, dual-fuel engines, gas turbines, fuel cells - Energy carriers for maritime applications: properties, special features, on-board handling, safety aspects, resulting requirements for converters - Design specifics of large engines (low-speed, medium-speed, high-speed), gas turbines and fuel cells and their auxiliary systems - Installation on board, integration into ship propulsion and power systems, specific requirements on engines from ship operation - Hybrid energy system concepts: layouts, potentials regarding efficiency and emissions, operational aspects - Emissions: Limit values for maritime applications, internal and external reduction measures - Future trends: exhaust gas treatment, fuels and strategies for the maritime energy transition - Excursion aboard a modern ferry: evaluation of the energy and propulsion system – layout, functionality, operational and safety aspects

Kategorie	Inhalt	
Literatur	- Latarche, M.: Pounder's Marine Diesel Engines and Gas Turbines; Butterworth-Heinemann Ltd, 10th Edition, 2020. - Tschöke, H., Mollenhauer, K.,: Handbook of Diesel Engines; Springer-Verlag, Auflage 2010 - Meier-Peter, H., Bernhardt, F., (Hrsg.): Handbuch Schiffsbetriebstechnik, DVV Media Group, 2. Auflage, 2012 - Bilousov, I., Bulgakov, M., Savchuk, V.: Modern Marine Internal Combustion Engines: A Technical and Historical Overview, Springer Verlag, 2020 - Elvers, B.;Schütze, A.; Handbook of Fuels – Energy Sources for Transportation, Wiley-VCH, 2021	
Lehrveranstaltungen	Praktikum Vorlesung Gesamt	2.SWS 2 SWS 4 SWS
Lernformen	Gruppenarbeit, Literaturstudium, Selbststudium, Praktikum	
Arbeitsaufwand für Studierende	Präsenzzeit Vor- und Nachbearbeitung der Präsenzzeit Strukturiertes Selbststudium Übungsaufgaben Praxis Prüfungsvorbereitung/ Prüfungsvorleistung/ Prüfung Gesamtarbeitsaufwand	60 Std. 20 Std. 50 Std. 20 Std. 0 Std. 30 Std. 180 Std.
Prüfungsvorleistungen	keine	
Prüfungsleistungen/ Voraussetzungen für einen erfolgreichen Modulabschluss	Prüfungsleistung: Mündliche Prüfung (30 Minuten)	
Regelprüfungstermin	Regelprüfungstermin gemäß jeweils gültiger Studiengangsspezifischer Prüfungs- und Studienordnung.	
Bewertung	Bewertung gemäß jeweils gültiger Studiengangsspezifischer Prüfungs- und Studienordnung.	
Hinweise	keine	
Modulnummer		

Title: **TEAM PROJECT**

6 credits

Ref (URO): 1551490 EMship+: M2- URO-8

Prof. Patrick Kaeding and Colleagues Teaching Period: October – January

Link: see EMship+ LMS

Course contents

This module is strictly linked to any course to be taken at URO. Depending on the topics of the selected course, a problem will have to be solved in a team. Students can select the course for the teamwork project according to their preference.

Learning outcomes of the course

Students will experience themselves in a team solving a defined problem in a defined time span. Depending on the course, the teamwork is linked to students that will intensively make use of different computer programs to solve the assigned task or will perform their own programming and experiments. While doing so, students will have a better understanding of the topics taught as they will work on a real world problem.

In teamwork students will develop to work effectively with a group as leader or member, they can clarify tasks and make appropriate use of the capacities of group members. They are able to negotiate and handle conflicts with confidence in a project in which the participants contribute with different but integrated software components.

Students will be able to demonstrate initiative and originality in problem solving, can act autonomously in planning and implementing tasks at a professional level while making decisions in complex and unpredictable situations. They will develop a comprehensive understanding of techniques and methodologies applicable to their own work.

Prerequisites

Students have to register in the course, the team project is linked to.