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

Category	Content
Modul name	Design of Offshore Systems
Credit points	6
Responsibility	MSF/Meerestechnik
Contact person	Prof. Dr. Sascha Kosleck
Language	English
Admission restrictions	none
Level	Master’s degree
Mandatory prerequisites	none
Recommended prerequisites	Fluid Mechanics: Types of Flow, Continuity Equation, Bernoulli's Equation, Reynolds Number, Flow Resistance, Hydrostatics Mathematics: Linear Algebra, Vector Analysis, Calculus, Geometry Mechanics: Statics, Dynamics of rigid bodies
This module is part of the following curricula	M.Sc. Sustainable Maritime Engineering; EMShip, M.Sc. Bauingenieurwesen
Module duration	1 semester
Integration into curricula	Winter semester
Learning outcomes	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 analysis 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 selected 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. Finally, they will be able to evaluate and synthesize the results of theoretical and experimental analyses in a professional and qualified manner.
Content	• 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 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 • Energy of water waves • A short introduction to the nonlinear wave theory according to Stokes, wave drift forces
Literature	• 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	Lecture 2 SWS Exercise 2 SWS

	Total	4 SWS
Learning activities	Presentations, discussions, literature study, solving tutorial questions, self-study, lab experiments, excursion	
Learning hours	Attendance	60 hrs
	Weekly preparation	20 hrs
	Self-study	50 hrs
	Exercises	20 hrs
	Assessed coursework and preparation for exam	30 hrs
	Total	180 hrs
Prerequisites for admission to examination	Laboratory report or written assignment (approx. 15 pages)	
Examinations / Assessments required for a successful completion of the module	Type of examination:	Oral examination (30 minutes) or written examination (150 minutes) The examination format will be announced no later than in the second week of lectures.
Examination schedule	Regular examination date according to the respective valid examination and study regulations of the degree program.	
Assessment	Assessment according to the respective valid examination and study regulations of the degree program.	
Comments	Oral examinations are offered in either English or German; written examinations are offered exclusively in English. Examinations may take place on-site or online. According to the Examination Regulations (RPO), the written exam may also be conducted as a multiple-choice test, an e-exam, or a take-home exam. The examination format must be announced by the examiner no later than in the second week of lectures.	
Module number	1552430	

Selected Topics for the Analysis of Marine Structures

Category	Content
Modul name	Selected Topics for the Analysis of Marine Structures
Credit points	6
Responsibility	MSF/Schiffstechnische Konstruktionen
Contact person	Prof. Dr. Patrick Kaeding
Language	English
Admission restrictions	none
Level	Master's degree
Mandatory prerequisites	none
Recommended prerequisites	Basic knowledge to analyse structural components of marine structures. Fundamentals of Finite Element Method and its application to solve linear and nonlinear structural problems. Fundamentals of Ship and Offshore Structures as well as Ship Design.
This module is part of the following curricula	M.Sc. Sustainable Maritime Engineering
Module duration	1 semester
Integration into curricula	Winter semester
Learning outcomes	Students know the fundamentals of different methods to analyse marine structures and to judge upon its structural behaviour. They apply the shear force and the warping torsion theory to 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 apply the Finite Element Method (FEM) as a feasible tool to analyse various structural systems. Different element types and its applicability are investigated. The students perform nonlinear Finite Element Analyses (FEA) to develop a profound knowledge of appropriate solution methods. In frame of this course different solution methods implemented commonly in finite element software packages are applied. Finally, the students have a more comprehensive understanding to perform structural analyses of complex systems.
Content	• General Review of the Analysis and Design of Marine Structures • Theory of Shear Force Application • Warping Torsion Theory • Elastic Foundation • Response Spectrum Analysis • Beam Element Formulations • Newton-Raphson Schemes • Arc-Length Method • Displacement Control • Introduction to Ultimate Strength
Literature	Lecture notes
Type of course	Lecture 2 SWS Exercise 2 SWS Total 4 SWS
Learning activities	Literature study, solving tutorial questions, self-study
Learning hours	Attendance 60 hrs Weekly preparation 20 hrs Self-study 50 hrs Exercises 20 hrs Assessed coursework and preparation for exam 30 hrs Total 180 hrs
Prerequisites for admission to examination	3 coursework assignments, to be announced no later than in the second week of lectures.
Examinations / Assessments required for a successful completion of the module	Type of examination: Oral examination (30 minutes) or written examination (180 minutes) The examination format will be announced no later than in the second week of lectures.

Examination schedule	Regular examination date according to the respective valid examination and study regulations of the degree program.
Assessment	Assessment according to the respective valid examination and study regulations of the degree program.
Comments	Oral examinations are offered in either English or German; written examinations are offered exclusively in English. Examinations may take place on-site or online. According to the Examination Regulations (RPO), the written exam may also be conducted as a multiple-choice test, an e-exam, or a take-home exam. The examination format must be announced by the examiner no later than in the second week of lectures.
Module number	1552680

Mathematical Models in Ship Theory

Category	Content
Modul name	Mathematical Models in Ship Theory
Credit points	6
Responsibility	MSF/Schiffbau
Contact person	Prof. Dr. Florian Sprenger
Language	English
Admission restrictions	none
Level	Master's degree
Mandatory prerequisites	none
Recommended prerequisites	Basic knowledge of: • different ship types and their subsystems • ship main parameters and their interaction • energy efficiency measures for ships • relevant environmental and safety regulations • Linear wave theory • Regular und irregular waves • Sea spectra
This module is part of the following curricula	M.Sc. Sustainable Maritime Engineering
Module duration	1 semester
Integration into curricula	Winter semester
Learning outcomes	This module covers two topics, that are to design a ship for safe operation: seakeeping, which describes the responses of a ship encountering waves at sea and manoeuvrability, which describes the capability of a ship to perform certain manoeuvres such as turning, course-keeping or stopping. The students understand the physical background that is necessary to comprehend the interaction of ships and waves as well as the theoretical principles of manoeuvrability. They are able to compare the operability of different ship design variants based on seakeeping performance indicators. Based on this foundation, they know different methods (empirical, numerical, experimental approach) to assess the seakeeping and manoeuvring performance of a ship, and are qualified to critically review the capabilities and limitations of state-of-the-art approaches and write their own program codes. Furthermore, the students are aware of the procedures of manoeuvring sea trials.
Content	• Linearized small amplitude ship motions • Roll damping • Ship motions in regular waves (RAOs) • Ship motions in irregular waves (spectra, stochastic properties) • Added resistance and involuntary speed loss • Seakeeping criteria and operability • Ship controllability, rigid body dynamics • Hydrodynamic forces in manoeuvring • Equations of motion • Turning, rudder design • Experiments and sea trials
Literature	• Lecture Notes • Lloyd, A. R. J. M.: Seakeeping: Ship Behavior in Rough Weather • Faltinsen, O. M.: Sea Loads on Ships and Offshore Structures • Fossen, T. I.: Handbook of of Marine Craft Hydrodynamics and Motion Control • Bertram, V.: Practical Ship Hydrodynamics • el Moctar, B. O. et al.: Numerical Methods for Seakeeping Problems • Brix, J.: Manoeuvring Technical Manual • Lewis, E. V.: Principles of Naval Architecture (Volume III) • Lewandowski, E. M.: The Dynamics of Marine Craft (Advanced Series on Ocean Engineering Volume 22)
Type of course	Lecture 2 SWS Exercise 2 SWS

	Total	4 SWS
Learning activities	Literature study, solving of exercises, self-study, discussions, excursions	
Learning hours	Attendance	60 hrs
	Weekly preparation	20 hrs
	Self-study	50 hrs
	Exercises	20 hrs
	Assessed coursework and preparation for exam	30 hrs
	Total	180 hrs
Prerequisites for admission to examination	1 coursework assignment	
Examinations / Assessments required for a successful completion of the module	Type of examination:	Oral examination (30 minutes) or written examination (90 minutes) The examination format will be announced no later than in the second week of lectures.
Examination schedule	Regular examination date according to the respective valid examination and study regulations of the degree program.	
Assessment	Assessment according to the respective valid examination and study regulations of the degree program.	
Comments	Oral examinations are offered in either English or German; written examinations are offered exclusively in English. Examinations may take place on-site or online. According to the Examination Regulations (RPO), the written exam may also be conducted as a multiple-choice test, an e-exam, or a take-home exam. The examination format must be announced by the examiner no later than in the second week of lectures.	
Module number	1552520	

Ship Life Cycle Digitalization

Category	Content		
Modul name	Ship Life Cycle Digitalization		
Credit points	6		
Responsibility	MSF/Schiffbau		
Contact person	Prof. Dr. Florian Sprenger		
Language	English		
Admission restrictions	none		
Level	Master's degree		
Mandatory prerequisites	none		
Recommended prerequisites	Basic knowledge of • ship design process • geometric modelling • data analysis methods		
This module is part of the following curricula	M.Sc. Sustainable Maritime Engineering		
Module duration	1 semester		
Integration into curricula	Winter semester		
Learning outcomes	Students understand the fundamentals and mathematical modelling techniques implemented in modern CAD tools. They are able to formulate target functions and set up an optimization procedure in the ship design process. They understand the necessity of an efficient information exchange between partners and tasks over the entire ship life cycle, and they can apply suitable information exchange methods and tools. The students understand the role and potential of IT in the ship production process. Based on selected examples of operational data from a real ship, they are aware of the potential and experience the challenges of heterogenous big data collected from multiple sources during ship operation. They can apply selected data science techniques to analyse large data sets.		
Content	• Product life cycle, process modelling, product data • Digitalisation of ship design: tools and methods • Fundamentals of shape definition • 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, automation		
Literature	• Lecture Notes • Lind, M. et al., Maritime Informatics • 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		
Type of course	Lecture Exercise Total		2 SWS 2 SWS 4 SWS
Learning activities	Literature study, solving tutorial questions, self-study, discussions, excursions		
Learning hours	Attendance Weekly preparation Self-study Exercises Assessed coursework and preparation for exam Total		60 hrs 20 hrs 50 hrs 20 hrs 30 hrs 180 hrs
Prerequisites for admission to examination	One coursework assignment or a presentation (approx. 20 minutes)		
Examinations / Assessments required for a successful completion of the module	Type of examination:	Oral examination (30 minutes) or written examination (90 minutes) The examination format will be announced no later than in the	

	second week of lectures.
Examination schedule	Regular examination date according to the respective valid examination and study regulations of the degree program.
Assessment	Assessment according to the respective valid examination and study regulations of the degree program.
Comments	Oral examinations are offered in either English or German; written examinations are offered exclusively in English. Examinations may take place on-site or online. According to the Examination Regulations (RPO), the written exam may also be conducted as a multiple-choice test, an e-exam, or a take-home exam. The examination format must be announced by the examiner no later than in the second week of lectures.
Module number	1552700

Safety of Maritime Systems

Category	Content
Modul name	Safety of Maritime Systems
Credit points	6
Responsibility	MSF/Schiffbau
Contact person	Prof. Dr. Florian Sprenger
Language	English
Admission restrictions	none
Level	Master’s degree
Mandatory prerequisites	none
Recommended prerequisites	Basic knowledge of • different ship types and their subsystems • ship main parameters and their interaction • relevant environmental and safety regulations • principles of intact stability
This module is part of the following curricula	M.Sc. Sustainable Maritime Engineering
Module duration	1 semester
Integration into curricula	Winter semester
Learning outcomes	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	• 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	• Lecture notes • 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 • 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	Lecture 2 SWS Exercise 2 SWS Total 4 SWS
Learning activities	Literature study, solving tutorial questions, self-study, discussions, excursions
Learning hours	Attendance 60 hrs Weekly preparation 20 hrs Self-study 50 hrs Exercises 20 hrs Assessed coursework and preparation for exam 30 hrs Total 180 hrs
Prerequisites for admission to examination	One coursework assignment

Examinations / Assessments required for a successful completion of the module	Type of examination:	Oral examination (30 minutes) or written examination (90 minutes) The examination format will be announced no later than in the second week of lectures.
Examination schedule	Regular examination date according to the respective valid examination and study regulations of the degree program.	
Assessment	Assessment according to the respective valid examination and study regulations of the degree program.	
Comments	Oral examinations are offered in either English or German; written examinations are offered exclusively in English. Examinations may take place on-site or online. According to the Examination Regulations (RPO), the written exam may also be conducted as a multiple-choice test, an e-exam, or a take-home exam. The examination format must be announced by the examiner no later than in the second week of lectures.	
Module number	1552650	

Ocean Research Technologies

Category	Content
Modul name	Ocean Research Technologies
Credit points	6
Responsibility	MSF/Meerestechnik
Contact person	Prof. Dr. Sascha Kosleck
Language	English
Admission restrictions	none
Level	Master's degree
Mandatory prerequisites	none
Recommended prerequisites	none
This module is part of the following curricula	M.Sc. Sustainable Maritime Engineering
Module duration	1 semester
Integration into curricula	Winter semester
Learning outcomes	In this module, students will explore and discuss various measurement, observation, and sampling methods used in marine research. They'll gain insights into the practical aspects of in situ and lab work, allowing them to comprehend key considerations. Armed with this knowledge, students will actively communicate vital requirements and operational modes, delving into operating principles and precision aspects. They will analyse potential interactions among the object being measured, the research instruments, and the observer. Consequently, students will possess the ability to identify and formulate optimized concepts for equipment and processes tailored to specific tasks in marine research.
Content	Measuring, observation and sampling methods for marine research: • Fundamental basics of 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	• Lecture handouts • Presentations
Type of course	Lecture 2 SWS Exercise 2 SWS Total 4 SWS
Learning activities	Presentations, discussions, literature study, solving tutorial questions, self-study, lab experiments, excursions
Learning hours	Attendance 60 hrs Weekly preparation 20 hrs Self-study 50 hrs Exercises 20 hrs Assessed coursework and preparation for exam 30 hrs Total 180 hrs
Prerequisites for admission to examination	Experimental report (approx. 15 pages) and, where applicable, a 20-minute presentation
Examinations / Assessments required for a successful completion of the module	Type of examination: Oral examination (30 minutes) or written examination (150 minutes) The examination format will be announced no later than in the second week of lectures.
Examination schedule	Regular examination date according to the respective valid examination and study regulations of the degree program.
Assessment	Assessment according to the respective valid examination and study regulations of

	the degree program.
Comments	Oral examinations are offered in either English or German; written examinations are offered exclusively in English. Examinations may take place on-site or online. According to the Examination Regulations (RPO), the written exam may also be conducted as a multiple-choice test, an e-exam, or a take-home exam. The examination format must be announced by the examiner no later than in the second week of lectures.
Module number	1552580

Large Engines, Energy Converters and Fuels for Climate Neutral Marine Applications

Category	Content
Modul name	Large Engines, Energy Converters and Fuels for Climate Neutral Marine Applications
Credit points	6
Responsibility	MSF/Kolbenmaschinen und Verbrennungsmotoren
Contact person	Prof. Dr. Bert Buchholz
Language	English
Admission restrictions	none
Level	Master’s degree
Mandatory prerequisites	none
Recommended prerequisites	• Basics of Thermodynamics • Basic knowledge in power and working machines – energy machines
This module is part of the following curricula	M.Sc. Sustainable Maritime Engineering
Module duration	1 semester
Integration into curricula	Winter semester
Learning outcomes	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.
Content	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
Literature	• Latarche, M.: Pounder’s Marine Diesel Engines and Gas Turbines; Butter- • worth-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	
Type of course	Lecture Practical course Total	2 SWS 2 SWS 4 SWS
Learning activities	Literature study, solving tutorial questions, self-study	
Learning hours	Attendance Weekly preparation Self-study Exercises Assessed coursework and preparation for exam Total	60 hrs 20 hrs 50 hrs 20 hrs 30 hrs 180 hrs
Prerequisites for admission to examination	none	
Examinations / Assessments required for a successful completion of the module	Type of examination:	Oral examination (30 minutes) or written examination (90 minutes) The examination format will be announced no later than in the second week of lectures.
Examination schedule	Regular examination date according to the respective valid examination and study regulations of the degree program.	
Assessment	Assessment according to the respective valid examination and study regulations of the degree program.	
Comments	Oral examinations are offered in either English or German; written examinations are offered exclusively in English. Examinations may take place on-site or online. According to the Examination Regulations (RPO), the written exam may also be conducted as a multiple-choice test, an e-exam, or a take-home exam. The examination format must be announced by the examiner no later than in the second week of lectures.	
Module number	1552510	

Team Project

Category	Content		
Modul name	Team Project		
Credit points	6		
Responsibility	MSF/ Fakultät für Maschinenbau und Schiffstechnik (MSF)		
Contact person	Prof. Dr. Patrick Kaeding		
Language	English		
Admission restrictions	none		
Level	Master's degree		
Mandatory prerequisites	none		
Recommended prerequisites	none		
This module is part of the following curricula	M.Sc. Sustainable Maritime Engineering		
Module duration	1 semester		
Integration into curricula	Winter semester		
Learning outcomes	Students demonstrate initiative and originality in problem solving. They act autonomously in planning and implementing of tasks at a professional level while making decisions in complex and unpredictable situations. The students develop a comprehensive understanding of techniques and methodologies applicable to their own work.		
Content	Different topics will be offered – all linked to other courses. A problem will have to be solved in a team.		
Literature	Lecture notes		
Type of course	Lecture Laboratory/practical class (compulsory attendance) Total		1 SWS 3 SWS 4 SWS
Learning activities	Discussion sessions, group work, student presentations, literature review, project work, independent study		
Learning hours	Attendance Assessed coursework and preparation for exam Total		60 hrs 120 hrs 180 hrs
Prerequisites for admission to examination	Mandatory attendance in the laboratory course		
Examinations / Assessments required for a successful completion of the module	Type of examination:	written report (~ 20 pages)	
Examination schedule	Regular examination date according to the respective valid examination and study regulations of the degree program.		
Assessment	Assessment according to the respective valid examination and study regulations of the degree program.		
Comments	Oral examinations are offered in either English or German; written examinations are offered exclusively in English. Examinations may take place on-site or online. According to the Examination Regulations (RPO), the written exam may also be conducted as a multiple-choice test, an e-exam, or a take-home exam. The examination format must be announced by the examiner no later than in the second week of lectures.		
Module number	1552730		