WESTERN NORWAY UNIVERSITY OF APPLIED SCIENCES

AND

UNIVERSITY OF APPLIED SCIENCES EMDEN/LEER

Programme description

Master of Science, Maritime Operations

Study Programme

Brief Facts:

Type of study : Full time

Department: : HS Emden/Leer Faculty of Maritime Sciences & Western Norway University of Applied Sciences, Department of Maritime Studies

Number of Credits: 120

Degree: Master of science, M.Sc

Duration: 4 semester

Campus: Haugesund/Leer

About the Programme (contents):

The maritime sector and associated branches of industry especially within the European Economic Area (EEA) have an increased need for post-graduate qualified employees with international orientation at the interface ship engineering/management and operations. Qualified candidates, combining technical, operational and managerial knowledge and who are exposed to an international environment are crucial. A joint master degree Programme with an international partner university offers a particularly suitable approach to fulfil these requirements. The newly accredited PhD-Programme in nautical operations will also recruit suitable candidates from the joint master in Maritime Operations. The degree Programme is developed and operated as a joint master Programme between Western Norway University of Applied Sciences and University of Applied Sciences Emden/Leer.

Central themes in the master Programme are related to ship technology, maritime operations and maritime management, which provide the students with a solid foundation for both working in the maritime industry and further studies on a PhD level.

Within the first semester the priorities are scientific work as well as a deeper introduction into international maritime processes. Cultural aspects, communication, safety and organizational learning are reviewed in detail. The access into maritime technology is achieved by a deeper understanding of the stability of floating devices. This is the key for safe technological maritime operation.

In the second semester the ability to analyse will be promoted by examples of complex projects. By the help of analysis models a variety of simulations are constructed. These are evaluated commercially, logistically and from the perspective of technology, quality and risk. Moreover optimizing methods are presented and applied to simulation models. Here management aspects are always a further dimension of consideration, which is imparted in a project oriented way.

In the third semester the student can expand the knowledge, skills and competencies gained so far while assisting in ongoing research projects. In this context the Faculty of Maritime Sciences in Leer offers the

profile „Sustainable Maritime Operations“. The Western Norway University of Applied Sciences has specialized in „Maritime Technology and Management“.

The graduates will be placed in a position to independently and responsibly solve technical, operational and managerial problems related to the maritime field using various methods and instruments conveyed during the course of the Programme. A student graduated from the Master of Maritime Operations has a broad competence related to technical, operational and managerial aspects of the maritime industry.

Besides specialized expertise within ship technology and maritime operations, the takeover of management duties often also requires leadership skills and management techniques as well as mental maturity, self-confidence, independence, decision-making abilities and the sense of responsibility. According to this the International Master in Maritime Operations" also focuses on the acquisition of methodological and social competence as well as personal development. Intercultural competence of the graduates is promoted during some of the courses, but also during the at least one semester abroad within the joint Programme.

Target group:

The target group for the participation in the International Maritime Operations Master's Programme are highly qualified and motivated students interested in the issue of technology, maritime operations and management and especially the international dimension of such. Moreover, they should be willing and able to analyze as well as assess complex processes from an interdisciplinary perspective.

Admission to this master's Programme is normally only granted to persons who have completed an academic degree of at least 180 ECTS (bachelor's degree or equivalent Programme of at least 180 ECTS) within relevant fields.

Graduates from different forms and fields of studies can be admitted if the completed Programme is judged to be equivalent in the regular admission procedure of the university for which the student applies.

Profile:

Haugesund: "Maritime Technology and Management"
Leer: "Sustainable Maritime Operations"

Learning outcomes:

Knowledge:

The candidate:

1. has advanced knowledge in the academic field of a variety of maritime disciplines, giving an interdisciplinary overview of the maritime environment
2. has specialized insight in offshore technology and its processes

3. can apply knowledge to new areas in the framework of design topics within the areas of maritime engineering and operations
4. has thorough knowledge of theories and methods in the field of maritime operations and technology e.g. the operation of vessels and maritime constructions as well as their safety- and risk assessment based on international research findings
5. can analyse academic problems related to the maritime field on the basis of history, tradition, distinctive characters and the place in society of the maritime industry
6. has thorough knowledge of the scholarly theories about environmental friendly systems and can discuss these in an operational, technical and management view
7. can apply his/her knowledge about the clues of safe and environmental maritime operations to the academic field of maritime technology, operation and management

Skills:

The candidate:

1. can analyse existing theories, methods and interpretations e.g. system analysis, cost benefit analysis, optimisation and risk assessment, in the field of the maritime industry
2. can deal critically with various sources of information both in the maritime and related fields and use them to structure and formulate scholarly arguments relevant for the maritime industry
3. can use relevant methods for research and scholarly development to point out the sustainability of technological developments as well as analyse and develop environmentally friendly and resource efficient solutions in technological systems, products and processes
4. can carry out an independent, limited research or development project under supervision and in accordance with applicable norms for research ethics
5. can analyze existing theories, methods and interpretations in the maritime field and work independently on practical and theoretical problems relevant for the field.

General competence:

The candidate**:**

1. can apply his/her knowledge and skills in new areas in order to carry out advanced assignments and projects
2. can communicate extensive independent work and masters language and terminology of the maritime sector, incl. rules, legislation and classification as well as knowledge of maritime technology and innovation
3. can contribute to new thinking and innovation processes within the maritime filed and independently initiate and implement academic and interdisciplinary collaboration
4. can analyze relevant academic, professional and research ethical problems related to the maritime field
5. can assume responsibility for own academic development and specialization that can finalize in a doctor course
6. can communicate about academic issues, analyses and conclusions related to the maritime field with both specialists or the general public

Forms of assessment (types of examination):

The forms of assessments are chosen according to the learning outcomes of the difference courses and the total learning outcomes of the Programme, and include assessment forms such as portfolio, written exams, oral exam, project thesis and master thesis.

We strive to have different assessments within the Programme so that the students can be tested on several aspects such as theory, ability to reflect, to work in groups, academic skills and so on.

More information regarding the forms of assessment can be found in the module descriptions.

The forms of assessment have two goals:

1. To give the students feedback to which level they are at, and thereby facilitate improvement.
2. To say something about the students' learning outcomes.

The grade scales consists of the grades A-F and passed/not passed. The grades A-E indicates that the student has passed the exam. The grade F indicates that the student has failed the exam. The grade C reflects a good and solid academic performance.

Teaching methods:

The teaching and learning methods are varied and aim to make the students actively participate and build up independent thinking. The teaching methods vary, with lectures, solving exercises in groups, and problem-based learning being the most common. In addition to individual work, group work is encouraged throughout the Programme. It is expected that the students show up for class well prepared, as the lecturers place a significant amount of time and effort in preparing the lectures.

Information and communication technology are integrated in the teaching, with Moodle/Fronter and computer based support systems as important tools in the scientific and educational work.

Practical training:

N/A.

R&D base:

A research-based and analytical approach to the topics is a key feature of the study. This means that teaching reflects a methodological approach to problems and the use of academic themes. Most lecturers conduct research and they convey their knowledge to students by combining theoretical and applied insights as well as exposing students to research issues and results from the industry at an early stage. In addition the students learn about Philosophy of science, research design and methods in the first semester. This course is tightly connected to several other courses within the Programme, such as e.g. the Maritime HTO-course and the master thesis.

The lecturers will guide students working with their master's thesis. The students will learn to apply relevant research literature and use research-based knowledge in their academic work.

Internationalization:

In this study Programme the first and second semesters are compulsory. During the first semester the students are in Haugesund, Norway and in Leer, Germany, during the second semester. In the third semester the students can select a profile, which will decide the place of study (Norway or Germany). The students' choice of topic for their master thesis affects the location for their last semester.

Practical information about the Programme:

This Programme is a joint master study Programme between the Western Norway University of Applied Sciences and the University of Applied Sciences Emden/Leer. The Programme takes 4 semesters. The first semester is compulsory in Haugesund (Norway) and the second semester compulsory in Leer (Germany). The lectures are all given in English. The two partner institutions provide each one profile that can be elected in the third semester. This determines the location of study. The master thesis in the fourth semester should be within the frame of the profile. Overall 120 ECTS are reached when completed the study Programme.

The study Programme is managed by a common steering committee consisting of members from both partners. Two students of the study Programme are part of this steering committee as well as 2 representatives of the maritime industry.

The students apply for this study Programme at the Western Norway University of Applied Sciences. A common selection committee will select the students from all the applicants. The students are enrolled at both universities. For the examinations the local examination rules are applied. A good level of understanding and speaking of English is recommended. At least a B2 level according the Common European Framework of References for Language is required.

The teaching methods vary, with lectures, exercises in groups, and problem-based learning. The workload in a course is measured in credits. One year full-time is 60 credits. Most courses are 10 or 6 credits. The courses run over one semester. In a full-time study, a minimum of 40 hours of productive work each week during the study is required. Some students will need to use more time.

An English online application is provided for all applicants.

Application:

Deadline December 1st for international students (outside EU/EAA).

Deadline April 15th for EU/EAA students

The Programme is scheduled to start last week of August.

The second semester is starting 1st of March in Leer.

Application and admission requirements:

A student who applies to the "Maritime Operations" Masters Programme needs to upload the following documents within the deadlines;

- Certificates and Diplomas from previous studies at a recognized higher education institution, or provide documentation indicating that the student will earn his/her first degree (not less than 3 years of full time studies) from such an institution by the time of enrolling in the Programme.
- Transcript of completed courses and grades for each semester (including course-list)
- Proof of English language skills (B2 CEF or equivalent)
- Statement of Purpose/motivation letter
- Curriculum Vitae
- Copy of the passport ID page
- Additional information related to the field

All documents, except for copies of the passport ID page and diploma/degree certificate must be submitted in English. All copies should be certified by the respective institutions, i.e. lawyers, Ministries, etc.

The Selection Committee will select the students on the basis of their:

- Relevant academic background (bachelor or equivalent).

If two or more candidates are of similar ranking, then the statement of Purpose/Motivation Letter will be taken into consideration upon selecting the candidates.

Programme / Course plan (Study model, overview over the subjects in the Programme):

Both institutions retain the right to make changes due to unforeseen events.

Programme / Course plan:

Course name	ECTS	C/E*	Semester	Organization
Philosophy of Science, Research Design and Methods	10	C	1	Session-based teaching Haugesund
Safety and Human Factors	10	C	1	Session-based teaching Haugesund
Modern ship design: Safety, Limitations and Hazards	10	C	1	Session-based teaching Haugesund
Maritime Computational Fluid Dynamics	6	C	2	Session-based teaching Emden/Leer

Cost Accounting	6	C	2	Session-based teaching Emden/Leer
Ship Propulsion Systems	6	C	2	Session-based teaching Emden/Leer
Quality and Risk Management	6	C	2	Session-based teaching Emden/Leer
Applied Approach to Tools of Optimization and Simulation	6	C	2	Session-based teaching Emden/Leer
Alternative 1: Profile: Sustainable Maritime Operations (30 ECTS) in Leer				
Technical Aspects of Sustainable Maritime Operations	6	E	3	Session-based teaching Emden/Leer
Operational Aspects of Sustainable Maritime Operations	6	E	3	Session-based teaching Emden/Leer
Economical Aspects of Sustainable Maritime Operations	6	E	3	Session-based teaching Emden/Leer
Maritime Project	12	E	3	Session-based teaching Emden/Leer
Alternative 2: Profile: Maritime Technology and Management (30 ECTS) in Haugesund				
Subsea Technology and Operations	10	E	3	Session-based teaching Haugesund
Marine Operations	10	E	3	Session-based teaching Haugesund
Ship Operation- and Maintenance Management	10	E	3	Session-based teaching Haugesund
Master thesis				
Master thesis	30	C	4	Session-based teaching Haugesund/ Emden-Leer

*C=Compulsory courses, E=Elective courses

4. 1 First semester Haugesund

For the first semester please check:
https://www.hvl.no/en/studies-at-hvl/study-programmes/maritime-operations/

4. 2 Second semester Leer

Documents added:

Applied Approach to Tools of Optimization and Simulation

Financial Business Administration and Cost Accounting

Maritime Computational Fluid Dynamics

Ship Propulsion Systems

Quality and Risk Management

Serving University: University of Applied Sciences Emden/Leer
Study course: M. Sc. Maritime Operations

Module description: Applied Approach to Tools of Optimization and Simulation

Semester	Frequency of offer	Duration	Type	ECTS-Points	Student Workload
2	SS	1 Sem	obligatory	**6**	(160) 48/112

Preliminaries for attendances	Used for	Conditions to give ECTS Points	Teaching method	Responsible
		Portfolio	lectures, supervision, net discussions, net based resources and work with portfolio elements. Lecturers and students will collaborate and communicate through the Internet-based system for teaching and learning; Moodle	Prof. Dr. Marcus Bentin

Qualification aims

This module aims to introduce students to use quantitive methods and techniques for effective decisions making; model formulation and applications that are used in solving business decision problems.

Knowledge:
The student has advanced knowledge:

- about OR science and its models and methods to apply them
- about the fundamentals of artificial intelligence its background and application possibilities to apply them
- has an understanding of the limits of the different optimization methods to evaluate the results of the methods.
- about probability concept, understand the theory of statistics and can use it on practical problems
- how to interprete optimization results

Skills:
The Student:

- can solve analytic optimization problems using popular tools

- can program the basics of a numerical optimization method
- can use software for optimizing a real world maritime problem

General Qualifications:
The student is able to:

- can analyze and structure a problem to extract the main parameters of a problem and describe the objects for optimization
- can plan, conduct and evaluate the problem in an interdisciplinary framework

Content
Operations research helps in solving problems in different environments that needs decisions. The module covers tradition topics of Operational research (OR) that include: linear programming, Transportation, Assignment. But this is not only limited to business problems, also technical problems have to optimized, for example weight and strength of a construction, resistance of a vessel by variating the shiphull. In these cases heuristic optimisation approach know as artificial intelligence are used. At least but not at last many processes are probilistic hence the optimum has to be found for unsure situation. For all of this a kind of simulation model is needed. These can be analytic ones but often they are a kind of discrete / numerical simulation model. Analytic techniques and computer packages will be used to solve problems facing business managers in decision environments. - Introduction to Operations Research (OR) - Introduction to Foundation mathematics and statistics - Linear Programming (LP), LP and allocation of resources, LP definition, Linearity requirement - Maximization Then Minimization problems. - Graphical LP Minimization solution, Introduction, Simplex method definition, formulating the Simplex model. - Linear Programming ¿ Simplex Method for Maximizing. - Simplex maximizing example for similar limitations, Mixed limitations - Example containing mixed constraints, Minimization example for similar limitations. - Introduction to Genetic Algorithms and Neural Networks - Introduction to simulated aneeling and branch and bound methods - Using an optimisation algorithm on a maritime challenge (Logistic, resistance, strength, ...) - Probability concepts and simulation, Monte Carlo Methods

Lectures		
Lecturer	**Title of lecture**	**Contact hours**
Prof. Dr. Marcus Bentin	Applied Approach to Tools of Optimization and Simulation	48

Serving University: University of Applied Sciences Emden/Leer
Study course: M. Sc. Maritime Operations

Module description: Financial Business Administration and Cost Accounting

Semester	Frequency of offer	Duration	Type	ECTS-Points	Student Workload
2	SS	1 Sem	obligatory	**6**	(160) 48/112

Preliminaries for attendances	Used for	Conditions to give ECTS Points	Teaching method	Responsible
Yes, (will be specified in the course plan by semester start)		Portfolio	Lectures, exercises, quizzes, and interactive discussions	Prof. Dr. Klaus Heilmann

Qualification aims

The student has broad knowledge in various aspects of Cost accounting for Decision Making and Control

Knowledge:
The student has advanced knowledge:

- Can explain various principles for cost estimation, cost distribution, and product calculations in general and can apply them to the field of maritime operations.
- Is familiar with budgeting as a management tool, and can explain how budgeting processes are organized and carried out.
- Can explain how new investments of environmental friendly systems are considered, and apply the relevant investment appraisal methods and evaluate their impact on maritime operations
- how annual accounts are prepared and analyzed.
- Can explain and use the basis for the time value of money and the relationship between the use of net present value as a decision-making criterion for investments.
- Knows the concepts of expenses, costs, expenditures, revenues, and payments and has acquired a good understanding of the cost concept and cost variation in order to synthesizing the different aspects.
- Knows and applies various principles for cost distribution, and product calculation and knows how to assess them in the process of making price decisions for maritime products & services.
- Is familiar with budget as a management tool, and can account for how budget processes are

organized and carried out.

Skills:

The Student:

- Can budget cash flows that are relevant for decision-making concerning investment and financial decisions.
- Can carry out profitability analyses based on net present value.
- Can calculate an internal rate of return and give recommendation based on this calculations.
- Is able to carry out cost, profit and volume analyzes.
- Can apply the most common instruments of strategic management accounting to evaluate an organization's performance and to support strategic decision-making.
- Is able to create pre and post calculations using the self-cost and contribution principles for firms in various business sectors.
- Can compose cost calculations based on the traditional costing methods.
- Can design and set up budgets (result, liquidity, and balance budgets) based on the company's plans and activities for a given period and analyze the connection between the company's various subordinate budgets.
- Can apply knowledge from the various academic fields to practical problems in the workplace and can collect and analyze relevant information in order to solve a wide specter of problems within Cost and management accounting.
- Is able to update his/her own knowledge throughout his/her working life.

General Qualifications:

The student is able to:

- Has basic academic insight, analytical training, and an understanding of problems within the general fields of Cost and Management Accounting.
- Can plan and carry out his/her own analyses of practical problems and make decisions based on these analyses.
- Can convey academic material both orally and in writing, and can exchange views and experience, thereby contributing towards the development of good work experiences.
- Can ask critical questions about and reflect upon central prerequisites and assumptions within this academic field.

Content

The course covers the most important aspects of cost accounting for Decision Making and Control for technical oriented participants and managers in the maritime industry. The course introduces the foundations of investments and finance, several aspects of Management Accounting and Controlling including Management Accounting in a Changing Environment.

The module focusses on the following areas:

- Prerequisites and foundations for investments and finance including calculating cash flows relevant for decision making, interest calculations and financial mathematics, net present value calculations, and investment analysis
- Introduction of key ideas, concepts, and tools of strategic management accounting and control
- The nature of Costs
- Budgeting
- Cost Allocation: Theory and Practices

- Absorption Cost Systems: Theory and Criticisms/Limitations
- Variable Costing
- Activity-based Costing
- Management Accounting in a Changing Environment

Lectures		
Lecturer	**Title of lecture**	**Contact hours**
Prof. Dr. Klaus Heilmann	Cost Accounting	48

Serving University: University of Applied Sciences Emden/Leer
Study course: M. Sc. Maritime Operations

Module description: Maritime Computational Fluid Dynamics

Semester	Frequency of offer	Duration	Type	ECTS-Points	Student Workload
2	SS	1 Sem	obligatory	**6**	(160) 48/112

Preliminaries for attendances	Used for	Conditions to give ECTS Points	Teaching method	Responsible
		Portfolio	lectures, project-oriented conceptual exercises	Prof. Dr.-Ing. Jann Strybny

Qualification aims

Knowledge:
The student has advanced knowledge in:

- identifying the significant physical processes (current, propulsion, wind, waves, morphodynamics),
- prioritizing the dimensionality and relevant scales in time and space regarding the flow close to vessels and offshore structures,
- choosing suitable numerical CFD algorithms on the basis of the Navier Stokes Equations,
- analyzing of highly three-dimensional and transient fluid dynamic processes in the surroundings of maritime structures,
- evaluating the limitations of numerical models, especially the risk of empirical approaches included in numerical models,
- indentifying the need and availability of appropriate measurement techniques for the steering, calibration and verification of models,
- planning maritime measurements in laboratory (theory of similarity) and nature,
- judging limits of accuracy of different maritime modelling and simulation concepts.

Skills:
The student:

- can design a so called hybrid modeling concept for investigating complex fluid dynamics around a maritime system including mathematical and empirical models,
- can build complete chains of open source computational fluid dynamic models including preprocessing (e.g. FreeCAD), processing (e.g. OpenFOAM) and postprocessing (e.g. ParaView),
- can create measurement campaigns for understanding identified maritime fluid dynamic processes in a targeted manner.

General Competences:
The student is able to:

- operate with systems for distributed work and remote access (e.g. VPN, SSH, AnyDesk), to apply professional scientific IT-systems on the basis of the operating system Linux and to use high performance computing systems.
- supervise the quality of ordered highly cost-intensive investigations on the basis of computational fluid dynamic models or in towing tanks or with the help of research vessels.

Content

The students attending successful the course acquire an advanced understanding of the conceptual design of fluid dynamic models in the field of maritime sciences. The way is shown to a suitable computational fluid dynamics modeling strategy for a complex maritime system. Special emphasis will be placed on a broad introduction of the scientific term “modeling”. The most relevant maritime fluid dynamic investigation concepts (mathematical, lab and nature) will be combined to hybrid modeling strategies. Special emphasis is placed on teaching students the use of open source CFD procedures interactively.

Close links to applied maritime topics:

- Scope on special maritime engineering applications. Broad range of exercises with a close interactive collaboration: opportunities and limits of generating solutions on the basis of fluid dynamic investigations for example for the hull of a vessel or a wind propulsion system or the wave forces on offshore structures or sediment transport in waterways.

Lectures

Lecturer	Title of lecture	Contact hours
Prof. Dr.-Ing. Jann Strybny & Team	Maritime Computational Fluid Dynamics - lectures and self-performed IT-exercises in the CFD lab - attendance in presence in Leer is highly recommended	40
Prof. Dr.-Ing. Jann Strybny & Team	Maritime Computational Fluid Dynamics - self-performed experiments in the Maritime Experimental Center in Leer - mandatory attendance in presence in Leer for each student - one day usually in May of each academic year - the exact date will be announced at the beginning of each summer term	8

Serving University: University of Applied Sciences Emden/Leer
Study course: M. Sc. Maritime Operations

Module description: Quality and Risk Management

Semester	Frequency of offer	Duration	Type	ECTS-Points	Student Workload
2	SS	1 Sem	obligatory	**6**	(160) 48/112

Preliminaries for attendances	Used for	Conditions to give ECTS Points	Teaching method	Responsible
		Portfolio	lectures, supervision, net discussions, net based resources and work with portfolio elements	Prof. Rudolf Kreutzer

Qualification aims

This module aims to introduce students to use quantitive methods and techniques for effective decisions making; model formulation and applications that are used in solving business decision problems in regard to QMS.

Knowledge:
The student has advanced knowledge:

- to describe the risk based approach in maritime operations
- to compare the principles of risk management (e.g. HAZID, HAZOP, ALARP) and how to apply it in maritime operations
- to evaluate and differentiate the existing quality management systems (QMS)
- to analyze QMS used in the maritime environment (e.g. ISM, TMSA, OVMSA)
- to point out the need for change management

Skills:
The Student:

- can describe the risk management processes of a company in regard to technical safety and safe working operations
- can integrate QMS into existing management structures of a company
- can manage quality management systems purpose-oriented in the maritime environment

- can analyze quality management systems, formulate corrective actions and support the implementation
- can implement an effective change management
- can design appropriate measures to improve the safety of ship operations
- can conduct incident/accident investigations

General Qualifications:
The student is able to:

- analyze and structure a problem to extract the main parameters of a problem and describe the objects for optimization
- plan, conduct and evaluate a problem in an interdisciplinary framework

Content

Shipping is a process that that is linked to operational (e.g. navigational risks), safety (e.g. fire, abandoning ship risks) and environmental (e.g. handling of cargos and bunkers) risks and is taking place in a global competition. Similar problems can be found in varying degrees in all industries (e.g. offshore, aviation, automotive).
The student should be able to understand and apply the generic philosophy of the risk based approach and quality management. He is a specialist in maritime processes regarding the operation of a ship, as well as for offshore structures. He can analyze the potential risks to human safety and to the environment and is familiar with the process of safety management and environmental protection.

- The term "quality" in the maritime environment
- Fundamentals of quality management systems (QMS)
- Quality Management Standards (e.g. ISO 9000, ISO 14000, ISO 18000, ISO 50000)
- Introduction into "Quality Management Systems" in the maritime environment (ISM, TMSA, OVMSA)
- Prerequisites for a successful use of QMS in companies
- Strategies for creating, implementing, auditing, improvements (e.g. quality indicators, handling of deviations, Plan-Do-Check-Act cycle) of QMS
- Methods to conduct incident/accident investigations (e.g. Bow Tie, STEP, Loss Causation Model)
- Introduction into the risk management process (Identification, Assessment, Evaluation and control of risks) in the maritime environment
- Fundamental aspects of accident prevention and safe working procedures on ships and offshore installations
- Management of change

Lectures

Lecturer	Title of lecture	Contact hours
Prof. Rudolf Kreutzer	Quality and Risk Management	48

Serving University: University of Applied Sciences Emden/Leer
Study course: M. Sc. Maritime Operations

Module description: Ship Propulsion Systems

Semester	Frequency of offer	Duration	Type	ECTS-Points	Student Workload
2	SS	1 Sem	obligatory	**6**	(160) 48/112

Preliminaries for attendances	Used for	Conditions to give ECTS Points	Teaching method	Responsible
		Portfolio	lectures; work in groups (layout work, experiments/ measurements)	Prof. Freerk Meyer

Qualification aims

Knowledge:
The student has advanced knowledge in:

- ship propulsion systems, fuels, environmental aspects and ship handling.
- evaluation of ship propulsion systems in order to give optimized configuration hints for a vessel.
- ship system layout and basic international rules for system layout to apply them in system design
- major research methodologies for applied research to analyses according ship propulsion, engines and ship operation systems

Skills:
The student is:

- able to analyze ship propulsion systems on different types of ships
- able to evaluate the basic layout of different systems on board
- able to measure and analyze engine data (engine operation in the engine room lab)
- able to discuss/ work with the different partners in the ship building/ maritime industry

General Qualifications:
The student is able to:

- work in groups, manage report writing, presentation, function in a multi-disciplinary and intercultural team

Content
- Introduction to ship propulsion systems (Layout, Engines, Gears, Bearings, Seals, Shafts, Propeller, Diesel- Electric systems, ...) - Introduction to ship operating systems (Layout, pipework, devices, fittings, ¿) - Introduction to ship engines (2 stroke engines, 4 stroke engines, gas turbines) - Introduction to ship fuels (todays fuels and future fuels) - Different Fuel systems according the fuel (tanks, handling, safety) - Thermodynamics of combustion engines => todays and future fuels - Combustion => todays and future fuels - Propulsion system dynamics, Safety and Availability, installation complexity of the different propulsion systems /propulsion engines - Environmental aspects / efficiency, exhaust gas composition - Calculation and measurement methods for engine power output, fuel consumption, heat exchange, temperatures, pressures, flows, speed, exhaust gas composition, - Engine Operation in the Engine Room Lab. Working with real measurement data from combustion engines

Lectures		
Lecturer	**Title of lecture**	**Contact hours**
Prof. Freerk Meyer	Ship Propulsion Systems	40
Prof. Freerk Meyer & Team	Engine Operation in the Engine Room Lab (1 day) (Maritime Experimental Center in Leer) Data Collection, Data Analyze, Data Discussion Mandatory attendance in Leer in presence during the engine operation (General realization during the lecture week in May, Subject to change)	8

4. 3 Third semester Leer

Documents added:

Economical Aspects of Sustainable Maritime Operations

Maritime Project

Operational Aspects of Sustainable Maritime Operations

Technical Aspects of Sustainable Maritime Operations

Serving University: University of Applied Sciences Emden/Leer
Study course: M. Sc. Maritime Operations, Profile: Sustainable Maritime Operations

Module description: Economical Aspects of Sustainable Maritime Operations

Semester	Frequency of offer	Duration	Type	ECTS-Points	Student Workload
3rd	WS	1 Sem	Obligatory	6	(160) 48/112

Preliminaries for attendances	Used for	Conditions to give ECTS Points	Teaching method	Responsible
		Portfolio	lectures, group work, supervision, net discussions, net based resources, and work with portfolio elements	Prof. Dr. Klaus Heilmann Prof. Dr. Mathias Münchau

Qualification aims

Knowledge:
The student has advanced knowledge:

- management and decision methods and identifies which is best to select and to apply
- analyze the managerial view on a maritime problem
- point out and analyze the relation between environmental and business aspects of a project
- understands methods for analyzing investment decisions and can assess and predict the financial outcomes of investments
- creating and writing project forecasts especially regarding their financial and economical impacts
- producing a project-related risk analysis and concluding about it in regard to their environmental friendliness
- recommending which investment opportunity to choose and applying it also new areas related to maritime operations
- create a ship evaluation based on ship evaluation standards
- understand the structure and mechanisms of shipbuilding and ship purchase contracts
- assess the legal implications regarding drafting and negotiating of shipbuilding contracts
- explain the financing instruments in the framework of shipbuilding and ship purchase projects
- contrast various forms of financing in the general context of shipping economics

Skills:

The student:

- can use management tools
- is able to analyze and structure maritime problems
- can create and appraise cost benefit analysis
- can assess the risks of maritime projects especially regarding economical and legal aspects
- can contribute towards developing project ideas / Specify project goals /
- is able to plan projects / follow-up project work /
- can analyze and structure a problem to extract the main parameters of a problem and describe the objects for optimization
- can plan, conduct and evaluate a the problem in an interdisciplinary framework
- understands the discipline's terminology and complexity, and has a critical insight into its methodology
- can apply knowledge and skills from the discipline in an independent manner in the various phases of a project by demonstrating cooperation, responsibility, and introspection
- can classify the respective aspects into the frame work of sustainability
- can estimate the impact of the discussed aspects on the sustainability of the maritime operations

General Qualifications:
The student is able to:

- enlarge its skills in interdisciplinary works
- Identify and communicate the essential points of its scientific work
- enlarge its skills concerning self and time management when processing complex problems
- evaluate the quality of existing research literature
- plan, conduct and evaluate a limited research project

Content

This module focusses on enlarging knowledge and acquiring skills about the economical aspects of sustainable Maritime Operations from a managerial view. It is divided into two parts. The first part is covering the legal perspective, the second part is covering the economical perspective of that approach.

The legal perspective deals with the most important legal aspects of shipbuilding projects and has a particular emphasis on the shipbuilding contract and the relevant international safety and environment regulations.

The economical perspective deals with the most important economic aspects of shipbuilding projects. Part A covers the theory and methods of Capital Investment Decisions. Based on the process of an investment appraisal the gathering of data for creating a forecast, performing and assessing financial analysis with the forecast, designing a business proposal and selecting the best opportunity will be learned. The content of Part B are selected aspects of project financing, project-related risk analysis, and economic evaluation of investments using real existing ship investments as an example. Finally a ship evaluation based on ship evaluation standard is conducted.

Legal aspects of shipbuilding projects:

- Legal framework: standard contracts, applicable law, technical regulations
- Main elements and key issues of a shipbuilding contract
- Contract and claim management

- Liability, insurance and dispute settlement
- Ship repair and conversion contracts; ship sale and purchase contracts

Economic and financial aspects of shipbuilding projects:

- Theory and methods of analyzing investment decisions
- Stages of an investment appraisal:
  - Gather data and create a forecast
  - Perform and assess financial analysis
  - Design business proposal and select the best proposal
- Financing of shipbuilding projects
- Project-related risk analysis
- Controlling of shipbuilding projects
- Economic evaluation of investments using real existing ship investments as an example
- Ship evaluation based on Hamburg Ship Evaluation Standards

Lectures		
Lecturer	**Title of lecture**	**Contact hours**
Prof. Dr. Münchau	Legal perspective of Economical Aspects of Sustainable Maritime Operations	16
Prof. Dr. Heilmann	Economical perspective of Economical Aspects of Sustainable Maritime Operations	32

Serving University: University of Applied Sciences Emden/Leer
Study course: M. Sc. Maritime Operations, Profile: Sustainable Maritime Operations

Module description: Maritime Project

Semester	Frequency of offer	Duration	Type	ECTS-Points	Student Workload
3rd	WS	1 Sem	obligatory	12	(320) 96/224

Preliminaries for attendances	Used for	Conditions to give ECTS Points	Teaching method	Responsible
		Term paper attendance of seminar "Sustainable Maritime Operations"	course contains supervision. Students will collaborate and communicate through our Internet-based system for teaching and learning; Moodle	Prof. Dr. Marcus Bentin

Qualification aims

Knowledge:
The students:

- have practical and theoretical knowledge of the topic he/she deepened in the project using scientific approaches
- know the theory and concepts of sustainability to apply them

Skills:
The students:

- can apply scientific methods on a specific task to solve a problem
- can critical evaluate the process of investigation under scientific aspects; correctly interpret
- find results and their own contribution to the solution
- can classify their results into the theory of sustainability

General Qualifications:
The students:

- enlarging their skills concerning self and time management when processing complex problems
- Identify and communicate the essential points of its scientific work

Content
A term paper is the self-written processing of a subject-specific or interdisciplinary task. The student shall work independently on the basic of scientific methods to solve the tasks of a maritime problem. These projects are often integrated in ongoing research projects. The necessary deepened theory for the project is prepared by several lectures and modules which are provided in the third semester. The offered lectures are clustered in three master modules: - Technical Aspects of Sustainable Shipping - Operational Aspects of Sustainable Shipping - Economical Aspects of Sustainable Shipping This module includes a seminar on sustainability, where the theory of sustainability will be discussed. It is a holistic approach to understand the socio-ecological process of maritime operations characterized by the pursuit of a common ideal. Therefore the ideal has to be defined in a given time and space. However, it will be shown that persistently and dynamically approaching the ideal will be a process resulting in a sustainable system. - Three pillars of sustainability with environment, social and economic pillars. - The requirements of UN and IMO on a sustainable maritime industry - Resiliency of the maritime environment and ocean - Measurement of sustainability - Consumption as major driver of human impact on earth - Impact of human on the Ecosystem - Sustainable development goals and how the maritime industry can participate - How to decouple environmental degradation and economic growth in maritime industry - The social dimension of the maritime industry - The cultural dimension of the maritime industry

Lectures		
Lecturer	**Title of lecture**	**Contact hours**
All lectures	supervision	96
Prof. Dr. Michael Schlaak	Sustainable Maritime Operations	24

Serving University: University of Applied Sciences Emden/Leer
Study course: M. Sc. Maritime Operations, Profile: Sustainable Maritime Operations

Module description: Operational Aspects of Sustainable Maritime Operations

Semester	Frequency of offer	Duration	Type	ECTS-Points	Student Workload
3rd	WS	1 Sem	Obligatory	6	(160) 48/112

Preliminaries for attendances	Used for	Conditions to give ECTS Points (Prüfungsform/ Prüfungsdauer	Teaching method	Responsible
		Portfolio	lectures, supervision, net discussions, net based resources and work with portfolio elements	Prof. Michael Vahs

Qualification aims

Knowledge:
The students:

- know the parameters in operation that influence the sustainability and can analyze them
- have knowledge about environmental legislation how to apply it
- have knowledge of the different simulation techniques needed to understand, analyze and train maritime operations, as well as the relations and dependencies between each simulation system.
- have deep knowledge about nautical operations, how to discuss and evaluate them.
- have knowledge about different maintenance concepts and knows which one should be applied
- know the parameters to analyse and optimise the fleet
- know different sensors and methods to retrieve data
- know concepts that describe the ship performance like EEDI and EEOI and can apply them
- know concepts to manage sustainability like SEEMP and can apply them
- have practical and theoretical knowledge about the tools used to measure a broad range of Ocean parameters, e.g. water sampling technology, CTD, Secchi disk, bottom samplers, plankton and micro plastic nets
- have practical and theoretical knowledge about sonar systems and underwater camera systems
- have practical and theoretical knowledge about the interaction between shipping and aquatic ecosystems
- have knowledge about navigational aspects in measurement campaigns

- have knowledge about the different wind propulsion systems and can evaluate their efficiency, potentials and limitations
- know the main parameters in operating different propulsion systems and how to maximize their efficiency, sustainability and economy
- analyses and optimises nautical operations for these systems.

Skills:
The students:
- work with scientific methods
- analyse the problem, build models
- use tools for monitoring and measuring
- can evaluate the results of simulation models against reality
- are able to use at least one of the simulation tools to model a part of the simulation chain
- can document modeling and simulation processes and describe results
- can analyse statistical data and draw the right conclusion
- can use optimisation techniques and give advice for the most important parameters of sustainability
- can plan a scientific measurement campaign
- can critically evaluate and analyse the measured parameters according international and national standards
- can operate the different tools e.g. sonar system, underwater camera, water sampling technology, CTD, Secchi disk, bottom samplers, plankton and micro plastic nets
- can evaluate the efficiency of different propulsion systems under service conditions
- estimate their influence on the ship's safety
- can formulate the project structure to develop ship propulsion from renewables
- can classify aspects into the framework of sustainability
- can estimate the impact of the discussed aspects on the sustainability of maritime operations

General Qualifications:
The students:
- enlarging their skills in interdisciplinary works
- Identifying and communicating the essentials of scientific work
- enlarging their skills concerning self and time management when processing complex problems
- evaluating the quality of research literature
- planning, conducting and evaluating a research project (low complexity)

Content

This module prepares the student for the operational view on maritime projects she/he has to prepare in the third semester. The lecture will be fitted to the student needs and depends on the projects chosen for the third semester. In the following the learning outcome is described as a sum of all possible lectures that can be given.
The operational aspect can be trained, understood and analysed by different simulation systems. Therefore this module gives a complete introduction into the chain of computational maritime modeling and simulation techniques in the course of lab exercises:
- Computer Aided Geometric Modeling
- Computational Fluid Dynamics (CFD)

- Ship Handling Simulation, Offshore- and DP-Simulation
- Engine Room Simulation, Liquid Cargo Handling Simulation
- Modeling and Simulation of the sustainable operation of vessels
- Interaction of vessels with other vessels, waterways, harbours, various coastal and offshore structures
- Modeling navigational aspects on the engineering of waterways and port structures
- Investigation on maritime operations influencing the marine environment
- Visualization
- Scientific reporting

The efficiency and sustainability of ships have to be enlarged steadily. Therefore, the condition of a vessel has to be determined to know the potential of improvement or to ensure that safe and environmentally friendly operations are obtained. This is a large field of data collection using sensors or manual stored data from all relevant systems of the vessel including the ship's hull. All these data have to be interpreted to draw the right conclusion. There are questions like:

- optimal trim
- optimal speed
- optimal maintenance concepts for each system
- managing the fleet and its sustainability

Preparation and conduct of expedition cruises:

- Research expedition cruises (e.g. 1 week)
- Operation of sailing research vessels to minimize ship-environment interaction
- Planning of measurement campaigns on research vessels
- Field exercises for the measuring of a broad range of ocean parameters:
    - marine weather observation
    - usage of water sampling technology, CTD, Secchi disk, bottom samplers, plankton and micro plastic nets

Operation of sonar imaging systems and underwater camera systems, influences on the results caused by navigational aspects

- Laboratory exercises regarding the interaction between shipping and aquatic ecosystems e.g.:
    - control of the operational reliability of ballast water treatment technologies with systems approved by IMO, US-Coastguard
    - effectiveness of environmental friendly anti fouling systems
- Analysis, scientific reporting

Operation of wind powered ships: different technologies, on-board implementation, operation, potentials and limitations:

- Technologies: soft sails, rigid wing sails, Flettner rotors, kites, others
- Implementation: system installation, impact on ship design, new-build and retrofit
- System operation: handling, efficiency, stability, manoeuvring characteristics, other safety aspects, hybrid mode
- Economic considerations: analysis of cost structure, savings
- Case studies (from current research projects)

Lectures		
Lecturer	**Title of lecture**	**Contact hours**
Prof. Michael Vahs; Prof. Rudolf Kreutzer	Operational Aspects of Sustainable Maritime Operations	48

Serving University: University of Applied Sciences Emden/Leer
Study course: M. Sc. Maritime Operations, Profile: Sustainable Maritime Operations

Module description: Technical Aspects of Sustainable Maritime Operations

Semester	Frequency of offer	Duration	Type	ECTS-Points	Student Workload
3rd	WS	1 Sem	Obligatory	6	(160) 48/112

Preliminaries for attendances	Used for	Conditions to give ECTS Points	Teaching method	Responsible
		Portfolio	lectures, supervision, and work in groups (layout work, experiments / measurements in the ship propulsion and operation labor), net discussions, net based resources and work with portfolio elements	Prof. Dr. Marcus Bentin

Qualification aims

Knowledge:
The student:

- analyzing the forces acting on a ship
- understanding a design brief
- analyzes the main parameters of the forces in ship operation that influence the sustainability
- stating the effects of the forces on the ship design.
- advanced understanding of the conceptual design of models in the field of engineering sciences. Special emphasis is on identifying the significant physical processes and the choice of the most efficient modelling type
- has an insight into the methodology of selection of materials
- knowledge to analyze ship propulsion systems, fuel consumption, environmental aspects and ship handling
- knowledge to evaluate modern ship system layout and basic international rules for system layout

Skills:
The students:

- working with engineering methods
- design parts of a vessel respecting the environment
- analyze, measuring and structure maritime problems
- can calculate forces according thump rules and classification society
- can use different programs to calculate resistance and maneuvering forces
- can discuss the interaction of numerical simulations with field measurements and laboratory
- measurements including the theory of similarity
- can calculate the stress in the rig and foundation
- can design the sails for the required ship speed
- able to analysis ship propulsion systems on different types of ships
- able to layout the different systems on board (according todays and future rules for environmental safe ship design)
- able to work in groups, manage report writing, presentation, function in a multi-disciplinary and intercultural team
- can classify the respective aspects into the frame work of sustainability
- can estimate the impact of the discussed aspects on the sustainability of the maritime operations

General Qualifications:
The students:

- enlarging their skills in interdisciplinary works
- Identify and communicate the essential points of its scientific work
- enlarging their skills concerning self and time management when processing complex problems
- can evaluate the quality of existing research literature,
- can plan, conduct and evaluate a limited research project

Content

This module prepares the student for the technical view on maritime project she/he has to prepare in the third semester. In the following the learning outcome is described as a sum of all possible lectures that can be given.

To understand the potential of sustainable operations the forces acting on a vessel have to be understood. There are on the one hand forces due to load and bouncy a ship has to be designed for. On the other hand there are also forces due to wind and waves that influences the steel structure for safe shipping. The vessel is moving true the water therefore it needs power to overcome the resistance. All these forces have to be understood and calculated. For some forces formulas in rules from classification societies can be found or some thump rules for estimation exists. But all these forces can also be calculated by numerical methods. Some can be verified by measuring at models to get force coefficients that can be used for the real case. The module will discuss the following forces:

- Bending moments and shear forces due to load
- Forces due to wind and waves, seakeeping of vessel
- Dynamic loads and frequencies
- Resistance
- Theory of similarity, range of dimensionless numbers

To design a sailing system the overall concept has to be considered. Hence the sailing capacities of the ship hull in respect of stability and maneuverability is important. On the other side stress calculations for the rig and its foundations are necessary. In order to calculate the stress, the forces has to be known. But these depend also on the ship hull and the requirements given from the planned ship operations and scenarios. The required ship speed influences directly the size of the sailing systems and therefore the forces.

- Calculating stress using classical and Finite Element methods
- layout of sailing system and choosing the material
- calculating ship stability under sailing condition

Layout of Low Emission Ship Propulsion Systems

- Basic Understanding of the different Ship Propulsion Systems (Combustion Engines, Gas Turbines, Electric Systems (e.g. Fuel Cells), Sailing Systems e.g. Flettner Rotors, Modern Sailing Arrangements, …)
- Basic Understanding: Power Supply / Power Need of different ship types and ship size
- Combustion Engines
    - Different Ship Fuels (Comparison: “classic” and “new” fuels according: tanks, handling, efficiency, safety, ….)
    - New fuels: Environmental aspects, efficiency, availability, costs, exhaust gas composition, ….
    - New technologies to reduce environmental impact of ship propulsion systems (e.g. exhaust gas cleaning systems, systems to increase the propulsion efficiency…)
- Sailing Systems
    - Modern Technologies to use Wind and Sun for Ship Propulsion

Design of environmental safe Ship Operation Systems

- Basic Understanding of the different Ship Operation Systems (Cooling Systems, Ballast
- Water Systems, Drinking Water Systems, Waste Water Systems, Bilge Systems,….)
- New Technologies to reduce environmental Impact of Ship Operation Systems (Energy consumption, chemical waste water, …)

Lectures		
Lecturer	**Title of lecture**	**Contact hours**
Prof. Dr. Marcus Bentin; Prof. Freerk Meyer	Technical Aspects of Sustainable Maritime Operations	48

4. 4 Third semester Haugesund

For the third semester please check:

https://www.hvl.no/en/studies-at-hvl/study-programmes/maritime-operations/

Serving University: University of Applied Sciences Emden/Leer & Western Norway University of Applied Sciences
Study course: M. Sc. Maritime Operations

Module description: Master Thesis

Semester	Frequency of offer	Duration	Type	ECTS-Points	Student Workload
4th	SS	1 Sem	Obligatory	30	(800) 10/790

Preliminaries for attendances	Used for	Conditions to give ECTS Points	Teaching method	Responsible
		Thesis and presentation	supervision	Prof. Dr. Marcus Bentin

Qualification aims

Knowledge:
The students:

- have knowledge to evaluate key directions within scientific theory
- have knowledge to evaluate key research methods within maritime research
- have insight into what scientific knowledge is and how this is developed
- have practical and theoretical knowledge of the phases of a research project to apply them
- have knowledge of applicable norms for research ethics to apply them

Skills:
The students:

- are able to develop a research design and do theoretical and/or empirical analyses on own or existing material
- can analyze and critically assess different sources of information
- can reflect on research ethics and related issues
- can formulate research questions and relate these to different methods
- are able to use software for analysis of qualitative and quantitative data
- can carry out an independent, limited research project under supervision and in accordance with applicable norms for research ethics

General Qualifications:
The students:
can reflect on and critically assess own and other people's work
can communicate extensive independent work and masters language and terminology of both the academic and maritime field
can analyze problems related to the profession, academia and research ethics
can discuss own and other's work with both specialists and the general public
are able to evaluate the quality of existing research literature
can use the knowledge and skills achieved through the work on the master's thesis on future research projects

Content

The master's thesis is an independent, empirical and scientific work in which the student documents insight into research and development work, relevant theory and methods relevant for the problem examined in the thesis. Based on the students profile choice the subject will provide the student with the ability to deepen their knowledge about a specific topic within the maritime field.
Through the independent work the students shall develop their analytical abilities and achieve a deeper understanding of theoretical and/or empirical possibilities and challenges within the chosen field of study
The work on the master's thesis is to be carried out in accordance with ethical guidelines for research and rules and regulations at the partner institutions. In total, the master's thesis will document understanding, reflection and maturity.

The master's thesis will include:

- academic and scientific theory positioning of the problem area and issue
- justification of the theory and method selection
- implementation of a research project in the chosen practice field
- presentation, analysis and discussion of results

Lectures

Lecturer	Title of lecture	Contact hours
All lecturers	Supervision	10