Marine Engineering (Master)

Appendix 1 Module description

Module name	**PM 1 – Risk Management**
Responsible lecturer	Prof. Dr. Ketut Buda Artana

Content	• Introduction to Risk management
	• Basic Probability Concept
	• Rules for combining probabilities
	• Hazard identification
	  o Hazop
	  o Hazid
	  o FMEA
	  o FMECA
	• Quantitative Risk assessment technique
	  o Fault Tree Analysis
	  o Event Tree Analysis
	  o Conditional Probability
	  o Cut Set/Tie Set
	• Qualitative risk Assessment
	• Consequence modelling
	• Risk mitigation
	• Case studies

Qualification aim	Student understands process of assessing risk and able to propose the optimum way to mitigate the risk. Student able to apply the risk assessment process and method into a real case for maritime facilities.
Teaching language	English
Kinds of teaching	Lesson, seminars, exercises, computer laboratory-Simulation, field trips
Prerequisites	Basic in mathematics and basic in statistics
Usability	Usable in Master Marine Engineering
Requirements to award credits	Class attendance, Assignment, Case study, Mid-final exam, kinds of exam are written test, oral test or alternative test.
Work load	180 hours: 96 h (6 SWH) tuition, 84 h (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester odd (1)
Time of module	1 Semester
Literature	Penilaian risiko pipa gas bawah laut (artana, et.al, 2014) Risk evaluation in engineering process (hunt, 2001) Reliability Engineering System Safety

Module name	PM 02 – Maritime Economics
Responsible lecturer	Dr. Saut
Content	The micro foundations of maritime economics: Traditional framework for maritime economics; game theory for freight rates; Shipyard, srap and second hand market; the supply of vessels – the impact of shipyard capacity; how expectations freight rates are generated; time charter market; The macro-ecoomics of shipping markets: the efficiency of shipping market – martingale model and random walk model; maritime business cycle, the economic and statistical interpretation of business cycle, fiscal policy in maritime business cycle; Theory of shipping cycles – the tinbergen-kopmans model, an integrated model of business and shipping cycles; The market structure of shipping and ship finance; The financialisation of shipping markets: asset-led business cycles; hedging and speculation; the financialisation of oil tanker market; structural changes of oil tanker market; the finansialisation of dry bulk market; solving the puzzles of structural changes The interaction of business and shipping cycles: freight rate as leading indicator, the stylised facts of shipping factors; uncertainty-lead shipping cycles; business cycle in Japan, Germany and Indonesia, financial-lead shipping cycles Investment strategy: The major decisions in shipping, when to invest and sell in the market; case studies in dry bulk and tanker;
Qualification aim	Students are able to analyse the macro and micro determining factors that impact shipping business and cycles and performance. Including appy investment strategy in preparing the finansialitation of various shipping market particulary on tanker, dry bulk and container
Teaching language	English
Kinds of teaching	Lessons, seminars, economic model exercises, case studies, teamwork projects
Prerequisites	Maritime Business (Bachelor level), Maritime Economics (Bachelor level)
Usability	Usable in Master Engineering of Marine Engineering
Requirements to award credits	Successful passing of exam; kinds of exam are written test, oral test or alternative test.
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 Credits according ECTS
Offer period	Semester odd (1)
Time of module	1 Semester
Literature	Stopford M.: Maritime economics; Branch, A.E.: Economics of Shipping Practice and Management; Karakitsos, E & Varavides L: Maritime economics ; a macroeconomic approach Further references will be submitted during the course

Module name	PM 03 – Fuel Technology and Operation
Responsible lecturer	Semin Ph.D
Content	Introduction in fuel engineering and combustion regarding - Conventional fuels, liquid and gas like Gasoline, diesel fuel, CNG and LNG, Hydrogen; - Alkoholics like methanol, ethanol; - Renewable fuels like biogas and biodiesel fuel; - Fuel cell technology and - Hybrid fuels Fundamentals in combustion in theory and real combustion processes Advanced combustion process
Qualification aim	Student is able to understand the different types of fuel; they're production process, the availability and stock as well as the usage of fuel and the processes during the combustion itself.
Teaching language	English
Kinds of teaching	Lesson and seminars
Prerequisites	Non
Usability	Usable in Master Marine Engineering
Requirements to award credits	Assignment and successful passing of exam; kinds of exam are written test, oral test or alternative test.
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester odd (1)
Time of Module	1 semester
Literature	Journals like Fuel; Fuel management and Policy; Combustion Books: Kowalewicz, Andrzej., 1984. Combustion System of High-Speed Piston I.C. Engines, Wydawnictwa Komunikacji i Lacznosci, Warszawa Heywood, J.B., 1988. Internal Combustion Engine Fundamentals, McGraw-Hill, Singapore. Stone, Richard., 1997. Introduction to Internal Combustion Engines-Second Edition, SAE Inc., USA Ganesan, V., 1999. Internal Combustion Engines Second Edition, Tata McGraw-Hill, New Delhi

Module name	PM 04 – Reliability and Operations Research
Responsible lecturer	A.A. B Dinariyana, Ph.D
Content	Elementary probability and distribution theory, regression and linear models, fundamental concept of reliability, simple network modelling, failure time distribution, repairable system, Linear programming, Inventory control theory (EOQ models, dynamic demand model, concept of probabilistic models) Basic Statistics: Elementary probability and distribution theory, regression and linear models; Reliability: Fundamental concept of reliability, simple network modelling, failure time distribution, repairable system; Operations Research: Linear programming, Inventory control theory (EOQ models, dynamic demand model, concept of probabilistic models), Queuing theory (M/M/s), Game theory (two person zero-sum game)
Qualification aim	Students understand the theory of reliability, availability and modelling of system. Student are capable to apply these theories for analysing and evaluating marine system reliability both qualitatively and quantitatively. Students also able to apply operations research approaches in modelling real problem and to use the operations research methodology for decision making in management and engineering
Teaching language	English
Kinds of teaching	Lectures and tutorials
Prerequisites	None
Usability	Usable in Master Marine Engineering
Requirements to award credits	Assignment and successful passing of exam; kinds of exam are written test, oral test or alternative test.
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester odd (1)
Time of Module	1 Semester
Literature	Will be given later

Module name	PM 5 – Renewable Offshore Energy and Simulation
Responsible lecturer	Prof. Dr.-Ing. Axel Rafoth
Content	Renewable Offshore Energy General aspects of Wind energy, technology, controls, simulation, Special aspects of Offshore wind energy, environmental conditions, converter platforms, Simulation of Wind turbine components and systems • Grid, transmission lines, • Insulated systems • generator, • converter, • controls
Qualification aim	Ability to define complex technical systems, to do analyses using mathematical tools, to approach problems with right methodology, Discussion and right valuation
Teaching language	English
Kinds of teaching	Lesson, seminars, exercises, laboratory, optionally field trips
Prerequisites	Non
Usability	Usable in Master Marine Engineering
Requirements to award credits	Laboratory sheet and successful passing of exam; kinds of exam are written test, oral test or alternative test.
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester even (2)
Time of module	1 semester
Literature	Grid Integration of Wind Energy Conversion Systems Mohan Undeland Robbins, Power electronics Power System Stability And Control, Prabha Kundur

Module name	PM 6 – Maritime Communication
Responsible lecturer	Mrs. Buttler
Content	The students shall improve through discussion and presentation of maritime technical problems their skills and knowledge in English
Qualification aim	Students are able to understand, follow and conduct qualified professional English discussion, as well as be able to communicate correctly in written form, particularly with view on maritime professional topics.
Teaching language	English
Kinds of teaching	This course will be offered as blended learning with 50 % contact time (seminars) and 50 % with E-learning content (self-study).
Prerequisites	Non
Usability	Usable in Master Marine Engineering
Requirement to award credits	Successful passing of exam; kinds of exam are written test, oral test or alternative test
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester even (2)
Time of module	1 semester
Literature	*will be given later*

Module name	PM 7 – Structural Analysis
Responsible lecturer	Prof. Dr.-Ing. Siegl
Content	Introduction - Solution approach for dimensioning and construction of floating bodies - Longitudinal strength in still water and wave conditions - Local loads of selected structure areas Global considered dimensioning - Method and solution approach according international applied construction rules and guidelines - Causes and effects of natural-, design related- and cargo related forces and moments Local considered dimensioning - Determining and calculation, of forces in local context - Construction and dimensioning of deck structure regarding occurring loads, forces and moments Assignment - Manual and computer supported dimensioning of main frame section - Determining of forces , moments and they're effect on hull in global context
Qualification aim	Increasing knowledge and skills in the field of technical mechanic and the application in practical sense by using of existing example. Students learn how to solve global as well local design and construction procedures of floating bodies. Students knowing the causes and effects of relevant impact factors and they will be able to transform the factors in the construction process.
Teaching language	English
Kinds of teaching	Lesson, seminars, exercises, self-study and self-prepared presentations.
Prerequisites	- Basic knowledge in ship building
Usability	Usable in Master Marine Engineering and master in Operation and Management of Maritime Systems
Requirements to award credits	Assignment and Successful passing of examination; kinds of exam are written test, oral test or alternatively test
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester even (2)
Time of module	1 Semester
Literature	Rules for classification and construction

Module name	PM 8 – Research Methodology
Responsible lecturer	Mr. Hilgenfeld M.Sc.(responsible) and Ms. Schaub M.Sc.
Content	Scientific papers: Structure, content, recherché in focus area, citation styles and authorship. Layout an own paper: Very professional operating with MS Word, quotation in Word Evaluate scientific documents (papers, articles, research proposal): Kinds of publications, Hirsch factor, Impact factor, peer review system, international publications, Presentation technics: Creation of scientific presentations, feedback rules, spontaneous reaction to changed presentation focus, regional studies (Germany) with presentation. Capturing measurement data: Kind of data, measurement mistakes, visualization of data (e.g. line, bar, boxplot). Research programs: Understanding of research calls (European Union). Creation of own research proposal: Presentation of the idea (Documentation based on the HSW internal research program)
Qualification aim	With successful result of the examination the students are able to generate complex scientific papers (e.g. final thesis). Furthermore the participants have the knowledge and skills to write professional articles and research proposals.
Teaching language	English
Kinds of teaching	Lessons, seminars, exercises, self-study and self-prepared presentations.
Prerequisites	Non
Usability	Usable in Master Marine Engineering and Master in Operation and Management of Maritime Systems
Requirements to award credits	Assignment and Successful passing of examination; kinds of exam are written test, oral test or alternatively test
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester even (2)
Time of module	1 Semester
Literature	*will be given later*

Module name	PM 9 – Thermal and Fluid System design
Responsible lecturer	Sutopo Purwono Fitri, PhD.
Content	Basic of fluid flow and heat transfer: Thermodynamics and refrigeration cycles; heat transfer modes; conduction-steady state and transient, one-dimensional and multidimensional; natural and forced convection; thermal radiation; basic of fluid flow; boiling and condensation; mass transfer; Heat exchanger design-type and the dimensioning. Steam and thermal oil system: Boiler and its classifications; boiler operations; thermal plants; thermal oil – characteristics; pro/cons. TO plant system and its thermal transport; TO heater/burner, tanks, and other equipment. Thermal engineering analysis: Pool boiling and flow boiling analysis; two-phase flow; mini-channel and microchannel heat transfer; electronic packaging; uncertainty analysis. Reefer technology: basic reefer method; refrigeration processes; refrigerant; refrigeration components and regulation; thermal and moisture control; psychometrics; air conditioning technology; insulation; ventilation and infiltration; energy estimating and modelling methods; pipe sizing and duct design; maintenance; codes and standard. Optimization and simulation of thermal system: conservation laws for mass, momentum, and energy; mathematical and numerical modelling of thermal transport phenomena; optimization of thermal systems-multi-objective optimization method; modelling and simulation of refrigeration system.
Qualification aim	Students are able to analyse the required thermal and fluid system for industrial processes or onboard ship systems such as steam and reefer plants. It is expected also they fulfil projects or tasks for evaluating thermal performance based on the corresponding methods and appropriate applications.
Teaching language	English
Kinds of teaching	Lesson, seminars, exercises, laboratory, field trips, team work projects
Prerequisites	Fluid mechanics and heat transfer
Usability	Usable in Master Marine Engineering
Requirements to award credits	Assignment and Successful passing of examination; kinds of exam are written test, oral test or alternatively test
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	& according ECTS
Offer period	Semester odd (3)
Time of module	1 Semester
Literatur	1. J.H. Lienhard, Heat Transfer, 4th edition, 2015 2. Stoecker, Industrial Refrigeration Handbook, 1998 3. ASHRAE Handbook, 2005 4. Yunus A. Cengel, Heat Transfer: a Practical Approach, 2nd Edition, 2002 Further references will be submitted during the course

Module name	PM 10 – Efficient Ship and Fleet Operation
Responsible lecturer	Dr.-Ing. Wolfgang Busse
Content	Ship & fleet management: Key Performance Indicators (KPI's) in shipping; Commercial, navigational & technical ship operation; Technical ship management - objectives, tasks, processes, resources; Integrated maritime management information systems; Technical performance and commercial performance: Costs (fixed, operating, voyage costs), revenue, financial performance, commercial value of a ship; Technical performance parameters, availability, reliability, power performance, energy efficiency, safety and environmental performance; Influence of technical performance on financial performance and commercial value; Influence of the O&M strategy; Efficient performance management and asset management of ships: Technical assessment and commercial valuation of ships; Voyage and vessel performance monitoring; Operating and maintenance cost structure; Ship performance and ship value versus operating and maintenance costs; Condition monitoring and condition-based maintenance; Maintenance versus replacement; Economics of technological change; Ship lifecycle and lifetime cost management; Energy efficiency in shipping: Optimization and management of ship and company energy efficiency (using EEOI, SEEMP, CEEMP); Integrated approach to vessel energy efficiency; Efficiency in regulatory compliance: effective and efficient implementation of regulations (IMO, Flag State) and certificate management;
Qualification aim	Students are able to analyse the economic consequences of various maritime technical management decisions, and to organise, monitor and control maritime-technical processes well-performing and efficiently
Teaching language	English
Kinds of teaching	Lessons, seminars, simulator exercises, case studies, teamwork projects
Prerequisites	Technical Ship Operation (Bachelor level) Complex Ship Operation Laboratory (Bachelor level), Maritime Economics (Bachelor level)
Usability	Usable in Master Marine Engineering
Requirements to award credits	Assignment and Successful passing of examination; kinds of exam are written test, oral test or alternatively test
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester odd (3)
Time of module	1 Semester
Literature	Stopford M.: Maritime economics; Branch, A.E.: Economics of Shipping Practice and Management; Further references will be submitted during the course

Module name	PM 11 Risk Based Design and Marine Evacuation
Responsible lecturer	Dr.Eng. Trika Pitana
Contents	Marine Evacuation: Human behaviours in case of fire and smoke spreading; Human ingress in case of marine accident, such as fires, ship healing, trim, smoke spreading.; Human response time in case of fire; Several types of marine evacuation; The walking speed of human; Simplied marine evacuation analysis; Advances marine evacuation analysis; Fire Modeling using Fire Dynamic Simulator Risk Based Design: Introduction Risk Based Approach in Maritime Industries; Risk Based Ship Design; Regulatory Framework; Risk Based Approval; Method and Tools; Application
Qualification aim	Students are able to conduct marine evacuation analysis during ship design by using simplified and advanced evacuation analiysis as well as investigating marine casualties in term of marine evacuation. Students are able to conduct risk based design analysis for such as fire and safety plan evaluation and evacuation route plan.
Teaching language	English
Kinds of teaching	Lectures and tutorials
Prerequisites	Non
Usability	Usable in Master Marine Engineering
Requirements to award credits	Assignment and Successful passing of examination; kinds of exam are written test, oral test or alternatively test
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester odd (3)
Time of module	1 semester
Literature	Will be given later

Module name	WPM 12 – Integrated Manoeuvring/Propulsion and Navigation Systems
Responsible Persons	Prof. Dr.-Ing. Siegl
Contents	Integrated Manoeuvring/Propulsion Systems: Design, Application, pros and cons for propulsion and steering of subsequently systems: – Azimuth-Propeller/Azipods – Voith Propeller and rotating rudder propellers – Waterjet-Thrusters – Wing-in-Ground Effect Vessels – Propulsion systems based on alternative Energy – Sails, kites – Flettner Rotors, others – Simulation exercises and case studies for those specific vessels. Navigation System: – Additional features by integration – Parameter analysing of important functions – Network and system redundancies – Modern bridge configuration – Failure scenarios and options for action
Qualification aim	Enabling students to widely understand the principles of modern propulsion/manoeuvring systems as well as ship handling simulation systems with respect to technical concepts, characteristics and range of application, discussion of pros & cons in relation to complex analyses of energy, environmental and safety aspects.
Teaching Language	English
Prerequisites	Non
Usability	Master in Marine Engineering
Requirements to award credits	Assignment and Successful passing of examination; kinds of exam are written test, oral test or alternatively test
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester even (2)
Time of module	1 semester
Literature	*Will be given later*

Module name	WPM 13 – Operation, Monitoring & Maintenance of Technical Systems
Responsible Persons	Prof. Dr.-Ing. Frank Bernhardt, Prof. Dr.-Ing. Karsten Wehner
Contents	Overview: – Elementary supervision stages; Design, manufacturing and testing, primary acceptance, putting into service, maintenance and repair as well as recurrent in-service supervision. Basic theoretical and practical aspects of international methods and requirements of plant supervision. Maintenance: – Advantages and disadvantages of different maintenance strategies; Availability and reliability; Optimisation methods. Technical Diagnostic: – Theoretical Aspects and methods of Technical Diagnostic; Selection of special diagnostically tools and processes; Web based services and long-time analysis. Applications & Tools: – TITAN und GLSM. Classification: – Condition based Survey. Specific Samples: – Fired and unfired pressure equipment plants with respect to economic aspects.
Qualification aim	The students know how to prepare, perform and documented a standard-compliant put into service, supervision as well as safety and environment relevant assessment of technical plants. They have the knowledge to optimize around the availability and reliability. The students are familiar with advantages and disadvantages of the various maintenance strategies trust and by specific application of methods of the technical diagnosis the advantages of the condition based maintenance can be realized.
Teaching language	English
Kinds of Teaching	Seminars, self-study
Prerequisites	Non
Usability	Laboratory sheet and Successful passing of examination; kinds of exam are written test, oral test or alternatively test
Requirements to award credits	Successful passing of examination
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester even (2)
Time of module	1 semester
Literature	*Will be given later*

Module name	WPM – 14 Maritime Operation System
Responsible person	Hilgenfeld M.Sc.
Content	Container Terminal Operation: - Different types of container terminals - Detailed view on the operational processes of load, discharge, relocate, receive rail and truck, dispatch rail and truck - Truck Appointment System solutions - Requirements of special container in operational processes: Reefer, Dangerous goods, OOG, Empties - Equipment control - Yard Control - Berth planning Maritime Transport Systems - World transport routes, Hub-Functions - Maritime transportation chain (Feeder) - Category and type of ship (e.g. Panamax, Ice class) - Source-destination relationship (e.g. basic traffic planning) - Efficiency of the Transport (e.g. Efficiency Index of ships) - IT-Platform and Systems for fleet management - Management Information Systems
Qualification aim	Increasing knowledge and skills in the field the maritime industry as a basis for business Decisions. The Students obtain also knowledge about the world sea routes, development of DWT, source-destination relationship and IT Systems in maritime context.
Teaching language	English
Kinds of teaching	Lesson, seminars, exercises, self-study and self-prepared presentations.
Prerequisites	PM 2 “Maritime Business”
Usability	Usable in Master Marine Engineering
Requirements to award credits	Successful passing of examination; kinds of exam are written test, oral test or alternatively test
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester even (2)
Time of module	1 Semester
Literature	*will be given later*

Module name	WPM 15 – Technical of Internal Combustion Engine
Responsible lecturer	Dr. I Made Ariana and Dr. Aguk Zuhdi M. Fathallah
Content	Design construction and operation of internal combustion engines: engine cycle; operation parameter; engine configurations; engine examples; alternative power plant Combustion, fuels and lubrications: the use of fuel oils in the marine industry; classification and grades; composition; energy content; combustion process stage; influence of fuels oils on combustion performance; combustion of gas fuels; lubrication technology and systems Engine performance and characteristics: engine testing; engine set up; dynamometers principles and frictions factor; engine performance; engine performance maps; Combustion product and emission control: health and environmental significance of combustion products; quantification of gaseous exhaust emissions; assessment of particulate emissions and smoke; exhaust emission from shipping; exhaust control measures; methods to reduce NOX and SOX emissions
Qualification aim	This course studies the design and operation of internal combustion engines and its effect on performance, operation, fuel requirements, lubrication systems, emissions, and environmental impact
Teaching language	English
Kinds of teaching	Lessons, seminars, laboratory work, case studies, small projects
Prerequisites	Marine diesel (Bachelor level)
Usability	Usable in Master Engineering
Requirements to award credits	Laboratory works; and Successful passing of examination; kinds of exam are written test, oral test or alternatively test
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester odd (3)
Time of module	1 Semester
Literature	Ferguson C.R and Kirkpatrick A.T. 2001. Internal combustion engine applied thermos-sciences, 2ndEd., John Welay and sons; Wright A.A. 2000.MEP Series, Volume3, Part 20 Exhaust Emissions from Combustion Machinery, Published by Institute of Marine Engineer; Sher E.1998. Handbook of Air Pollution from Internal Combustion Engines Pollutant Formation and control, Academic Press

Module name	WPM 16 – Marine Control System
Responsible lecturer	Dr. AA Masroeri
Content	Mathematical models and modelling of physical systems especially for marine system, How to described by differential and algebraic equations and represented by state-space models, transfer functions, and use of simulation models as tools for analysis and problem solving. Stability diffentiation and performance in closed-loop feedback systems. Including linear vs. nonlinear systems, linearization, Laplace transform, time response, frequency response, block diagrams, Bode plots, feedback and feed-forward control loops. Fundamental topology and architecture of marine control systems. Including Auto Pilot, Marine Propultion Plant, Power management system, Minimalization of Fuel consumtion.
Qualification aim	Students are able to design automatic control system with logically based on the theory by him self or cooperation with bigger teamwork.
Teaching language	English
Kinds of teaching	Lessons, seminars, case studies, self or/and teamwork projects,
Prerequisites	Automation Control (bachelor level) Marine Electrical and Automation System (Bachelor level)
Usability	Usable in Master Engineering
Requirements to award credits	Assignment and Successful passing of examination; kinds of exam are written test, oral test or alternatively test
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 credits according ECTS
Offer period	Semester odd (3)
Time of module	1 Semester
Literature	Benjamin C. Kuo, “Automatic Control System”, 7’th edition. Thor Fossen, Handbook of Marine Craft Hydrodynamics and Motion Control, Wiley, 2011. Thor Fossen, Marine Control Systems - Guidance, Navigation, and Control of Ships, Rigs and Underwater Vehicles, www.marinecybernetics.com , 2002.

Module name	WPM 17 – Safety of Navigation
Responsible person	Dr. Eng. M. Badrus Zaman
Contents	Safety of Navigation: Advance of safety of navigation, analysis of ship accidents, Human error analysis and modelling, understanding of regulation, Formal Safety Assessment, Implementation of navigation technology for safety, Understanding of ISM code, Environmental management on-board, in ports, at enterprises; planning, monitoring and documentation; Responsibilities of flag states: maritime surveillance regulations, ship reports and ship certification, verification, maritime casual investigations.
Course aim	Students are able to understand the scope of the safety of navigation in the ship, studying the regulations for the safety of navigation, understanding Human Factor analysis model as well as the use of methods in the evaluation of the implementation of a regulation, management of ship operations.
Teaching language	English
Kinds of teaching	Lectures and tutorials
Prerequisites	non
Usability	Usable in Master Marine Engineering
Requirements to award credits	Assignment and successful passing of examination; kinds of exam are written test, oral test or alternatively test
Work load	180 hours: 64 hours (4 SWH) tuition, 116 hours (7,25 SWH) self-study
Credits	6 Credits according ECTS
Offer period	Semester odd (3)
Time of module	1 semester
Literature	Will be given later

Module name	PM 18 Master Thesis and Colloquium
Responsible person	All teaching personnel in master program
Content	The thematic assignment of the master thesis is processed between student and tutor and takes into account following aspects: - adaptable in the programme - outline and complexity - scientific standard - relevance to practice While the colloquium the topic of the master thesis and adjacent subjects are being discussed and main issues highlighted.
Qualification aim	The student shall prove the ability to apply the gained knowledge and skills to actual topics and problems in and of maritime systems under consideration of scientific methods. Student is able to argue gained results scientifically and integrate them into the practical routine in maritime systems. The master thesis is completed with passing of colloquium. The student shall prove the ability to present, discuss and defend his thesis.
Teaching language	English
Kinds of teaching	Self-study
Prerequisites	75 credits for Master Thesis, 90 credits for colloquium
Usability	Usable in Master Marine Engineering
Requirements to award credits	Positive assessment of Master thesis and successful passing of colloquium
Work load	900 hours
Credits	30 credits according ECTS
Offer period	Semester even (4)
Time of module	16 weeks
Literature	