University of Rijeka
Faculty of Engineering

CURRICULUM
GRADUATE UNIVERSITY STUDY OF NAVAL ARCHITECTURE

Rijeka, April 2021

1. CURRICULUM DESCRIPTION

1.1. The list of compulsory and elective courses with the number of active classes required for their performance and ECTS credits

1. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Mathematics for Engineers	3	2			5	6
	Ship Structural Design	2	1		1	4	5
	Marine Electrical Engineering	2	1			3	4
	Methodology of Ship Production	2	1		1	4	5
	Numerical Methods and Optimization	2		2		4	4
Subjects from elective group Design and Construction of Floating Objects:							
	Marine Hydrodynamics II	3			2	5	6
Subjects from elective group Technology and Organization of Naval Architecture:							
	Technological Process of Shipbuilding	2	1		1	4	6
	TOTAL					**25**	**30**

L - lectures, aT – auditory tutorials, lT – laboratory tutorials, dT – design tutorials.

2. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Ship Systems	3		1		4	5
	Project I[1]					2	5
	Elective Subject I					4	5
	Free Elective Subject I[2]						5
	Professional Practice II						5
Subject from elective group Design and Construction of Floating Objects:							
	Ship Structural Analysis	2			2	4	5
Subject from elective group Technology and Organization of Naval Architecture:							
	Ship Outfitting and Repair	3			1	4	5
	TOTAL					**18**	**30**

[1] Enroll one of the professional subjects in the 1st and 2nd semester.

[2] Enroll one subject in the 2nd semester from other elective groups or from other graduate studies at the Faculty of Engineering University of Rijeka, worth 5 ECTS or more.

Elective Subject I							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
Subjects from elective group Design and Construction of Floating Objects:							
	Offshore Structures and Vessels	2	2			4	5
	Small Craft Construction	2			2	4	5
	Dynamics of Offshore Structures	2	2			4	5
Subjects from elective group Technology and Organization of Naval Architecture:							
	Offshore Structures and Vessels	2	2			4	5
	Small Craft Construction	2			2	4	5

3. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Ship Design I	3	1			4	5
	Project II[3]					2	5
	Elective Subject II						5
	Free Elective Subject II[4]						5
Subjects from elective group Design and Construction of Floating Objects:							
	Ship Stability in Exploitation	3	2			5	5
	Seakeeping	3	2			5	5
Subjects from elective group Technology and Organization of Naval Architecture:							
	Quality Management and Metroloqy	2	2			4	5
	Shipyard Design	2	1		1	4	5
	TOTAL					**24**	**30**

[3] Enroll one of the professional subjects in the 1st, 2nd and 3rd semester, except already enrolled as Project I.

[4] Enroll one subject in the 3rd semester from other elective groups or from other graduate studies at the Faculty of Engineering University of Rijeka, worth 5 ECTS or more.

Elective Subject II							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
Subjects from elective group Design and Construction of Floating Objects:							
	Shipyard Design	2	1		1	4	5
	Offshore Operations	2	2			4	5
Subjects from elective group Technology and Organization of Naval Architecture:							
	Ship Stability in Exploitation	3	2			5	5
	Welding Engineering	2		2		4	5

4. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Elective Subject III						5
	Free Elective Subject III[5]						5
	Graduate Work						10
Subjects from elective group Design and Construction of Floating Objects:							
	Ship Design II	1	1		2	4	5
	Marine Propulsion Engines	2	1			3	5
Subjects from elective group Technology and Organization of Naval Architecture:							
	Project Management in Shipbuilding	2	1		1	4	5
	Shipyard Organization and Management	2	1			3	5
	TOTAL					**15**	**30**

[5] Enroll one subject in the 4th semester from other elective groups or from other graduate studies at the Faculty of Engineering University of Rijeka, worth 5 ECTS or more.

Elective Subject III							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
Subjects from elective group Design and Construction of Floating Objects:							
	Project Management in Shipbuilding	2	1		1	4	5
	Small Craft Design	2	2			4	5
	Ship Negotiation Process	2	1			3	5
Subjects from elective group Technology and Organization of Naval Architecture:							
	Ship Negotiation Process	2	1			3	5
	Small Crafts Equipment	2		1	1	4	5

GRADUATE UNIVERSITY STUDY OF NAVAL ARCHITECTURE TOTAL	Hours	ECTS
	82	120

Basic description		
Course title	**Dynamics of Offshore Structures**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Understanding stochastic models of sea waves, current and wind loads on offshore constructions. The ability to estimate the probability of exceedance for certain dynamic effects criteria. Developing the ability to work in small groups (teamwork).

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Specify the basic methods of dynamic analysis of offshore structures. Properly explain, and interpreted the basic parameters of the waves as a random process. Explain stochastic model of action of waves, currents and wind on offshore structures. Indicate the design and operational parameters which have an influence on the dynamic response of offshore structures on the sea waves. Describe the procedures for short-term and long-term prediction of the dynamic response of offshore structures. Calculate the probability of exceedance of certain dynamic effects.

1.4. Course content

Dynamic aspects of importance for various offshore structures. Methods of analysis. Fundaments of probabilistic processes. Sea waves and sea states. Wave spectrums. Wave forces on slender structures (Morison's equation). Wave forces on large structures (diffraction theory). Effect of currents and winds. Response of a one-degree-of-freedom system. Multi-degree-of-freedom linear system. Deterministic and stochastic design methods. Response of offshore structures on sea waves. Short-term and long term prediction.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☒ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments	-	

1.7. Student's obligations

Course attendance, activity, studying.

1.8. Evaluation of student's work

Course	2	Activity/Participation		Seminar paper	0.5	Experimental	

attendance						work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	1.5	Report		Practice	
Portfolio		Homework					

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, seminar paper, activity, continuous knowledge testing, written and oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Prpić-Oršić J.: Basic ship dynamics, Faculty of Engineering University of Rijeka, Fintrade &Tours, 2009. (in Croatian)
Journee, J.M.J., Massie, W.W.: Introduction in Offshore Hydromechanics, Delft University of Technology, Delft, Netherlands, 2001.

1.11. Optional / additional reading (at the time of proposing study programme)

Prpić-Oršić J., Čorić V.: Seakeeping, Zigo, University of Rijeka, 2006. (in Croatian)
Brebbia, C.A., Walker, S.: Dynamics Analysis of Offshore Structures, Newnes-Butterwoths, London, 1979.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Prpić-Oršić J.: Basic ship dynamics, Faculty of Engineering University of Rijeka, Fintrade &Tours, 2009. (in Croatian)	10	9
Journee, J.M.J., Massie, W.W.: Introduction in Offshore Hydromechanics, Delft University of Technology, Delft, Netherlands, 2001.	Available on internet	9

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Graduate Work**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	compulsory	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	10
	Number of hours (L+E+S)	-

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Graduate work is an individual assignment and verification of student expertises, which should show the appropriate level of engineering skills for individually solving specific professional task.							
1.2. Course enrolment requirements							
Enrolled course from which the Graduate Work is selected.							
1.3. Expected course learning outcomes							
Apply acquired knowledge, expertises and skills of the content of Graduate Work associated course. Solve practical task. Acquire competence for individually solving specific professional task.							
1.4. Course content							
The content of the Graduate Work is based on the application of acquired knowledge from educational programs at the graduate university studies. Final thesis can be specified from a particular course specific professional content and exceptionally from course that belongs to the group of shared content, when it represents a broader entity with a particular course specific content of the studies. Student enrollers the Graduate Work by enrolling the last semester. Thesis of the Graduate Work is establishes by Commission for Graduate Works, based on suggestion of teacher who will mentor the Graduate Work.							
1.5. Teaching methods	☐ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork		☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Attending the consultation, individually solving task and writing the Graduate Work report.							
1.8. Evaluation of student's work							
Course attendance		Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Sustained knowledge check		Report		Practice	
Portfolio		Individual task solving	8	Final work in written form	2		
1.9. Procedure and examples of learning outcome assessment in class and at the final exam							

Assesses and evaluates the accuracy and completeness of a given task solving process, the Graduate Work written report, and its oral presentation

1.10. Assigned reading (at the time of the submission of study programme proposal)

1.11. Optional / additional reading (at the time of proposing study programme)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Marine Electrical Engineering**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	30+15+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
The course is a professional discipline for all the students of naval architecture. The goal is to introduce the students to ships electric devices.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Define and explain the requirements for ships electric devices. Evaluate systems for electric power generation on crafts. Evaluate systems for electric power distribution on crafts. Define and explain technical measures for protection from electric current shock. Apply measures for personal safety on work with ships electric power system. Analyse electric protections of ship electric devices. Define and explain ships electric drives. Define and explain ships lighting system.							
1.4. Course content							
Requirements for ships electric devices. Generation and transformation of electric energy. Distribution and transmission of electric energy. Electric energy consumption on ship. Electric propulsion. Safety. Monitoring, inspection, disturbances and maintenance of ships electric power system.							
1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork		☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Course attendance, activity, seminar paper, studying.							
1.8. Evaluation of student's work							
Course attendance	1.5	Activity/Participation		Seminar paper	0.5	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio							
1.9. Procedure and examples of learning outcome assessment in class and at the final exam							

Course attendance, activity, seminar paper, continuous knowledge testing (two mid-term exams), written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

I. Vlahinić: Electrical systems of vessels, Faculty of Maritime Studies, Rijeka 1988
B. Skalicki, J. Grilec: Marine electrical devicei, Faculty of Mechanical Engineering and Naval Architecture, Zagreb 2000

1.11. Optional / additional reading (at the time of proposing study programme)

D.T. Hall: Practical Marine Electrical Knowledge, Witherby London 1999
IEC International Standard
Croatian Register of Shipping

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
I. Vlahinić: Electrical systems of vessels, Faculty of Maritime Studies, Rijeka 1988	3	
B. Skalicki, J. Grilec: Marine electrical devicei, Faculty of Mechanical Engineering and Naval Architecture, Zagreb 2000	3	

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Marine Hydrodynamics II**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
The acquisition of specific competencies dealing with ship resistance and propulsion. Ability to solve a given problem in order to determine the ship resistance, the required ship's main engine power and the propeller characteristics. Acquiring specific knowledge in ship's controllability.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Explain the influence of the hull form and appendages on ship resistance. Explain the features of the propeller design. Preliminary calculation of the ship resistance, the required main engine power and the ship screw propeller together with the screw propeller drawing of a chosen ship. Analyze the impact of ship hydrodynamic characteristics on ship energy efficiency requirements. Explain the forces acting on fast motor boats and sailing boats. Explain the forces and moments on the ship's rudder. Interpret correctly the term of the ship controllability and describe the ship controllability experiments.							
1.4. Course content							
Effects of the hull form and appendages on ship resistance. Added resistance due to waves. Computational models for the determination of the hydrodynamic characteristics of the ship hull. Propeller design. Energy efficiency of a ship. Hydrodynamic lift. Flow over an inclined flat plate. The forces on a planing craft. Resistance components. Dynamic instability of planing crafts. Flow around a flat foil. The forces on a sailing boat. Resistance components. The balance between hydrodynamic and aerodynamic forces. Ship controllability. Course keeping. Maneuvering. Speed changing. Controllability in the ship design spiral. Control loop and basic equations of motion. Motion stability definitions. Rudder forces and moments. Maneuverability activities of IMO. Maneuvering trials. Turning test. Z-maneuver test. Direct and reversed spiral test. Pull-out test. Stopping test. Other tests. Mathematical maneuvering models. Model tests.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☒ fieldwork		☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Attendance at lectures, activity in class, project assignment, self learning.							
1.8. Evaluation of student's work							
Course	2.5	Activity/Participation	0.5	Seminar paper		Experimental	

attendance						work	
Written exam	0.5	Oral exam	0.5	Essay		Research	
Project	1	Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Class attendance, class activity, project assignment, continuous knowledge assessment (mid-term exams), written and oral examination.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Lewis, E. V., (ed.), Principles of Naval Architecture, Vol. II – Resistance, Propulsion and Vibration, The Society of Naval Architects and Marine Engineers, Jersey City, 1988.
Lewis, E. V., (ed.), Principles of Naval Architecture, Vol. III - Motions and Conrollability, The Society of Naval Architects and Marine Engineers, Jersey City, 1989.

1.11. Optional / additional reading (at the time of proposing study programme)

Blount, D. L., Performance by Design: Hydrodynamics for High-Speed Vessels, Donald L. Blount, Virginia Beach, 2014.
Larsson, L., Eliasson, R. E.: Principles of Yacht Design, Second Edition, Adlard Coles Nautical, 2000.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Lewis, E. V., (ed.), Principles of Naval Architecture, Vol. II – Resistance, Propulsion and Vibration, The Society of Naval Architects and Marine Engineers, Jersey City, 1988..	1	15
Lewis, E. V., (ed.), Principles of Naval Architecture, Vol. III - Motions and Conrollability, The Society of Naval Architects and Marine Engineers, Jersey City, 1989.	1	15

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution’s quality assurance system.

Basic description		
Course title	**Marine Propulsion Engines**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+15+0

1. **COURSE DESCRIPTION**		
1.1. Course objectives		
Adoption of theoretical knowledge and development of skills to solve practical problems in the field of marine propulsion machinery, determination of necessary power and selection of propulsion engines, their systems and equipment.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Analysis of ship characteristics and navigation conditions for the selection of the ship propulsion plant. Application of the laws of thermodynamics and mechanics to the process analysis in steam turbine ship propulsion plant. Analysis of the processes in the steam turbine plant and its systems and their impact on the characteristics of the plant. Analysis of processes in gas-turbine ship propulsion plant of the ship. Analysis of the processes of gas-turbine plant and its systems and their impact on the characteristics of the propulsion plant. Application of the laws of thermodynamics and fluid mechanics to processes of internal combustion engines. Analysis of the operation of the internal combustion engines and its equipment and their impact on the characteristics of the engine system as a whole. Analysis of the influential parameters on the overall characteristics of propulsion plant and its operating costs.		
1.4. Course content		
Introduction to marine propulsion engines. The basis for calculation of ship propulsion power and selection of the propulsion engines. Ship steam generators. Marine steam turbine. Equipment and systems of marine steam turbine. Steam turbine propulsion plant. Nuclear propulsion. Gas turbines and their application in ship propulsion. Internal combustion engines. Dynamics of the crankshaft mechanism. Diesel engine operation. Exchange of the working fluid. Turbocharging. Preparation and combustion of the fuel-air mixture. Application of heavy fuel. Design of marine diesel engines. Engines for propulsion of small vessels. The combined systems for ship propulsion. Diesel-electric propulsion. Auxiliary equipment and systems. Marine engine rooms. Rational use of energy. Emissions and environmental protection.		
1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments	None	
1.7. Student's obligations		

Course attendance, activity, homework, studying.

1.8. Evaluation of student's work

Course attendance	1.5	Activity/Participation		Seminar paper	0.5	Experimental work	
Written exam	1	Oral exam	1	Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio		Homework					

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, homework, continuous knowledge testing (two mid-term exams), written and oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Grljušić, M.: Marine Prpulsion Engines, Fakultet elektrotehnike, strojarstva i brodogradnje u Splitu, 2000. (in Croatian)
Tireli, E.: Marine Heat Turbines, Sveučilište u Rijeci, 2001. (in Croatian)
Parat, Ž.: Marine Internal Combustion Engines, Sveučilište u Zagrebu, 2005. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Grljušić, M.: Internal Combustion Engines, FESB, Split, 2000. (in Croatian)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Grljušić, M.: Internal Combustion Engines, FESB, Split, 2000. (in Croatian)	1	20

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Mathematics for Engineers**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Acquiring basic knowledge in mathematical analysis and vector analysis.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Define and correctly interpret basic notions in trigonometric polynomials approximations, partial differential equations, and vector analysis. Compute approximations of some functions with trigonometric polynomials, determine analytical solutions for typical equations of mathematical physics on simple domains, and find solutions of problems in vector analysis. Give physical interpretation for: typical equations of mathematical physics, gradient of scalar fields, divergence and rotor of vector fields, solenoid and conservative fields, and curve and surface integrals.							
1.4. Course content							
Approximation of functions with trigonometric polynomials. Applications. Partial differential equations of mathematical physics. Applications. Vector analysis Applications. Curve integrals. Surface integrals. Triple integrals. Integral theorems Applications.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork		☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other				
1.6. Comments	-						
1.7. Student's obligations							
Course attendance, activity/participation, studying							
1.8. Evaluation of student's work							
Course attendance	2.5	Activity/Participation		Seminar paper		Experimental work	
Written exam	0.5	Oral exam	0.5	Essay		Research	
Project		Sustained knowledge check	2.5	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity/participation, mid-term exams, and written and/or oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Kreyszig, E.: Advanced Engineering Mathematics, John Wiley & Sons, Inc., 1993
Štefan Trubić M., Črnjarić-Žic N., Maćešić S., Mathematics for engineers, course material (on-line available on e-course)
Pavčević M.: Vector Analysis, (FER) Biblioteka Bolonja, Element, 2007. (In Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Farlow J. S., Partial differential equations for scientists and engineers, Dover publication Inc., 1993

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Kreyszig, E.: Advanced Engineering Mathematics, John Wiley & Sons, Inc., 1993	3	30
Štefan Trubić M., Črnjarić-Žic N., Maćešić S., Mathematics for engineers, course material (on-line available on e-course)	150	30
Pavčević M.: Vector Analysis, (FER) Biblioteka Bolonja, Element, 2007. (In Croatian)	2	30

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Methodology of Ship Production**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Introducing student with examples that illustrate the use of methods and techniques for production of vessels, and with the analysis of the ship production methodology applications at shipyards, according to defined learning outcomes.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

To analyze basic characteristics of the ship production process. Analyze the integration of ship hull construction, outfitting and painting. To interpret the interaction between design process methodology, preparation processes and ship production processes. To analyze the possibilities of operations research methods application. Argue and describe contemporary concepts of shipbuilding processes design and management. Define the constraints for ship elements fabrication, interim products, and ship production and outfitting. Analyze and describe the concept of assembly shipyard. Analyze and describe the concept of a virtual shipyard and simulation modelling. Analyze and define the product and production design methodology.

1.4. Course content

Basic characteristics of ship production process. Integration of hull production, outfitting and painting. Methodology for designing a product and process. Shiproduction technology design. Operational research methods applications. Methodology of ship production preparation procedures. Contemporary concepts of shipbuilding processes design and management. Elements fabrication, subassembly, assembly, erection and outfitting analysis. Space - zone outfitting. Process accuracy. Digital twin of product and process. Digital/Smart Shipyard. Ship structure and technology informations design and modelling in specialised shipbuilding softwer.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☒ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Course attendance, activity, student project, studying.

1.8. Evaluation of student's work

Course	2	Activity/Participation		Seminar paper		Experimental	

attendance						work	
Written exam	1	Oral exam		Essay		Research	
Project	1	Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, sustained knowledge check (two mid-term exams), project, written and oral exam or their combination.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Teaching material of class: „Methodology of Ship Production“
Lamb, T., et al., Ship Design & Construction, Vol. I, II, SNAME, 2003.
London, 1995. Winston, W.L., Operations research-Application & Algorithms. Duxbury Press, Belmont, 2003

1.11. Optional / additional reading (at the time of proposing study programme)

Storch, R. L. at al: Ship Production, 2nd edition, SNAME, 2007.
Pierre de Lit, A. Delchambre, Integrated design of a Product Family and its Assembly System, Springer, 2003.
Design for production Manual, Nation Shipbuilding Research, 1999.
Fei Tao , Meng Zhang et al, Digital Twin Driven Smart Manufacturing, 2019
Steffen Bangsow, Technomatix Plant Simulation, Modelling & Programming by Means of Examples, Springer, 2015.
Gideon Halevi Hanbook of Production Management Methods, Butterworth Heinemann, 2001.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Teaching material of class: „Methodology of Ship Production“,pdf		
Lamb, T., et al., Ship Design & Construction, Vol. I, II, SNAME, 2003.	2	15
London, 1995. Winston, W.L., Operations research - Application and Algorithms. Duxbury Press, Belmont, 2003	4	15

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution’s quality assurance system.

Basic description		
Course title	**Numerical Methods and Optimization**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	4
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Recognize computational problems in engineering. Understand and apply basic numerical methods. Understand fundamental ideas and possibilities of application of chosen optimization methods. Independently write short program code and use existing software for numerical problem solving.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Recognize appropriate computational methods for given simpler mathematical formulations of engineering problems. Correctly explain fundamental ideas, advantages and disadvantages of particular numerical methods and optimization methods. Correctly explain fundamental ideas as well as advantages and disadvantages of particular numerical methods. Compare methods applicable to the same type of problem. Write simple computer programs for particular computational methods by following instructions. Correctly explain ideas and properties of some optimization methods. Evaluate results of numerical methods and optimization methods.							
1.4. Course content							
Numerical methods and computer programs for: nonlinear equations with one unknown; systems of nonlinear equations; curve fitting (regression, interpolation); ordinary differential equations. Methods and computer programs for: optimizing a function of one variable, optimizing a function of multiple variables, linear programming. Operational research methods. Appropriate computer programs.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork		☐ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other				
1.6. Comments	-						
1.7. Student's obligations							
Course attendance, mid-term exams, computer knowledge checks.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam	0.5	Essay		Research	

Project		Sustained knowledge check	1.5	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, mid-term exams, computer knowledge checks, oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Chapra, S. C., Channale, R. P., Numerical methods for engineers, McGrowHill Inc., 1988
Press, W., et al: Numerical Recipes for C/C++/Pascal/Fortran, Cambridge University Press, 1992
Winston, L.W., Operations Research – Applications and Algorithms, Duxbury Press, Belmont, 1994

1.11. Optional / additional reading (at the time of proposing study programme)

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1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Chapra, S. C., Channale, R. P., Numerical methods for engineers, McGrowHill Inc., 1988	6	17
Press, W., et al: Numerical Recipes for C/C++/Pascal/fortran, Cambridge University Press, 1992	6	17
Winston, L.W., Operations Research – Applications and Algorithms, Duxbury Press, Belmont, 1994	3	17

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Offshore Operations**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Creating preconditions for complex analysis of the scope and specificities of marine operations in offshore industry. Acquiring specific competencies in complex offshore operations. Ability to carry out appropriate analysis and assessment of corresponding requirements during planning and performing offshore operations. Acquiring specific knowledge in risk analysis of marine and offshore operations.							
1.2. Course enrolment requirements							
Attended course Offshore Structures and Vessels.							
1.3. Expected course learning outcomes							
To define and distinguish marine operations in offshore industry. To describe how weather windows can be determined according to weather forecasts and environmental loads. To have knowledge and competences about selected marine operations. To describe and analyze marine and offshore operations like station keeping, path following, heavy object lifting, pipe playing, tandem loading and off-loading, heave compensation. To be able to quantitatively and qualitatively analyze risks during marine and offshore operations.							
1.4. Course content							
Introduction in marine and offshore operations. Weather windows and uncertainties in weather forecasts. Marine and offshore operations: installation and operation of offshore oil and gas fields, towing and transportation of offshore structures, lifting and landing of large and heavy objects, mooring, pipe and cable laying, offshore loading and off-loading, heave compensation, subsea operations, remotely operated and autonomous operations. Analysis and assessment of requirements during planning and performing of offshore operations. Operational profiles. Risk analysis in marine and offshore operations. Qualitative and quantitative risk analysis. Safety of operations. Cost benefit analysis.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☒ fieldwork		☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Attendance, participation, seminar paper, self-study.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper	1	Experimental work	

Written exam		Oral exam	1	Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Attendance, activity, individual assignments, continuous assessment (2 mid-term exams), oral examination.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Nielsen, F.G. (2007). Marine Operations. Lecture Notes, Department of Marine Technology, Faculty of Engineering, Norwegian University of Science and Technology, Trondheim/Bergen, Norway.
Gudmestad, O.T. (2015). Marine Technology and Operations: Theory & Practice. WIT Press, UK.
DNV GL (2017). Environmental conditions and environmental loads. Report DNVGL-RP-C205, DNV GL AS, Norway. [Online]. Available: https://www.dnvgl.com/rules-standards/
DNV GL (2017). Modelling and analysis of marine operations. Report DNVGL-RP-N103, DNV GL AS, Norway. [Online]. Available: https://www.dnvgl.com/rules-standards/
DNV GL (2017). Risk management in marine and subsea operations. Report DNVGL-RP-N101, DNV GL AS, Norway. [Online]. Available: https://www.dnvgl.com/rules-standards/

1.11. Optional / additional reading (at the time of proposing study programme)

Carlton, J., Jukes, P., Choo, Y.-S., Eds. (2018). Encyclopedia of Maritime and Offshore Engineering. John Wiley & Sons, Inc., Hoboken, USA.
Dhanak, M.R., Xiros, N.I., Eds. (2016). Springer Handbook of Ocean Engineering. Springer, Germany.
Chakrabarti, S.K. (2005). Handbook of Offshore Engineering, Vol. 2. Elsevier, Oxford, UK.
Fossen, T.I. (2011). Handbook of Marine Craft Hydrodynamics and Motion Control. John Wiley & Sons, Ltd., UK.
Vinnem, J.-E. (2014). Offshore Risk Assessment - Principles, Modelling and Applications of QRA Studies - Vol. 1 & 2, 3rd Ed. Springer-Verlag, London, UK.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Nielsen, F.G. (2007). Marine Operations. Lecture Notes, Department of Marine Technology, Faculty of Engineering, Norwegian University of Science and Technology, Trondheim/Bergen, Norway.	1	20
Gudmestad, O.T. (2015). Marine Technology and Operations: Theory & Practice. WIT Press, UK.	1	20
DNV GL (2017). Environmental conditions and environmental loads. Report DNVGL-RP-C205, DNV GL AS, Norway. [Online]. Available: https://www.dnvgl.com/rules-standards/	available online	20
DNV GL (2017). Modelling and analysis of marine operations. Report DNVGL-RP-N103, DNV GL AS, Norway. [Online]. Available: https://www.dnvgl.com/rules-standards/	available online	20
DNV GL (2017). Risk management in marine and subsea operations. Report DNVGL-RP-N101, DNV GL AS, Norway. [Online]. Available: https://www.dnvgl.com/rules-standards/	available online	20

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through a structured system of quality assurance of the Faculty.

Basic description		
Course title	**Offshore Structures and Vessels**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

1.COURSE DESCRIPTION

1.1. Course objectives

Creating preconditions for complex analysis of the scope and specifics of maritime technology. Based on the basic knowledge of the technical requirements, and how to achieve compliance with the broader basis for understanding the essential factors in the design, construction and operation in the maritime technology.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

To distinguish offshore structures and vessels and to describe their characteristics. To estimate environmental and other loads and their impact on offshore structures and vessels. To perform static analysis of mooring lines. To describe construction and installation requirements for selected offshore structures and vehicles. To describe and perform capability analysis of dynamic positioning system. To distinguish special purpose vessels and to describe their characteristics. To distinguish other floating units and subsea structures and objects and to describe their characteristics. To analyse and elaborate environmental and ecological impact of offshore structures and vessels.

1.4. Course content

Classification of offshore structures and vessels. Fixed platforms. Compliant platforms. Jacket platforms. Jack-up platforms. Tension-leg platforms. Mooring systems. Static analysis of mooring lines. Semi-submersible rigs and ships. Dynamic positioning systems. Environmental loads. Other loads. Construction and installation requirements. Special purpose vessels: tugs, offshore supply vessels, cable-laying vessels, pipe-laying vessels, dredgers, drilling ships, heavy cargo vessels. Floating, production, storage and offloading units. Offshore wind farms and other offshore renewable energy systems. Offshore aquaculture structures. Offshore mobile bases. Subsea systems, structures and objects. Environmental and ecological aspects of offshore structures and vessels.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☒ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Attendance, participation, seminar paper, self-study.

1.8. Evaluation of student's work

Course	2	Activity/Participation		Seminar paper	1	Experimental	

attendance						work	
Written exam		Oral exam	1	Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Attendance, activity, individual assignments, continuous assessment (2 mid-term exams), oral examination.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Reddy, D.V., Swamidas, A.S.J. (2014). Essentials of Offshore Structures - Framed and Gravity Platforms. CRC Press, Taylor & Francis Group, LLC, Boca Raton, FL, USA.
Wilson, J.F., Ed. (2003). Dynamics of Offshore Structures. John Wiley & Sons, Inc., Hoboken, New Jersey, USA.
Chakrabarti, S.K. (2005). Handbook of Offshore Engineering, Vol. 1 & 2. Elsevier, Oxford, UK.
DNV GL (2017). DNV GL rules for classification: Ships (RU-SHIP), Underwater technology (RU-UWT), Offshore units (RU-OU), Offshore standards (OS). [Online]. Available: https://www.dnvgl.com/rules-standards/

1.11. Optional / additional reading (at the time of proposing study programme)

El-Reedy, M.A. (2012). Offshore Structures - Design, Construction and Maintenance. Elsevier, USA.
McCormick, M.E. (2010). Ocean Engineering Mechanics with Applications. Cambridge University Press, New York, USA.
Faltinsen, O.M. (1990). Sea Loads on Ships and Offshore Structures. Cambridge University Press, Cambridge, UK.
Karimirad, M. (2014). Offshore Energy Structures - For Wind Power, Wave Energy and Hybrid Marine Platforms. Springer International Publishing, Switzerland.
Carlton, J., Jukes, P., Choo, Y.-S., Eds. (2018). Encyclopedia of Maritime and Offshore Engineering. John Wiley & Sons, Inc., Hoboken, USA.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Reddy, D.V., Swamidas, A.S.J. (2014). Essentials of Offshore Structures - Framed and Gravity Platforms. CRC Press, Taylor & Francis Group, LLC, Boca Raton, FL, USA.	1	20
Wilson, J.F., Ed. (2003). Dynamics of Offshore Structures. John Wiley & Sons, Inc., Hoboken, New Jersey, USA.	1	20
Chakrabarti, S.K. (2005). Handbook of Offshore Engineering, Vol. 1 & 2. Elsevier, Oxford, UK.	1	20
DNV GL (2017). DNV GL rules for classification: Ships (RU-SHIP), Underwater technology (RU-UWT), Offshore units (RU-OU), Offshore standards (OS). [Online]. Available: https://www.dnvgl.com/rules-standards/	Available online	20

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through a structured system of quality assurance of the Faculty.

Basic description		
Course title	**Professional Practice II**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	-

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Student verifies and complements his own expertise, along with a comprehensive view of the work process.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Apply acquired knowledge and skills from studied courses professional content. Gain working process experience. Develop and further improve competence for solving specific professional engineering problems.							
1.4. Course content							
Industrial practice within Graduate University Study of Naval Architecture is carried out individually in work organization that is engaged in the student's field of study, and with activities in accordance with the Industrial Practice Rules and Study Program curriculum. Within such practice, student is familiarized with the corresponding jobs that are studied through programs of education, with the task of verifying and complementing their own expertise, along with a comprehensive view of the work process.							
1.5. Teaching methods	☐ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☒ fieldwork		☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Conducting professional practice in duration of 15 working days, or 120 hours, and writing the corresponding report.							
1.8. Evaluation of student's work							
Course attendance		Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Sustained knowledge check		Report	1	Practice	4
Portfolio							
1.9. Procedure and examples of learning outcome assessment in class and at the final exam							
Assesses and evaluates student work and dedication, and written report.							

1.10. Assigned reading (at the time of the submission of study programme proposal)

1.11. Optional / additional reading (at the time of proposing study programme)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Project I**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	0+30+0

1. **COURSE DESCRIPTION**			
1.1. Course objectives			
Application of acquired knowledge and skills to solve practical problems in the field of associated course from which the Project I is elected.			
1.2. Course enrolment requirements			
Enrolled course from which the Project I is elected.			
1.3. Expected course learning outcomes			
Apply the knowledge and skills from professional content of the associated course. Solve practical task. Acquire competence for individually solving specific professional tasks.			
1.4. Course content			
Chosen chapter of associated course from which the project was elected.			
1.5. Teaching methods	☐ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other	
1.6. Comments			
1.7. Student's obligations			
Attending the consultation, individually solving task and writing the project report.			
1.8. Evaluation of student's work			

Course attendance		Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project	2	Sustained knowledge check		Report		Practice	
Portfolio		Individual task solving	3				

1.9. Procedure and examples of learning outcome assessment in class and at the final exam	
Assesses and evaluates the accuracy and completeness of the project task solution and its presentation.	
1.10. Assigned reading (at the time of the submission of study programme proposal)	
References listed for the associated course from which the Project I is elected.	

1.11. Optional / additional reading (at the time of proposing study programme)		
References listed for the associated course from which the Project I is elected.		
1.12. Number of assigned reading copies with regard to the number of students currently attending the course		
Title	*Number of copies*	*Number of students*
1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences		
Through the Institution's quality assurance system.		

Basic description		
Course title	**Project II**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	0+30+0

1. **COURSE DESCRIPTION**			
1.1. Course objectives			
Application of acquired knowledge and skills to solve practical problems in the field of associated course from which the Project II is elected.			
1.2. Course enrolment requirements			
Enrolled course from which the Project II is elected.			
1.3. Expected course learning outcomes			
Apply the knowledge and skills from professional content of the associated course. Solve practical task. Acquire competence for individually solving specific professional tasks.			
1.4. Course content			
Chosen chapter of associated course from which the project was elected.			
1.5. Teaching methods	☐ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other	
1.6. Comments			
1.7. Student's obligations			
Attending the consultation, individually solving task and writing the project report.			
1.8. Evaluation of student's work			

Course attendance		Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project	2	Sustained knowledge check		Report		Practice	
Portfolio		Individual task solving	3				

1.9. Procedure and examples of learning outcome assessment in class and at the final exam	
Assesses and evaluates the accuracy and completeness of the project task solution and its presentation.	
1.10. Assigned reading (at the time of the submission of study programme proposal)	
References listed for the associated course from which the Project II is elected.	

1.11. Optional / additional reading (at the time of proposing study programme)		
References listed for the associated course from which the Project II is elected.		
1.12. Number of assigned reading copies with regard to the number of students currently attending the course		
Title	*Number of copies*	*Number of students*
1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences		
Through the Institution's quality assurance system.		

Basic description		
Course title	**Project Management in Shipbuilding**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**			
1.1. Course objectives			
Introduction to the project management of the construction of the vessel or facility of marine technology, and introduction to project management methods applied in the shipyard in accordance with defined learning outcomes.			
1.2. Course enrolment requirements			
None.			
1.3. Expected course learning outcomes			
Interpret and explain the processes of project management. Analyze the conditions for the start of the project. Interpret the simultaneous engineering. Analyze the project management implementation. Explain risk management. Distinguish the specifics of project management in the shipbuilding industry. Describe the trends in development of project management in the shipbuilding industry.			
1.4. Course content			
Introduction and basic concepts. Project management processes. Making the project. Simultaneous engineering. Time management for project implementation, cost, procurement, quality and communications project. Risk Management. The specifics of the vessel and objects of marine technology new building project management. Development trends in project management that are of great importance for the economy.			
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☒ long distance education ☒ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other	
1.6. Comments			
1.7. Student's obligations			
Course attendance, activity, homework, studying.			
1.8. Evaluation of student's work			

Course attendance	2	Activity/Participation		Seminar paper	1	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, continuous knowledge testing (two mid-term exams), Seminar paper, written exam, oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Matulja, T.: Teaching material published on e-learning course Project Management in Shipbuilding, 2021.
..., Project Management Institute , A Guide to the Project Management Body of Knowledge, PMI., USA, 2013.
Ostwald, F. P., McLaren, S. T., Cost Analysis and Estimating for Engineers and Management, Prentice Hall, 2003.
Merow, E.W., Industrial Megaprojects, 1st edition, Wiley, 2011.

1.11. Optional / additional reading (at the time of proposing study programme)

Iyigun, M. Guven, A Decision Support System for R&D Project Selection and Resource Allocation under Uncertainty, Project Management Journal, December 1993.
Rodney Turner, J., The Handbook of Project Based Management, McGraw-Hill, New York, 1992.
..., ISO: Code of Good Practice for Standardization, Geneva, Switzerland: ISO Press, 1994.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Matulja, T.: Teaching material published on e-learning course Project Management in Shipbuilding, 2021.		9
..., Project Management Institute, A Guide to the Project Management Body of Knowledge, Project Management Ins., USA, 2013.	1	9
Ostwald, F. P., McLaren, S. T., Cost Analysis and Estimating for Engineers and Management, Prentice Hall, 2003.	1	9
Merow, E.W., Industrial Megaprojects, 1st edition, Wiley, 2011.	1	9

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution’s quality assurance system.

Basic description		
Course title	**Quality Management and Metrology**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
The course is designed to provide the student with basic knowledge in quality management and metrology topics. Through individual projects, students are introduced with practical application of several course objectives.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Compare different approaches to quality management. Specify implementation of quality management system and international quality standards ISO 90001. Compare models of excellence. Differentiate methods for quality improvement. Assess capability of measurement system. Interpret advanced metrology concepts. Assess quality by statistical process control. Asses risk.							
1.4. Course content							
History and characteristics of quality management. Strategies of quality management. Total quality management. Quality planning methods. Quality management system. Methods for quality improvement. Basic and advanced continuous quality improvement tools.. Statistical process control. Control charts. Process capability analysis. Measurement system capability analysis. Reliability and risk management. Quality management in projects. Process improvement with designed experiments. Full factorial experiments. Fractional factorial experiments.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☒ fieldwork		☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Course attendance, active participation in the course, attendance at exercises and fieldwork, seminar paper and independent learning.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper	0.75	Experimental work	

Written exam	0.5	Oral exam		Essay		Research	
Project		Sustained knowledge check	1.5	Report		Practice	
Portfolio		Fieldwork	0.25				

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Sustained knowledge check and final written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

1.11. Optional / additional reading (at the time of proposing study programme)

Montgomery, D. C.: Introduction to statistical quality control, 8th ed., J. Wiley & Sons, New York, 2019.
Montgomery, D.C., Jennings, C. L., Pfund, M. E.: Managing, controlling, and improving quality, John Wiley & Sons Wiley, 2011.
Bilić, B.: Kvaliteta-planiranje, analiza i upravljanje, FESB, 2016.
Kondić, Ž., Maglić, L., Pavletić, D.: Kvaliteta 1, 2, 3, Sveučilište Sjever, Strojarski fakultet Slavonski Brod, Tehnički fakultet Sveučilišta u Rijeci, 2018
Jay L. Bucher: The Metrology Handbook, ASQ Quality Press, 2004.
Smith, G. T.: Industrial Metrology, Springer, 2002.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution’s quality assurance system.

Basic description		
Course title	**Seakeeping**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	45+30+0

1. **COURSE DESCRIPTION**			
1.1. Course objectives			
Understanding stochastic models of ship motions on sea waves. The ability to analyze and compare alternative design solutions based on the vessel's operational efficiency. Developing the ability to work in small groups (teamwork) and present the obtained results.			
1.2. Course enrolment requirements			
None.			
1.3. Expected course learning outcomes			
Explain the mechanism of regular progressive wave. Statistically analyze the sea waves data for different geographical areas. Describe the methods of long-term prediction of extreme values. Explain strip theory of ship motion. Itemize the dynamic effect of ship motion and describe the methods of calculation. Calculate the response spectrum of the ship and exceedance of the dynamic effect criteria on certain weather conditions. State and explain the impact of certain design and operating parameters on the dynamic response of the ship on sea waves. Analyze and compare alternative ship design solutions based on operational efficiency.			
1.4. Course content			
Linear wave theory. Sea waves as stochastic process. Sea waves statistics. Design sea state. Ship behaviour on regular wave. Strip theory. Response amplitude operators. Ship response on sea waves. Dynamic effects on sea waves. Polar plots. Seakeeping criteria. Operability. Motion stabilization. Seakeeping in design.			
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other	
1.6. Comments	-		
1.7. Student's obligations			
Course attendance, activity, studying.			
1.8. Evaluation of student's work			

Course attendance	2.5	Activity/Participation		Seminar paper	0.5	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	

Portfolio		Homework					

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, seminar paper, activity, continuous knowledge testing (two mid-term exams), written and oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Prpić-Oršić J., Čorić V.: Seakeeping, Zigo, University of Rijeka, 2006. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Lloyd A.R.M.J.: Seakeeping: Ship behaviour in Rough water, Pllis Horwood Ltd, New York, 1989.
Faltinsen, O. M.: Sea Loads on Ships and Offshore Structures, University Press, Cambridge, 1998.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Prpić-Oršić J., Čorić V.: Seakeeping, Zigo, University of Rijeka, 2006. (in Croatian)	5	5

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Ship Design I**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	compulsory	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	45+15+0

1. **COURSE DESCRIPTION**		
1.1. Course objectives		
Acquiring specific competencies in ship design. Developing the ability for solving problems set in order to define design requirements and to create a preliminary design of a ship.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Describe the process of the ship design and analyze the phases of ship design. Define and describe the concept of design requirements and concept and preliminary design. Specify and analyze methods of preparing a preliminary design and selection of main ship dimensions. Define the hull shape and check the ship floatability and stability in the intact and damaged condition. Analyze the rationality of subdivision and the layout of ship spaces and tanks. Accomplish a preliminary propulsion calculation and prediction diagram. Define masses and centers of gravity in various iterative design stages. Create a general arrangement plan, technical specification and get acquainted with the classification documentation. Analyze and explain the application of computers for basic calculations in the design of the vessels. Acquaint with the delivery documentation and delivery testing program. Analyze the use of computers for basic calculations in ship design.		
1.4. Course content		
Introduction to the ship design. Phases of the ship design. Design requirements. Concept design. Preliminary design. Methods of preparing a preliminary project. Selection of the ship main dimensions. Defining the ship's hull form and creating the ship lines plan. Checking the floatability and stability in the intact and damaged condition. Determination of the required power and choice of main propulsion machinery. Creating a general arrangement plan. Ship subdivision. Layout of ship spaces and tanks. Preliminary determination of masses and centers of gravities. Contract design. Technical specification. Classification documentation. International regulations, standards and conventions and rules of classification societies related to the ship design. Delivery documentation and delivery testing program. Using of computers for basic calculations in ship design.		
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		
1.7. Student's obligations		

Class attendance, class activity, project assignment, individual learning.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation	0.5	Seminar paper		Experimental work	
Written exam	0.5	Oral exam	0.5	Essay		Research	
Project	1	Sustained knowledge check	0.5	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Class attendance, class activity, project assignment, continuous assessment (mid-term exams), written and oral exam

1.10. Assigned reading (at the time of the submission of study programme proposal)

Papanikolau, A.: Ship Design - Methodologies of Preliminary Design, Springer, London, 2014.
Roh, M.I., Lee, K.-Y.: Computational Ship Design, Springer Nature Singapore Pte Ltd, Singapore, 2018.
Watson, D.: Practical Ship Design, Elsevier Science Ltd., Oxford, 1998.
Schneekluth, H., Bertram, V.: Ship Design for Efficiency & Economy, Butte rworth Heinemann, Oxford, 1998.

1.11. Optional / additional reading (at the time of proposing study programme)

Belamarić, I.: Brod i entropija, Književni krug, Split, 1998.
..., Rules for the Classification of Ships, Croatian Register of Shipping, , Split, 2018.
..., Instructions for using shipbuilding software packages for ship basic design calculations

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Papanikolau, A.: Ship Design - Methodologies of Preliminary Design, Springer, London, 2014.	1	10
Roh, M.I., Lee, K.-Y.: Computational Ship Design, Springer Nature Singapore Pte Ltd, Singapore, 2018.	1	10
Watson, D.: Practical Ship Design, Elsevier Science Ltd., Oxford, 1998.	1	10
Schneekluth, H., Bertram, V.: Ship Design for Efficiency & Economy, Butterworth Heinemann, Oxford, 1998.	1	10

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through a structured system of quality assurance of the Faculty.

Basic description		
Course title	**Ship Design II**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	15+45+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Acquiring specific competencies in ship design. Developing the ability for solving problems set in order to define design requirements and to create an own preliminary design of a ship.							
1.2. Course enrolment requirements							
Attended course Ship Design I.							
1.3. Expected course learning outcomes							
Distinguish and argue the basic theoretical and empirical formula in ship design. Specify and analyze technical specification for particular concept designs. Make a ship concept design with associated calculations and draw a general arrangement plan and create a technical specification.							
1.4. Course content							
Presentation of the basic theoretical and empirical formulas useful in ship design. Getting acquainted with the technical requirements for particular concept designs. Ship design methodology. Risk-based ship design. Individual creation a ship concept design by phases. Creating an associated calculations, general arrangement plan and technical specification.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork		☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Class attendance, class activity, project assignment, individual learning.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation	0.5	Seminar paper		Experimental work	
Written exam	0.5	Oral exam		Essay		Research	
Project	2	Sustained knowledge check		Report		Practice	
Portfolio							
1.9. Procedure and examples of learning outcome assessment in class and at the final exam							
Class attendance, class activity, project assignment, continuous assessment (mid-term exams), written and oral exam							

1.10. Assigned reading (at the time of the submission of study programme proposal)

Papanikolau, A.: Ship Design - Methodologies of Preliminary Design, Springer, London, 2014.
Watson, D.: Practical Ship Design, Elsevier Science Ltd., Oxford, 1998.
Papanikolau, A. (ed.): Risk-Based Ship Design - Methods, Tools and Applications, Springer, London, 2009.
Papanikolau, A. (ed.): A Holistoic Approach to Ship Design, Volume 1: Optimisation of Ship Design and Operation for Life Cycle, Springer Nature Switzerland AG, Cham, 2019

1.11. Optional / additional reading (at the time of proposing study programme)

Belamarić, I.: Brod i entropija, Književni krug, Split, 1998.
..., Rules for the Classification of Ships, Croatian Register of Shipping, , Split, 2018.
..., Instructions for using shipbuilding software packages for ship basic design calculations

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Papanikolau, A.: Ship Design - Methodologies of Preliminary Design, Springer, London, 2014.	1	10
Watson, D.: Practical Ship Design, Elsevier Science Ltd., Oxford, 1998.	1	10
Papanikolau, A. (ed.): Risk-Based Ship Design - Methods, Tools and Applications, Springer, London, 2009.	1	10
Papanikolau, A. (ed.): A Holistic Approach to Ship Design, Volume 1: Optimisation of Ship Design and Operation for Life Cycle, Springer Nature Switzerland AG, Cham, 2019	1	10

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through a structured system of quality assurance of the Faculty.

Basic description		
Course title	**Ship Negotiation Process**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+15+0

1. **COURSE DESCRIPTION**			
1.1. Course objectives			
Introducing students to the ship negotiation process according to defined learning outcomes.			
1.2. Course enrolment requirements			
None.			
1.3. Expected course learning outcomes			
Analyze the sales function within the business and production systems. Analyze and compare the business strategies, shipbuilding strategy, and the content of marine vessel negotiations. Display and interpret the actions of receiving and processing the inquiry. To analyze the inquiry from the financial and marketing standpoint. Distinguish and interpret the types and structure of calculations, the costs and the selling price. Analyze methods for ship building costs estimations. Define elements and content of the bid, compare and argue the options. Differentiate terminology, elements and types of business contracts. Describe the procedures to avoid risk.			
1.4. Course content			
Sales function in shipyard management-production system. Business and build strategy. Contents of contracting. Reception and processing of inquiry. Evaluation of inquiry regarding financial and marketing standpoint. Types of calculations. Structure of calculations. Costs estimation. Costing price and sale price. Elements and contents of bid, options. Business negotiations, business correspondence. Elements and contract standard types. Documentation. Avoiding risk. Optimal and satisfactory solutions.			
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☒ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other	
1.6. Comments			
1.7. Student's obligations			
Course attendance, activity, sustained knowledge check, seminar paper, studying.			
1.8. Evaluation of student's work			

Course attendance	1.5	Activity/Participation		Seminar paper	1	Experimental work	
Written exam	1.5	Oral exam		Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	

Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, sustained knowledge check, seminar paper, written and oral exam or their combination.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Teaching material of class: „Ship Negotiation Process"
„Shipbuilding Contracts", Hill Dickinson, Liverpool, England, 2010
„Standard shipbuilding Contract AWES 99", Association of European Shipbuilders and Shiprepairrs, 2002.
Benford, H.: Temeljna načela inženjerske ekonomije u projektiranju broda, Tehniki fakultet Rijeka i Brodogradilište "3.maj" Rijeka

1.11. Optional / additional reading (at the time of proposing study programme)

Simon Curtis, The Law of Shipbuilding Contracts, 2012.
Hunt, C. E., Butman, S. B., Marine Engineering Economics and Cost Analysis, Cornell Maritime Press, 1995.
Benford, H.: Temeljna načela inženjerske ekonomije u projektiranju broda, Tehniki fakultet Rijeka i Brodogradilište "3.maj" Rijeka, 1985.
Erichsen, S., Management of Marine Design, Butherworts, London, 1989

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Teaching material of class: „Ship Negotiation Process", pdf		
Benford, H.: Temeljna načela inženjerske ekonomije u projektiranju broda, Tehnički fakultet Rijeka i Brodogradilište "3.maj" Rijeka	4	15
Shipbuilding Contracts", Hill Dickinson, Liverpool, England, 2010	2	15
„Standard Shipbuilding Contract AWES 99", Association of European Shipbuilders and Shiprepairs, 2002.	2	15

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Ship Outfitting and Repair**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	45+15+0

1. **COURSE DESCRIPTION**		
1.1. Course objectives		
Introduction to documentation and procedures of fabrication and installation of the ship equipment, as well as to monitoring work execution, quality control, testing and monitoring ship outfitting costs in accordance with defined learning outcomes.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Explain and interpret the significance and complexity of ship outfitting and its structure and sequence. Apply the breakdown of the ship and the basic tenets of the ship outfitting process. Argue the benefits of outfitting ship sections and modular outfitting. Use adequate documentation in the process of ship outfitting. Analyze technological solutions for ship outfitting, outfitting process, quality control, testing procedures and costs. Develop a basic scheduler of outfitting works, estimate required man hours, and the calculation of the required workforce by profession and a list and plan of outfitting activities. Describe the technological process of ship outfitting regarding ship piping workers, mechanics, electricians, locksmiths, metalworkers, insulation workers and painters. Interpret and use curriculum of ship trial process. Define and describe the repair works and services. Describe the technological processes of ship repair. Distinguish types of docks and docking procedures.		
1.4. Course content		
Meaning and scope of ship outfitting. Product work breakdown structure. Basic scheme of ship outfitting process. Technological solutions and improvement of ship outfitting. Modular and advance ship outfitting. Structure, division and sequences of outfitting. Making a list and a plan of outfitting works. Monitoring the execution of works, quality, testing and direct costs. Piping works. Pipe blocks Installation of ship main engine, shaft and other machinery and equipment. Processing and installation of propeller shaft and rudder bearing. Installation of ship electrical equipment. Installation of ship cables. Description of metalwork, carpenter works, insulation and painting works. Monitoring the outfitting works and repairs, inspections, tests and ship trial. The purpose and reasons for the ship repair. Breakdown and description of ship repair. Repair facilities capacities and their utilization. Docks. Works and services in docking and ship repair. Ship Demolition and Recycling activities.		
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☒ long distance education ☒ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☒ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Course attendance, activity, sustained knowledge check, seminar paper, studying.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper	1	Experimental work	
Written exam	0.5	Oral exam	0.5	Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity at lectures and laboratory practice, sustained knowledge check (two mid-term exams), seminar paper, written and oral exam or their combination.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Matulja, T.: Teaching material published on e-learning course Skip Outfitting and Repair, 2021.
Butler, D., Guide to Ship Repair Estimates, Butterworth Heinemann, Oxford, 2000.
House, D.J., Dry Docking and Shipboard Maintenance, Witherby & Co. Ltd., London, 2003.

1.11. Optional / additional reading (at the time of proposing study programme)

Marušić, I.: Piping in Shipbuilding, Školska knjiga, Zagreb, 1983. (in Croatian)
Čujić, M.: Metalworks in Shipbuilding, Školska knjiga, Zagreb, 1984. (in Croatian)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Matulja, T.: Teaching material published on e-learning course Skip Outfitting and Repair, 2021.		
Butler, D., Guide to Ship Repair Estimates, Butterworth Heinemann, Oxford, 2000.	1	26
House, D.J., Dry Docking and Shipboard Maintenance, Witherby & Co. Ltd., London, 2003.	1	26

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Ship Stability in Exploitation**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	45+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Creating preconditions for complex recognizing of the importance of buoyancy and stability of the ship in service. Connectivity issues of buoyancy and stability of the ship in operation, with safety of the ship and crew (passengers) as well as environmental protection.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Describe the problems of buoyancy and stability of the ship in service. Argue transverse and longitudinal subdivision of the ship. Identify and analyze the ship loading condition and loading, unloading and transfer of cargo. Describe computer tools on board to check buoyancy, static and dynamic stability and shear forces and moments. Analyze the factors affecting the stability of the ship (liquid and bulk cargo, water penetration, waves). Argue the environmental aspects of exploitation. Describe the rules of classification societies and international recommendations and conventions. Describe the probabilistic approach to damage stability. Describe ships parametric rolling and dynamic effects influence on stability.							
1.4. Course content							
Introduction to buoyancy and stability of the ship in service. Transverse and longitudinal subdivision of the ship. Ship loading conditions. Loading, unloading and transfer of cargo on board. Computer tools on board to check buoyancy, static and dynamic stability and shear forces and moments. Ways to minimize the negative influence of liquid cargoes and the decanting of bulk cargo on the ship's stability in operation. Dangers in exploitation. Water intrusion alarm systems. Crossleveling ship systems. Ecological aspects of exploitation. Regulations of classification societies and international recommendations and conventions. Probabilistic approach to damage stability. Ships parametric rolling and dynamic effects influence on stability.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork			☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other			
1.6. Comments							
1.7. Student's obligations							
Attendance, class participation, seminar paper, studying.							
1.8. Evaluation of student's work							
Course	2.5	Activity/Participation		Seminar paper	0.5	Experimental	

attendance						work	
Written exam		Oral exam	1	Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Attendance, continuous assessment (2 mid-term exams), seminar project, written examination, oral examination, or any combination of these forms.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Watson, D.: Practical Ship Design, Elsevier Science Ltd., Oxford, 1998.
Schneekluth, H., Bertram, V.: Ship Design for Efficiency & Economy, Butterworth Heinemann, Oxford, 1998.
..., Principles of Naval Architecture, The Society of Naval Architects and Marine Engineers, Jersey
Biran, A. B.: Ship hydrostatics and stability, 2006.
Van Dokkum. K.: Ship stability, Dokmar Maritime Publishers; 4th edition including CD ROM, 2013.

1.11. Optional / additional reading (at the time of proposing study programme)

Belamarić, I.: Ship and Entropy, Književni krug, Split, 1998. (in Croatian)
..., Rules for Ship Technical Survey, Part 1.-8., Hrvatski registar brodova, Split, 1999. (in Croatian)
Guidelines for the use of software packages for basic design calculations and description of marine forms.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Watson, D.: Practical Ship Design, Elsevier Science Ltd., Oxford, 1998.	1	10
Schneekluth, H., Bertram, V.: Ship Design for Efficiency & Economy, Butterworth Heinemann, Oxford, 1998.	1	10
Principles of Naval Architecture,The Society of Naval Architects and Marine Engineers, 1988-1989	1	10
Biran, A. B.: Ship hydrostatics and stability, 2006.	1	10
Van Dokkum. K.: Ship stability, Dokmar Maritime Publishers; 4th edition including CD ROM, 2013.	1	10

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through a structured system of quality assurance of the Faculty.

Basic description		
Course title	**Ship Structural Design**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**		
1.1. Course objectives		
Obtaining theoretical knowledge and introducing basic methods and procedures for direct determination of global and local ship hull girder strength in frame of ship hull structural design.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Indicate and properly interpret the type of analysis of the ship hull structure strength assessment. Explain the phases of ship longitudinal strength calculation. To calculate distribution of normal and shear stresses on the cross section of the hull. Identify appropriate methods of direct calculation and assessment for local strength of the ship. Define and correctly interpret the bending and torsion of the ship's hull as a thin-walled beam. Define and correctly interpret the buckling of individual elements of the hull structure (truss, beam) and simple structure (panel, stiffened panel). Define and correctly interpret the plate bending (isotropic and orthotropic). Check the dimensions of the main structural elements of a merchant ship type obtained by the rules and regulations of a classification society in respect to the direct calculation method. Evaluate the results of direct calculation methods.		
1.4. Course content		
Fundamentals of the strength analysis of ship hull and structural elements within ship structural design process. Ship structural load. Ship structure model for longitudinal, transversal and local strength assessment. Ship hull as thin-walled structure, bending and torsion. Calculation of the normal and shear stresses. Effective plating. Influence of shear stresses to normal stresses and deformation. Torsion of open, closed and multi-cell section. Plates strength assessment in ship construction, isotropic and orthotropic plate bending. Fundamentals of stability calculations of the ship and structural elements.		
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		
1.7. Student's obligations		
Course attendance, activity, project work, studying		
1.8. Evaluation of student's work		

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam	0.5	Essay		Research	
Project	1	Sustained knowledge check	1.5	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, continuous knowledge testing (two mid-term exams), project work, written and oral exam

1.10. Assigned reading (at the time of the submission of study programme proposal)

Zamarin, A.: Ship Strength, internal script available over *Chair for floating objects construction* web page. (in Croatian)
Uršić, J.: Ship Strenght I, Sveučilište u Zagrebu, 1991. (in Croatian)
Uršić, J.: Ship Strenght II, Sveučilište u Zagrebu, 1992. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Hughes, O. F, Paik, J.K.: Ship structural design, SNAME, New Jersey, 2010.
Paik, J. K.: Ultimate limit state design of steel-plated structures, John Wiley & Sons, West Sussex, 2006.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Zamarin, A.: Ship Strength, internal script available over *Chair for floating objects construction* web page. (in Croatian)	18	18
Uršić, J.: Ship Strenght I, Sveučilište u Zagrebu, 1991. (in Croatian)	2	18
Uršić, J.: Ship Strenght II, Sveučilište u Zagrebu, 1992. (in Croatian)	2	18

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Ship Structural Analysis**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**		
1.1. Course objectives		
Within the course students will introduced ship structural design basics and learn the theoretical basis and the application of methods and procedures for the direct determination of global and local strength of ship hull. Team work skills in small groups.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Specify and correctly interpret the objectives and basic procedures for ship hull structural design according to strength criteria, within ship design. Specify and correctly interpret the design loads and types of ship structural analysis. Identify and explain appropriate methods and criteria for evaluation of the longitudinal, transversal and local strength of the ship. Specify and correctly interpreted basic principles of the finite element method. Define structure model applicable to different type of analysis. Apply state-of-the-art computer programs in modelling hull structure and calculation of stress and strain of the structural elements. Analyse the results in terms of fulfilling strength and reliability criteria.		
1.4. Course content		
Basic settings, procedures and methods in ship's structural design within the process of ship design. Types of analyses of the ship structure; static, quasi-static, dynamic. Fundamentals in fluid structure interaction. Basics of structure modelling, static and quasi-static analysis of hull structure in the elastic range. Review and application of finite element method in hull structure analysis. Selection of appropriate types of finite elements, modelling of loads and boundary conditions. Particulars in modelling; symmetry of the structure and the load. Procedure for ship ultimate strength calculation. Fundamentals of fatigue strength assessment. Application of the general purpose and/or special software in modelling and analysis of the hull structure elements.		
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		
1.7. Student's obligations		
Course attendance, activity, project work, studying		
1.8. Evaluation of student's work		

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam	0.5	Essay		Research	
Project	1.5	Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, continuous knowledge testing (one mid-term exams), project work, written and oral exam

1.10. Assigned reading (at the time of the submission of study programme proposal)

Senjanović, I.: FME in Ship Strucures Analysis, Sveučilište u Zagrebu, 1998. (in Croatian)
Uršić, J.: Ship Strenght II, Sveučilište u Zagrebu, 1992. (in Croatian)
Hughes, O. F., Paik, J. K.: Ship structural design, SNAME, New Jersey, 2010.

1.11. Optional / additional reading (at the time of proposing study programme)

Paik, J. K.: Ultimate limit state design of steel-plated structures, John Wiley & Sons, West Sussex, 2006.
Okumoto, Y., Takeda, Y., Mano, M., Okada T.: Design of Ship Hull structures, Springer, 2009.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Senjanović, I.: FME in Ship Strucures Analysis, Sveučilište u Zagrebu, 1998. (in Croatian)	5	14
Uršić, J.: Ship Strenght II, Sveučilište u Zagrebu, 1992. (in Croatian)	2	14
Hughes, O. F., Paik, J. K.: Ship structural design, SNAME, New Jersey, 2010.	1	14

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Ship Systems**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	compulsory	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	45+15+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Obtaining theoretical knowledge and develop skills to solve practical problems in the field of ship systems and design of ship systems.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Define and analyze ship propulsion systems of ships with diesel engine propulsion plants. Describe ship propulsion systems of ships with turbine propulsion. Describe and analyze ship ballast and bilge systems. Describe ship sanitary systems and fresh water systems. Describe and compare systems for cargo loading and unloading. Describe and analyze ship systems for cargo heating. Describe and compare ship fire fighting systems. Describe ship systems on LNG tankers.							
1.4. Course content							
Generally on ship systems. Rules for design, building and maintenance of ship systems. Fuel oil systems. Ship cooling systems. Compressed air systems. Lubrication oil systems. Other ship engine systems. Ballast systems. Bilge systems. Sanitary systems. Fire fighting systems. Other ship common systems. Systems for cargo loading and unloading. Inert gas systems. Tank cleaning systems. Special systems on chemical tankers. Special systems on LNG and LPG ships. Ship control systems.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☒ fieldwork			☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other			
1.6. Comments							
1.7. Student's obligations							
Course attendance, activity, homework, studying.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper	0.25	Experimental work	
Written exam		Oral exam	0.75	Essay		Research	

Project		Sustained knowledge check	2	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, seminar paper, continuous knowledge testing (two mid-term exams), oral or written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Ozretić, V.: Marine Auxiliary Machinery and Devices, Dalmacijapapir, Split, 1996. (in Croatian)
Martinović, D.: Marine Machinery Systems, Digital point, Rijeka, 2005. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Smith, D. W.: Marine Auxiliary Machinery, Butterworths, London, 1988.
Knak, C.: Diesel Motor Ships, Engines and Machinery, Institute of Marine Engineers, 1990.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Ozretić, V.: Marine Auxiliary Machinery and Devices, Dalmacijapapir, Split, 1996. (in Croatian)	8	30
Martinović, D.: Marine Machinery Systems, Digital point, Rijeka, 2005. (in Croatian)	3	30

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Shipyard Design**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**			
1.1. Course objectives			
Introducing to the features and design methodology of shipyards related to defined learning outcomes.			
1.2. Course enrolment requirements			
None.			
1.3. Expected course learning outcomes			
Explain and interpret the development of the shipyard. Systematize and classify the shipyard. Compare and analyze existing shipyards. Analyze and determine the location of the shipyard. Develop a general plan for the shipyards. Define the capacity of the shipyard. Apply the methodology of designing shipyards. Describe and define basic material flows. Describe and choose the means of production, equipment and facilities of the shipyard. Interpret production focus. Define shipyard work areas.			
1.4. Course content			
The historical development of the shipyard. Types of shipyards. Limitations. Location analysis and selection. General plan of shipyard. Cooperation, capacity and structure of the shipyard. Comparative analysis of existing shipyards. Design methodology and manufacturing processes. (Strategic planning, Feasibility study. Conceptual design). Calculation of production focuses of shipyards, warehouses, workshops, assembly areas. Qualitative and quantitative material flows. Means of production, equipment and facilities of the shipyard. Energy in the shipyard. Green shipyards.			
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☒ long distance education ☒ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☒ mentorship ☐ other	
1.6. Comments			
1.7. Student's obligations			
Course attendance, activity, homework, studying.			
1.8. Evaluation of student's work			

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	0.5	Oral exam	0.5	Essay		Research	
Project	1	Sustained knowledge check	1	Report		Practice	

Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, continuous knowledge testing (two mid-term exams), Seminar paper, written exam, oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Matulja, T.: Teaching material published on e-learning course Shipyard Design, 2021.
Stephens, M.P., Meyers, F.E., Manufacturing Facilities Design & Material Handling, 5th edition, Prentice Hall, 2013.
Tompkins, J.A., et al., Facilities Planning, 4th edition, Wiley, 2010.
Gaythwaite, J.W., Design of Marine Facilities for the Berthing, Mooring and Repair of Vessels, 2004.

1.11. Optional / additional reading (at the time of proposing study programme)

Winston, W.L., Operations research - Aplication and Algorithms, Duxbury Press, Belmont, 2003.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Matulja, T.: Teaching material published on e-learning course Shipyard Design, 2021.		20
Stephens, M.P., Meyers, F.E., Manufacturing Facilities Design & Material Handling, 5th edition, Prentice Hall, 2013.	1	20
Tompkins, J.A., et al., Facilities Planning, 4th edition, Wiley, 2010.	1	20
Gaythwaite, J.W., Design of Marine Facilities for the Berthing, Mooring and Repair of Vessels, 2004.	1	20

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution’s quality assurance system.

Basic description		
Course title	**Shipyard Organization and Management**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+15+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Within the course students acquire the basic knowledge of shipyard organization and management related to defined learning outcomes.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Interpret business systems with a single production. Analyze shipyard business management. Explain and describe the business policy of the shipyard. Analyze the shipbuilding market. Define shipyard production program. Analyze shipyard manufacturing processes. Interpret shipyard financing. Interpret and explain the organization of the shipyard. Distinguish contemporary organizational tendencies in shipbuilding. Compare the situation, problems and trends in the development of the Croatian shipbuilding.							
1.4. Course content							
Basics of Organisation. Operating system with individual production. Managing business system. Shipyard as a business system with a single production. Business policy. Shipbuilding policy. Shipbuilding market. The production process in the shipyard. Costs. Funding shipyards. Organization of the shipyards (Organizational structure. Organization of elements of organizational structure. Organizational dynamics.). Management of the shipyard. Modern organizational tendencies in shipbuilding. The organization and operation of ship repairing. Development of modern production. Case studies.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☒ long distance education ☒ fieldwork			☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other			
1.6. Comments							
1.7. Student's obligations							
Course attendance, activity, homework, studying.							
1.8. Evaluation of student's work							
Course attendance	1.5	Activity/Participation		Seminar paper	1.5	Experimental work	
Written exam	0.5	Oral exam	0.5	Essay		Research	
Project		Sustained knowledge	1	Report		Practice	

		check					
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, continuous knowledge testing (two mid-term exams), Seminar paper, written exam, oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Matulja, T.: Teaching material published on e-learning course Shipyard Organization and Management, 2021.
Papall, L., et al., Industrial Organization: Contemporary Theory and Empirical Applications, 5th Edition, Wiley, 2014.
Tod, D., The World Shipbuilding industry, Croom Helm Australia, Sydney, 2001.
Hunt, C. E., Butman, S. B., Marine Engineering Economics and Cost Analysis, Cornell Maritime Press, 1995.

1.11. Optional / additional reading (at the time of proposing study programme)

Sikavica, P.: Organizacija, ŠK, Zagreb, 2011.
Jurković, M.: Reinženjering proizvodnih poduzeća, Grafičar, 2011

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Matulja, T.: Teaching material published on e-learning course Shipyard Organization and Management, 2021.		
Papall, L., et al., Industrial Organization: Contemporary Theory and Empirical Applications, 5th Edition, Wiley, 2014.	1	12
Tod, D., The World Shipbuilding industry, Croom Helm Australia, Sydney, 2001.	1	12
Hunt, C. E., Butman, S. B., Marine Engineering Economics and Cost Analysis, Cornell Maritime Press, 1995.	1	12

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Small Craft Construction**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**		
1.1. Course objectives		
Within the course, students will gain a basic understanding of the small craft structural elements, and get familiar with the empirical approach to scantling determination of single hull vessels of up to 24m with restricted service area made of wood, composite or aluminum.		
1.2. Course enrolment requirements		
None.		
1.3. Expected course learning outcomes		
Indicate and correctly interpret the type of structural load of small crafts. Distinguish materials for the construction by mechanical characteristics. To calculate design loads according to the rules and regulations of classification societies. Enumerate specific structural units and define their functions. Enumerate specific structural elements within the structural unit and explain ways to connect. Apply the rules and regulations of classification societies and calculate the dimensions of the elements of the hull structure of small crafts. Identify and define the parameters necessary for the dimensioning of a structural element (primary or secondary). Outline specific solutions to specific structural units considering the material of construction of small crafts. Analyze the results calculation in terms of respecting the criteria for dimensioning by classification societies.		
1.4. Course content		
Review of small craft types regarding size and function and application of construction materials; wood, composites and aluminum. Review of the load, global, local and design load. Basic small craft structural elements regarding to specific characteristics of the construction material (wood, composites, aluminum). Keel and stems. Bottom elements. Bottom in engine room, engine seats. Shell, frames, stringers. Deck, deck beams, longitudinal under deck girder, pillars. Bulkhead. Superstructure. Rudder, propeller brackets. Special structure reinforcement. Application of rules and regulations of different classification societies in designing, scantling determination and construction of the small crafts.		
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		
1.7. Student's obligations		
Course attendance, activity, project work, studying		

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	0.5	Oral exam	0.5	Essay		Research	
Project	2	Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, project work, written and oral exam

1.10. Assigned reading (at the time of the submission of study programme proposal)

Zamarin, A.: Small Craft Construction, Internal script available over *Chair for construction of the floating objects* web page, 2009. (in Croatian)
Grubišić, I.: Smal Craft Construction, Digital Script, FSB Zagreb 2005. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Larsson, L., Eliasson, R. E.: Principles of yacht design, McGraw-Hill, 2000.
Gerr, D.: The elements of boat strength, McGraw-Hill, 2000.
..., Pravila i propisi klasifikacijskih društava ISO, LR-SSC, GL, HRB, za brodove do 24m duljine.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Zamarin, A.: Small Craft Construction, Internal script available over *Chair for construction of the floating objects* web page, 2009. (in Croatian)	15	15
Grubišić, I.: Smal Craft Construction, Digital Script, FSB Zagreb 2005. (in Croatian)	15	15
Larsson, L., Eliasson, R. E.: Principles of yacht design, McGraw-Hill, 2000.	1	15
Gerr, D.: The elements of boat strength, McGraw-Hill, 2000.	1	15
..., Rules and regulations of the classification societies ISO, LR-SSC, GL, HRB	8	15

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Small Craft Design**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Acquiring specific competencies in designing of small crafts. Developing the ability for solving problems set in order to define design requirements and to create a preliminary design of a small craft.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Describe the specifics of small crafts design, define the design objectives and analyze the concept design solutions. Differentiate the specificities in technical requirements of small crafts. Select the basic dimensions and hull shapes of small crafts. Analyze the choice of building materials. Distinguish special features of the structure and classification society's rules. Distinguish and compare the design specificities of different types of working and recreational small crafts.							
1.4. Course content							
Introduction to the small craft design. Design objectives. Conceptual design solutions. Specificities of the technical requirements of small crafts. Determination of the basic hull particulars and shapes of small crafts. Methods of estimation of masses and centers of gravity. The choice of building materials - steel, aluminum alloys, wood, fiberglass. Specificities of the structure and classification society's rules. Design specificities of different types of working and recreational small crafts.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork		☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Attendance, project development, independent learning.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam	0.5	Essay		Research	
Project	2.5	Sustained knowledge check		Report		Practice	

Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, project with a presentation, oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Papanikolau, A.: Ship Design - Methodologies of Preliminary Design, Springer, London, 2014.
Watson, D.: Practical Ship Design, Elsevier Science Ltd., Oxford, 1998.
Blount, D. L., Performance by Design: Hydrodynamics for High-Speed Vessels, Donald L. Blount, Virginia Beach, 2014.
Larsson, L., Eliasson, R. E., Principles of Yacht Design, Second Edition, Adlard Coles Nautical, 2000

1.11. Optional / additional reading (at the time of proposing study programme)

..., Rules for Technical Survey of Ships from Wood, Aluminum Alloys and Plastic Materials, Croatian Register of Shipping, Split, 2013. (in Croatian)
, Rules for Statuary Certifications of Boats and Yachts, Croatian Register of Shipping, Split, 2010. (in Croatian)
..., Rules for Statuary Certifications of Fishing Vessels, Croatian Register of Shipping, Split, 2012. (in Croatian)
..., The rules of other classification societies (LR, BV, DNV, GL,...)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Watson, D.: Practical Ship Design, Elsevier Science Ltd., Oxford, 1998.	1	10
Papanikolau, A.: Ship Design - Methodologies of Preliminary Design, Springer, London, 2014.	1	10
Larsson, L., Eliasson, R. E., Principles of Yacht Design, Second Edition, Adlard Coles Nautical, 2000.	1	10

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through a structured system of quality assurance of the Faculty.

Basic description		
Course title	**Small Crafts Equipment**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**			
1.1. Course objectives			
Within the course students acquire the basic knowledge of the elements, equipment and outfitting systems of small crafts related to defined learning outcomes.			
1.2. Course enrolment requirements			
None.			
1.3. Expected course learning outcomes			
Apply technical requirements, conventions, regulations, standards. Specify and describe hull equipment. Describe hull protection systems and equipment. Specify and describe the equipment for safety. Define and describe the helming gear, navigation and communication equipment. Interpret and describe outfitting systems. Develop schematics drawings for small craft system. Define and describe the equipment for mooring, anchoring and towing. Define and describe the equipment of the ship engine. Describe the specific equipment on special vessels.			
1.4. Course content			
Technical requirements, conventions, regulations, standards. Equipment for anchoring, mooring and towing. Lights and signalling devices. Equipment for steering, navigation and communication. Engines and related devices and outfitting systems. Systems of electricity. Systems of drinking and waste water. Equipment and systems for safety and rescue. Fire-fighting equipment. Partitions, doors, windows, openings. Isolation and air conditioning. Equipment quarters. Restraints troops and equipment. Special equipment: fishing boats, sailboats, boats to transport passengers / divers, fire boats and other special small vessels.			
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☒ long distance education ☒ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☒ mentorship ☐ other	
1.6. Comments			
1.7. Student's obligations			
Course attendance, activity, homework, studying.			
1.8. Evaluation of student's work			

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	0.5	Oral exam	0.5	Essay		Research	

Project	1	Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, continuous knowledge testing (two mid-term exams), Seminar paper, written exam, oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Matulja, T.: Teaching material published on e-learning course Small Crafts Equipment, 2021.
Nicolson, I., The Boat Data Book, 7th Edition, ACN London, 2014.
Gerr, D., Boat Mechanical Systems Handbook. ACN London, 2009.
Larsson, L., Eliasson. R., Principles of Yacht Design, International Marine, 4th Edition, 2013.

1.11. Optional / additional reading (at the time of proposing study programme)

Payne, J.: The Marine Electrical and Electronics Bible. Adlard Coles Nautical, III. Edition, London, 2007.
Ask, T.: Handbook of Marine Surveying. Sheridan House, II. Edition, NY, 2007.
Delić, S.: Sailing Yachts Equipment. Biblioteka More, 2008. (in Croatian)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Matulja, T.: Teaching material published on e-learning course Small Crafts Equipment, 2021.		
Nicolson, I., The Boat Data Book, 7th Edition, ACN London, 2014.	1	12
Gerr, D., Boat Mechanical Systems Handbook. ACN London, 2009.	1	12
Larsson, L., Eliasson. R., Principles of Yacht Design, International Marine, 4th Edition, 2013.	1	12

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Technological Process of Shipbuilding**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**1.**	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
Within this course students gain knowledge about technological process of shipbuilding in accordance with defined learning outcomes.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Define the shipbuilding business and manufacturing process as well as types of basic processes. To analyze the characteristics of the ship production process. Describe techniques for representing work, processes and procedures. Interpret various ship breakdown approaches. Analyze the preparatory phase of the ship production. Describe and differentiate the documentation for ship production. Analyze the study of work and time, and to define work normative. Describe the preparation of production documentation, materials and production resources. Interpret software support for ship production process. Analyze performance indicators for business, development and improvement of ship production process.							
1.4. Course content							
Introduction. Definition of shipbuilding business process. Definition and types of basic processes. Characteristics of ship production process. Techniques for representing work, process and procedures. Functional and technological ship breakdown. Planing and preparing stage of shipbuilding process. Ship production documentation, types and division. Preparation and analysis of working documentation, materials and production resources for process inprovment. Efficiency indicators of ship production process. Process rationalization, optimisation and effectiveness improvement. Operational research methods aplications for process improvement. Process software support and simulation modeling of production process.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☒ fieldwork		☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other				
1.6. Comments							
1.7. Student's obligations							
Course attendance, activity, sustained knowledge check, seminar paper, studying.							
1.8. Evaluation of student's work							
Course	2	Activity/Participation		Seminar paper	1	Experimental	

attendance						work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio							

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Course attendance, activity, sustained knowledge check (two mid-term exams), seminar paper, written and oral exam or their combination.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Teaching material of class: "Technological Process of Shipbuilding"
Storch, R. L., et al., Ship Production, 2nd edition, SNAME, 2007.
Steffen Bangsow, Technomatix Plant Simulation Modelling and Programming by Means of Examples, Springer, 2015.

1.11. Optional / additional reading (at the time of proposing study programme)

Lamb, T., at all: Ship Design and Construction, SNAME, 2003
Jingshan Li, Semyon M.Meerkov: Production Systems Engineering,Springer, 2009.
London, 1995. Winston, W.L., Operations research - Application and Algorithms. Duxbury Press, Belmont, 2003
Jerry Banks, Discrete Event System Simulation, 2005
Chang, Y. R., Kelly, K. P., Improving through Benchmarking, Kogan Page Ltd., London, 1995.
Fei Tao , Meng Zhang et al, Digital Twin Driven Smart Manufacturing, 2019

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Teaching material of class: "Technological Process of Shipbuilding", pdf		
Storch, R. L., et al., Ship Production, 2nd edition, SNAME, 2007.	1	10
Steffen Bangsow, Technomatix Plant Simulation Modelling and Programming by Means of Examples	2	10

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	**Welding Engineering**	
Study programme	**Graduate University Study of Naval Architecture**	
Course status	optional	
Year	**2.**	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	30+30+0

1. **COURSE DESCRIPTION**							
1.1. Course objectives							
The course is designed to provide the student with knowledge in welding engineering topics. Student is introduced with practical application of several welding processes.							
1.2. Course enrolment requirements							
None.							
1.3. Expected course learning outcomes							
Select a welding process for given base material. Explain weldability and describe the specifics of welding alloy steel, cast iron, aluminium and copper alloys. Select welding consumables. Calculate power requirements and consumption of welding consumables for arch welding. Propose a method for welds quality control. Prepare welding procedures.							
1.4. Course content							
Historical development of welding processes. Pressure welding processes. Fusion welding processes. Arc welding. Arc characteristics. Heat input. Classification of power sources. Power source equipment. Welding metallurgy. Metal transfer in arc welding. Microstructure of welded joints. Weldability. Preheating. Welded joint heat treatment. Alloys welding. Design of welded joints. Welding symbols. Welding consumables. Classification, characteristics and designation of covered electrodes. Electrodes selection. Filler rods, fluxes, shielding gases and backing bars. Energy consumption. Productivity indices. Quality of welds. Welds imperfections. Inspections of welds. Welding procedures.							
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☒ fieldwork		☐ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other				
1.6. Comments	-						
1.7. Student's obligations							
Course attendance, active participation in the course, attendance at laboratory exercises and on-site training, independent learning.							
1.8. Evaluation of student's work							
Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	0.5	Oral exam		Essay		Research	
Project		Sustained knowledge	2	Report		Practice	

		check					
Portfolio		On-site training	0.5				

1.9. Procedure and examples of learning outcome assessment in class and at the final exam

Sustained knowledge check and final written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

1.11. Optional / additional reading (at the time of proposing study programme)

Meden, G., i dr.: Osnove zavarivanja, Sveučilište u Rijeci, Tehnički fakultet, Rijeka, 2000.
Sinnes K.: Welding Handbook, Vol. 1, Welding Technology, AWS, American Welding Society, 2018
O'Brien, A.: Welding Handbook, Vol. 2, Welding Processes, AWS, Miami, 2013.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.