Sveučilište u Rijeci
POMORSKI FAKULTET

uniri

Doctoral (PhD) programme

MARITIME STUDIES

Cycle 17

Academic year 2026/2027

Scientific area:
TECHNICAL SCIENCES

Scientific field:
TRAFFIC AND TRANSPORT TECHNOLOGY

Course description

Rijeka, 2026

MODULES / COURSES							
Semester: I							
MODULE	COURSE TITLE	COURSE COORDINATOR	L	E	S	ECTS	STATUS*
Basic module (A)	Scientific research methods	Ana Perić Hadžić, PhD	12			6	C
	Selected topics in computational data analysis and machine learning	Marko Valčić, PhD	12			6	E
	Application of metaheuristic algorithms in shipping	Marko Gulić, PhD	12			6	E
	Discrete Event Simulation and Modeling	Dario Ogrizović, PhD	12			6	E
	Numerical modeling and optimization methods in engineering	Goran Vizentin, PhD	12			6	E
	Probability and statistics	Biserka Draščić Ban, PhD	12			6	E
Basic module (B)	Selected topics in Generative Artificial Intelligence, Big Data Analysis and Distributed Computing Systems	Dario Ogrizović, PhD	12			6	E
	Port systems	Alen Jugović, PhD	12			6	E
	Multimodal transport networks	*Professor emeritus* Serđo Kos, PhD Dražen Žgaljić, PhD	12			6	E
	Systematic approach to maritime affairs	*Professor emeritus* Pavao Komadina, PhD Davor Šakan, PhD	12			6	E
	Interactive Multimedia Simulation Systems	Dario Ogrizović, PhD	12			6	E
	Decision-making techniques in traffic	Svjetlana Hess, PhD	12			6	E
	Language technologies for improving written communication skills	Mirjana Borucinsky, PhD	12			6	E
Semester: I / II							

MODULE	COURSE TITLE	COURSE COORDINATOR	L	E	S	ECTS	STATUS
Nautical Sciences	Hydrographic activity and safety of navigation	Josip Kasum, PhD	12			6	E
	Integrated maritime safety and surveillance systems	*Professor emeritus* Pavao Komadina, PhD Igor Rudan, PhD	12			6	E
	Intercultural competence and communication in maritime industry	Sandra Tominac Coslovich, PhD	12			6	E
	The Role of the Human Factor in Maritime Accidents	Nermin Hasanspahić, PhD Đani Šabalja, PhD	12			6	E
	Research of environmental impacts on satellite navigation systems	*Professor emeritus* Serđo Kos, PhD David Brčić, PhD	12			6	E
	Concepts and capabilities of navigation information systems	Srđan Žuškin, PhD David Brčić, PhD	12			6	E
	Containerization functions in the maritime transportation	Renato Ivče, PhD	12			6	E
	Maritime safety of the ship	Robert Mohović, PhD	12			6	E
	International maritime safety and environment protection system	Vlado Frančić, PhD	12			6	E
	Modelling and analysis of maritime traffic flow	*Professor emeritus* Damir Zec, PhD	12			6	E
	Sea shipping optimization	Mirano Hess, PhD	12			6	E
	Assessment and management of maritime navigational risks	Đani Mohović, PhD	12			6	E
	Simulation planning and modelling of ship manoeuvring	Robert Mohović, PhD Mate Barić, PhD	12			6	E
MODULE	COURSE TITLE	COURSE COORDINATOR	L	E	S	ECTS	STATUS
Marine Power and Engineering Systems	Alternative fuels and emissions of harmful substances from marine energy systems	Radoslav Radonja, PhD	12			6	E
	The structural integrity of marine structures	Goran Vukelić, PhD Darko Pastorčić, PhD	12			6	E

	Dynamic effects on ship stability	Anton Turk, PhD	12			6	E
	Marine diesel engines selected chapters	Tomislav Senčić, PhD Dean Bernečić, PhD	12			6	E
	Selected chapters on marine auxiliary systems	Predrag Kralj, PhD	12			6	E
	Ship's propulsion plants optimisation	Josip Orović, PhD	12			6	E
	Simulations of the ship's systems behaviour using system dynamics	Mate Jurjević, PhD	12			6	E
	Thermodynamic analysis of marine steam turbine plants	Igor Poljak, PhD Ivica Glavan, PhD	12			6	E
	Selected chapters on energy systems	Vladimir Pelić, PhD	12			6	E
	Application of Numerical Methods in Thermodynamics	Fran Torbarina, PhD	12			6	E
	Computer Modeling of Thermal Systems	Fran Torbarina, PhD	12			6	E
MODULE	COURSE TITLE	COURSE COORDINATOR	L	E	S	ECTS	STATUS
Marine Electrical Engineering	Battery and hybrid power plants on marine vessels	Aleksandar Cuculić, PhD	12			6	E
	Electric propulsion	Ivan Panić, PhD	12			6	E
	Maritime cyber risk management	Boris Sviličić, PhD	12			6	E
	Cooperative intelligent transport systems	Jasmin Ćelić, PhD	12			6	E
	Advanced digital signal processing methods in transport	Nikola Lopac, PhD	12			6	E
	Advanced technologies in diagnostics and control systems	Robert Baždarić, PhD	12			6	E
	New technologies in maritime communications	Sanjin Valčić, PhD	12			6	E
	Optical technologies in maritime industry	Irena Jurdana, PhD	12			6	E
	Guidance and motion control of vessels	Marko Valčić, PhD	12			6	E
MODULE	COURSE TITLE	COURSE COORDINATOR	L	E	S	ECTS	STATUS

Maritime Logistics and Management	Maritime domain allocation and coastal zone management	Borna Debelić, PhD	12			6	E
	Economics of infrastructure projects in port system	Alen Jugović, PhD	12			6	E
	Economy of public private partnerships	Ana Perić Hadžić, PhD	12			6	E
	Business continuity and resilience of port clusters	Saša Aksentijević, PhD	12			6	E
	Information management in seaport clusters	Edvard Tijan, PhD	12			6	E
	Process management of smart and sustainable ports of nautical tourism	Livia Maglić, PhD Alen Jugović, PhD	12			6	E
	Legal framework for maritime domain and sea ports management	Biserka Rukavina, PhD Nikola Mandić, PhD	12			6	E
	Logistics and Development of Port Cities	Mladen Jardas, PhD Gorana Mudronja, PhD	12			6	E
MODULE	COURSE TITLE	COURSE COORDINATOR	L	E	S	ECTS	STATUS
Transport System	Planning of transport flows and transport route valorisation	Tanja Poletan Jugović, PhD	12			6	E
	Digital transformation of business and SMART management	Krešimir Buntak, PhD	12			6	E
	Methodology of shipping service quality measurement	Ines Kolanović, PhD	12			6	E
	Modelling tactical logistical problems on container terminals	Neven Grubišić, PhD	12			6	E
	Sustainability in urban transport	Siniša Vilke, PhD	12			6	E
	Optimization of storage yard operation in container terminals	Livia Maglić, PhD	12			6	E
	Traffic simulation and transport modelling	Neven Grubišić, PhD Luka Novačko, PhD	12			6	E
	Land use transport planning	Ljudevit Krpan, PhD	12			6	E

MODULE	COURSE TITLE	COURSE COORDINATOR	L	E	S	ECTS	STATUS
Marine and Coastal Protection	Ballast water management and risk assessment	*Professor emeritus* Damir Zec, PhD Matej David, PhD	12			6	E
	Sustainable fleet management	*Professor emeritus* Damir Zec, PhD Radoslav Radonja, PhD	12			6	E
	Sustainable navigation management	Lovro Maglić, PhD Marko Perkovič, PhD	12			6	E
	Emission limitation - electrical propulsion systems	Aleksandar Cuculić, PhD	12			6	E
	Legal aspects of the marine environment protection	Biserka Rukavina, PhD	12			6	E
	Pollution prevention by solid and liquid substances	Žarko Koboević, PhD Jelena Čulin, PhD	12			6	E
	Coastal zone management and sustainable development	Mirano Hess, PhD Mirjana Kovačić, PhD	12			6	E
	Marine spatial planning and protection of the marine environment	Biserka Rukavina, PhD Mirjana Kovačić, PhD	12			6	E
	Hydrogen Technologies in Shipping	*Professor emeritus* Frano Barbir, PhD	12			6	E
MODULE	COURSE TITLE	COURSE COORDINATOR	L	E	S	ECTS	STATUS
Naval Systems	Geopolitics and geostrategy	*Professor emeritus* Serđo Kos, PhD Luka Mihanović, PhD	12			6	E
	Navy combat systems	Luka Mihanović, PhD	12			6	E
	Maritime dimension of international security	Stjepan Domjančić, PhD	12			6	E
	Strategic planning and leadership	Robert Fabac, PhD	12			6	E
	Critical infrastructure security	Dario Ogrizović, PhD Dražen Žgaljić, PhD	12			6	E
	The Role of the Coast Guard in Enhancing Maritime Safety and Security Efficiency	Tomislav Sunko, PhD	12			6	E

*STATUS: C – Core, E – Elective.

Note: Course coordinators' contacts can be found at the end of the document.

BASIC MODULE A

CORE COURSE

General information		
Course coordinator	Ana Perić Hadžić, PhD	
Course title	Scientific research methods	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Core	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The main objectives of the course are:

- To explain the concept of scientific research methods as a set of different procedures used in scientific research, to investigate and disseminate the results of scientific research in the domain of science or scientific discipline.
- To enable PhD students to understand that scientific methods, used in all scientific research independent of the scientific area, consist of procedures or groups of activities that make up the structure of scientific research: identifying the scientific problem, explaining the phenomenon (problem by setting a hypothesis), testing the hypothesis, predicting and making a conclusion about the problem on the basis of the hypothesis test.
- To explain the basic terms such as methodology and technology of scientific research and to train PhD students to apply those in writing different types of papers.
- To familiarize the PhD students with the principles of making a doctoral dissertation as authentic, original scientific work, suitable for establishing their ability to act as independent researchers on the basis of the methodology of processing and the scientific contribution.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After finishing the course the PhD students will be able:

1. To demonstrate a systematic understanding and acquisition of scientific research skills and methods in a particular scientific field or scientific discipline,
2. To properly interpret and apply the scientific research methodology and technology in writing works at the level of postgraduate study (essay, critical review, scientific paper),
3. To demonstrate the ability to understand, design, implement and customize a serious scientific process in a particular scientific field or scientific discipline,
4. To develop generic skills for continuous advancement in theoretical and/or applied research and development of new techniques, ideas and approaches,
5. To apply critical analysis, evaluation and synthesis of new and complex ideas, making judgments on complex issues,
6. To develop the ability of written presentation of conclusions and results of the original research to scientific, professional and the general public in a clear and efficient way.

1.4. Course content

About science, Science and research, Scientific, scientific-professional and professional work. Concept and classification of scientific research methodology. Basic features of the scientific methods: objectivity, reliability, precision, systemic nature and universality. Review of scientific methods. The technology of scientific research: identifying scientific problem, hypothesis, selection and analysis of topics (titles), development of a research plan, compiling operative bibliography, collecting and studying literature and scientific information, solving the problem, formulating research results, application of research results, check the application of research results. Writing and technical processing of scientific 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

Student requirements, in addition to attendance, seminar papers and workshops, are based on independent tasks (seminar paper, preparation of a scientific paper for publication) related to the application of scientific research methods in the field of the PhD students' interest.

1.8. Evaluation[1] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2.6	Experiment	
Written exam		Oral exam	2	Essay		Research	1
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The learning outcomes are validated and evaluated by monitoring the students' work on the research, the obtained research results and the manner and quality of research publication or presentation.

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

1. Zelenika, R.: Metodologija i tehnologija izrade znanstvenog i stručnog djela, Pisana djela na stručnim i sveučilišnim studijima, knjiga peta, Ekonomski fakultet u Rijeci, Rijeka, 2011.
2. Žugaj, M.: Metodologija znanstveno-istraživačkog rada, Fakultet organizacije i informatike, Varaždin, 1997.
3. Trochim, William M. Research methods : the essential knowledge base / William M. Trochim, James P. Donnelly, Kanika Arora, 2nd ed, Boston : Cengage Learning, cop. 2016
4. White, Theresa L., Research methods / Theresa L. White, Donald H. McBurney, 9th ed, Belmont : Wadsworth, Cengage Learning, cop. 2013

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

1. Baban, Lj.: Primjena metodologije znanstvenog istraživanja, Ekonomski fakultet Sveučilišta J. J. Strossmayera u Osijeku, Osijek, 1993.
2. Ivanović, Z.: Metodologija izrade znanstvenog i stručnog djela, Hotelijerski fakultet u Opatiji Sveučilišta

[1] **NOTE**: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

u Rijeci, Opatija, 1996.
3. Kulenović, Z.: Metodologija istraživačkog rada, Pomorski fakultet Sveučilišta u Splitu, Split 2005.
4. Žugaj, M., Dumičić, K., Dušak, V.: Temelji znanstvenoistraživačkog rada : metodologija i metodika , 2. dopunjeno i izmijenjeno izdanje, Varaždin, Tiva , 2006
5. Charles, A.: Izvori podataka u istraživanju i pisanju znanstvenih radova i disertacija, Pomorstvo, godina 14., Split, 2000.
6. Doktorski studiji, Nacionalna zaklada za znanost, visoko školstvo i tehnologijski razvoj Republike Hrvatske, Zagreb, 2006.
7. Dunleavy, P.: Kako napisati disertaciju, Fakultet političkih znanosti Sveučilišta u Zagrebu, Zagreb, 2005

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*
Zelenika, R.: Metodologija i tehnologija izrade znanstvenog i stručnog djela, Pisana djela na stručnim i sveučilišnim studijima, knjiga peta, Ekonomski fakultet u Rijeci, Rijeka, 2011.	2	15
Žugaj, M.: Metodologija znanstveno-istraživačkog rada, Fakultet organizacije i informatike, Varaždin, 1997.	5	15
Trochim, William M. Research methods : the essential knowledge base / William M. Trochim, James P. Donnelly, Kanika Arora, 2nd ed, Boston : Cengage Learning, cop. 2016	1	15
White, Theresa L., Research methods / Theresa L. White, Donald H. McBurney, 9th ed, Belmont : Wadsworth, Cengage Learning, cop. 2013	1	15

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

ELECTIVE COURSES

General information		
Course coordinator	Marko Valčić, PhD	
Course title	**Selected topics in computational data analysis and machine learning**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Acquiring knowledge and skills that are required to carry out various computational data analyses, as well as to create appropriate empirical and semi-empirical models within the research scope that are based on selected computational methods and statistical algorithms, machine learning and artificial intelligence methods.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After passing the exam, the students will be able to:

1 Critically evaluate common data preparation and processing problems when developing empirical or semi-empirical data-driven models.
2 Formulate a research problem and an opinion related to approaches to solving it.
3 Present the theoretical background and assess the quality of appropriate machine learning methods to solve the previously raised problem.
4 Review the different criteria for selecting the most favourable method.
5 Rank the selected methods according to predefined performance criteria and recommend the most favourable method.
6 Discuss and provide arguments for the obtained results, evaluate the advantages and disadvantages of selected methods, and recommend guidelines for further research.

1.4. Course content

Data preparation and organization: importing and preprocessing, descriptive statistics, data transformation, data visualization. Data analysis using statistical and machine learning methods: function approximation, linear regression, nonlinear regression, classification, nonparametric supervised learning, cluster analysis and unsupervised learning, multi-dimensional data and dimensionality reduction, support vector machine, random number generation, Monte Carlo simulations. Neural networks: data types and training styles, learning algorithms, deep learning, multilayer neural networks, radial basis neural networks, self-organizing networks, dynamic neural networks, deep neural networks. Fuzzy inference systems and neuro-adaptive learning. Engineering optimization: unconstrained and constrained nonlinear optimization, multi-objective optimization algorithms, linear programming and mixed-integer linear programming, mixed-integer nonlinear programming, quadratic programming, nonlinear programming, direct search algorithms, genetic algorithms. Evaluation of

empirical and semi-empirical models: training (learning), validation, testing, error and noise, overfitting, generalization, regularization, model performance indexes, visualization of results, model retraining and calibration, sensitivity and uncertainty analysis, risk analysis and decision making.		
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 (consultations), completing the project assignment, preparation and presentation of the seminar work. The preparation of a project assignment and the presentation of a seminar work may be substituted by the preparation and publication of a scientific paper in an appropriate journal or the preparation and presentation of a paper at an appropriate scientific conference.

1.8. Evaluation[2] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1	Experiment	
Written exam		Oral exam	1	Essay		Research	1
Project	2.6	Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The process of evaluating the acquired learning outcomes takes place as follows:

- Through mentorship and monitoring of student's activities related to independent student's work on the assigned project task, research, and preparation of final report (seminar work or research paper) during course duration 70 % of the acquired learning outcomes are evaluated (1-6), where the student must realize a minimum of 50 % points.
- At the final part of the exam, 30 % of the acquired learning outcomes are evaluated (1-6), whereby the student must realize a minimum of 50 % of points to pass the final exam.
  Note: Publication of a scientific paper in an appropriate scientific journal or presentation of a paper at an appropriate scientific conference is equivalent to the final part of the exam.
- Final ECTS grade is defined on the basis of the achieved total % of knowledge, skills and competencies and numerical grade after the final / remedial exam is as follows:
  - grade *excellent* (5) corresponds to grade A in the ECTS scale and a success rate of 90 to 100 %,
  - a grade of *very good* (4) corresponds to a grade of B on the ECTS scale and a success rate of 75 to 89.9 %,
  - grade *good* (3) corresponds to grade C on the ECTS scale and a success rate of 60 to 74.9 %,
  - a grade of *sufficient* (2) corresponds to a grade of D on the ECTS scale and a success rate of 50 to 59.9 %,
  - the grade *insufficient* (1) corresponds to the grade F in the ECTS scale and the success rate from 0 to 49.9 %.

Examples of evaluating learning outcomes in relation to set learning outcomes are:

- Published research paper by the PhD student (main author) in an appropriate scientific journal.
- Prepared and accepted project assignment in the field of data science, machine learning and/or artificial

[2] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

intelligence. Based on the project task, a seminar paper is also prepared and presented. The practical part of the project assignment, i.e. the seminar paper, can be developed using programming environments/ languages such as MATLAB, Python or R.

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

Valčić, M. (2020). *Selected topics in computational data analysis and machine lear*ning. Lecture Notes, Faculty of Maritime Studies, University of Rijeka, Rijeka, Croatia.
Goodfellow, I., Bengio, Y., Courville, A. (2016). *Deep Learning*. The MIT Press, Cambridge, MA, USA. Available online: http://www.deeplearningbook.org/
Barber, D. (2012). *Bayesian Reasoning and Machine Learning*. Cambridge University Press, London, UK. Available online: http://www.cs.ucl.ac.uk/staff/d.barber/brml/
Hastie, T., Tibshirani, R., Friedman, J. (2017). *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*. 2nd Ed., Springer, New York, NY, USA. Available online: https://web.stanford.edu/~hastie/ElemStatLearn//

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

Jo, T. (2021). *Machine Learning Foundations: Supervised, Unsupervised, and Advanced Learning*. Springer Nature Switzerland AG, Cham, Switzerland.
Kelleher, J.D., Namee, B.M., D'Arcy, A. (2020). *Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies*. 2nd Ed. The MIT Press, Cambridge, Massachusetts, London, England.
Kroese, D.P., Botev, Z.I., Taimre, T., Vaisman, R. (2020). *Data Science and Machine Learning: Mathematical and Statistical Methods*. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
Theodoridis, S. (2020). *Machine Learning: A Bayesian and Optimization Perspective*. 2nd Ed. Academic Press - Elsevier, San Diego, CA, USA.
Brandt, S. (2014). *Data Analysis: Statistical and Computational Methods for Scientists and Engineers*. Springer, Heidelberg, Germany.
Rao, S.S. (2020). *Engineering Optimization: Theory and Practice*. 5th Ed., John Wiley & Sons, Inc., New York, NY, 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*
Valčić, M. (2020). *Selected topics in computational data analysis and machine lear*ning. Lecture Notes, Faculty of Maritime Studies, University of Rijeka, Rijeka, Croatia.	Available to enrolled students (pdf)	1-5
Goodfellow, I., Bengio, Y., Courville, A. (2016). *Deep Learning*. The MIT Press, Cambridge, MA, USA. Available online: http://www.deeplearningbook.org/	Available online	1-5
Barber, D. (2012). *Bayesian Reasoning and Machine Learning*. Cambridge University Press, London, UK. Available online: http://www.cs.ucl.ac.uk/staff/d.barber/brml/	Available online	1-5
Hastie, T., Tibshirani, R., Friedman, J. (2017). *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*. 2nd Ed., Springer, New York, NY, USA. Available online: https://web.stanford.edu/~hastie/ElemStatLearn//	Available online	1-5

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

University of Rijeka
FACULTY OF MARITIME STUDIES

General information		
Course coordinator	Marko Gulić, PhD	
Course title	**Application of metaheuristic algorithms to shipping**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The main objective of the course is to acquire knowledge of optimization problems and metaheuristic algorithms that solve these problems, in order to enable students to analyze and solve complex optimization problems. Through examples from logistics, students will learn to adjust the parameters of nature-inspired metaheuristic algorithms for efficient solving of NP-hard optimization problems.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam, students will be able to do the following:

1. Critically evaluate the selected optimization problem.
2. Mathematically formulate an optimization problem and express an opinion on possible solutions.
3. Present the theoretical foundations and evaluate the appropriate metaheuristic algorithms to solve the previously raised problem.
4. Review the different parameters of the corresponding metaheuristic algorithms with the aim of obtaining a better solution.
5. Rank selected metaheuristic algorithms according to predefined performance criteria and recommendation of the most favourable algorithm for the selected optimization problem.
6. Argumentatively discuss obtained results, evaluate the advantages and disadvantages of the selected metaheuristic algorithm, recommend guidelines for further research.

1.4. Course content

Optimization problems. Mathematical formulation of the optimization problem. The search for optimality. NP-hard optimization problems. Metaheuristic algorithms. Metaheuristic algorithms inspired by nature: Ant colony optimization algorithm, Artificial bee colony algorithm, Firefly algorithm, Bat algorithm, African bison algorithm, Genetic algorithm. Application of nature-inspired metaheuristic algorithms to solve NP-hard optimization problems. Parameter tuning of nature-inspired metaheuristic algorithms and analysis of algorithm performance. NP-hard problems in logistics. Overview of selected NP-hard logistics problems. Mathematical formulation of the selected logistics problem and application of the metaheuristic algorithm to solve the problem.

1.5. Teaching methods		
	☒ lectures	☒ individual assigment
	☒ seminars and workshops	☐ multimedia and network
	☐ exercises	☐ laboratories

	0☐ long distance education ☐ fieldwork	☒ mentorship ☐ other _____
1.6. Comments		

1.7. Student's obligations

Class participation (consultations), completing project assignments, writing and presenting a seminar paper. Writing and publishing a scientific paper in an appropriate journal or writing and presenting a paper at an appropriate scientific conference may be substituted for writing a traditional project assignment and presenting a project paper.

1.8. Evaluation[3] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experiment	
Written exam		Oral exam	1	Essay		Research	2.6
Project	1	Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The process of assessing acquired learning outcomes takes place in one of the following two ways:

- Preparation for publication of the doctoral student's scientific work (lead author) in an appropriate scientific journal or at an appropriate scientific conference.
- Preparation and acceptance of a project work in the field of logistic NP -hard problems with the application of metaheuristic algorithms inspired by nature. Based on the project task, a seminar paper was prepared and presented. The practical part of the project tasks (seminar) can also be created using a programming language.

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

1. Gulić, M. (2022). Application of metaheuristic algorithms to solve optimization problems in shipping. Lectureships, Faculty of Maritime Studies in Rijeka, University of Rijeka, Rijeka, Croatia
2. Yang, Xin-She. Nature-inspired metaheuristic algorithms. Luniver press, 2010.

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*
Gulić, M. Application of metaheuristic algorithms to solve optimization problems in shipping. Lectureships. 2022.	Available online	
Yang, Xin-She. Nature-inspired metaheuristic algorithms. Luniver press, 2010.	Available online	

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[3] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	dr. sc. Dario Ogrizović	
Course title	**Discrete Event Simulation and Modeling**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Application of simulation modeling and discrete event simulations in the analysis, design, and performance assessment of business processes.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After finishing the course, the students will be able:

1. Analyze and compare types of simulations
2. Apply simulation modeling to analyze and design business processes
3. Create simulation models using software tools that support simulation modeling methods and techniques and their verification
4. Create appropriate methods for conducting simulation experiments
5. Analyze and interpret solutions from conducted simulation experiments
6. Create business decision processes based on the results of simulation experiments

1.4. Course content

Fundamentals of discrete event simulation. Simulation modeling. Types of simulation models. Basic concepts, modeling methods, conducting simulation experiments, and their analysis. Verification of the computer model. Analysis of input data. Planning simulation experiments. Design of simulation experiments. Analysis of simulation experiment outputs. Computer tools for discrete event simulation. Criteria for selecting simulation software. Modeling and simulation with FlexSim software.

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

1.6. Comments

1.7. Student's obligations

Course attendance (consultations), preparing and presenting a seminar paper and project.

1.8. Evaluation[4] of student's work

Course attendance	0,4	Activity/Participation		Seminar paper	1	Experimental work	
Written exam		Oral exam		Essay		Research	2
Project	2,6	Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The learning outcomes are validated and evaluated by monitoring the students' work on the research, the obtained research results and the manner and quality of research and presentation of a seminar paper and project.

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

1. Law, A.M. 2024. Simulation Modeling and Analysis, 6th Edition, McGraw-Hill Education.
2. Banks, J., Carson, J.S., Nelson, B. L., Nicol, D.M. 2013. Discrete-Event System Simulation: Pearson New International Edition, Pearson Higher Ed.

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

1. Robinson, S. 2014. Simulation: The Practice of Model Development and Use (2nd edition), Red Globe Press

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*
Law, A.M. 2024. Simulation Modeling and Analysis, 6th Edition, McGraw-Hill Education.	3	2
Banks, J., Carson, J.S., Nelson, B. L., Nicol, D.M. 2013. Discrete-Event System Simulation: Pearson New International Edition, Pearson Higher Ed.	2	2

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[4] **NOTE**: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Goran, Vizentin, PhD	
Course title	**Numerical modeling and optimization methods in engineering**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Knowledge of the mathematical modeling based on ordinary differential equations, partial differential equations, and meta-models, necessary for solving problems in engineering. Knowledge of optimal control principles necessary for recognition of optimization problems in engineering practice. Mathematical definition of problems and its solution through the application of appropriate methods and software.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Set up a mathematical formulation of the observed problem that is based on differential equations and/or on metamodel, justify the choice of the formulation, analyze the complexity and solvability of the problem. Propose an appropriate numerical model. Set up a mathematical formulation of an optimization problem, analyse and evaluate the complexity and solvability of the problem based on the formulation. Investigate the possibilities of applying particular methods to a given optimization problem and choose the appropriate method. Explore problem-solving capabilities of numerical problem and/or optimization problem by using ready-made software and/or writing your own implementation of the optimization method, or build the metamodel using the data-driven algorithms. Critically evaluate and compare the obtained results and independently investigate the possible improvements.

1.4. Course content

Models based on ordinary differential equations. Dynamical systems. Numerical solution of differential equations.
Models based on partial differential equation in fluid mechanics thermodynamics, etc. Conservation laws for mass, momentum and energy. Concept of metamodels (surrogate models) and data-driven methods for building metamodels.
Optimal control problems in technology. Optimization problem formulation. Problems of optimal management of stationary and non-stationary phenomena. Optimal design problems. Model parameter calibration problems. Optimization problems of permutation type and optimal clustering. Treatment of restrictions. Optimization methods. Methods based on the gradient of objective function. Combinatorial methods. Heuristic methods. Evolutionary and stochastic optimization methods.

1.5. Teaching methods		
	☒ lectures	☒ individual assigment
	☒ seminars and workshops	☐ multimedia and network
	☐ exercises	☐ laboratories

	☐ long distance education ☐ fieldwork	☒ mentorship ☐ other _____
1.6. Comments		

1.7. Student's obligations

Course attendance (consultations), solving project assignment, preparing, presenting and defending the seminar.

1.8. Evaluation[5] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1.6	Experiment	
Written exam		Oral exam		Essay		Research	4
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Course attendance, class activity, project assignments, seminar paper.

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

Chapra, S.C., Canale, R.P.: Numerical methods for engineers, McGraw Hill Book Co., 1989
Strang, G.: Computational science and engineering, Wellesley-Cambridge Press, Cambridge, 2007
Press, W.H., Taukolsky, S.A., Flannery, B.P., W.T.: Numerical recipes, Cambridge Press, 1986
Winston, W. L.: Operations Research Application and Algorithms, Duxbury Press, Belmont, 1993.
Kochenderfer M. J., Wheeler T. A.: Algorithms for Optimization, MIT Press, 2019.

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

LeVeque, J.R., Finite Volume Methods for Hyperbolic Problems, Cambridge Univ. Press, 2002
Cheney, W., Kincaid, D.: Numerical mathematics and computing, Thomson Brooks/Cole, 2004.

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., Canale, R.P.: Numerical methods for engineers, McGraw Hill Book Co., 1989	1	5
Strang, G.: Computational science and engineering, Wellesley-Cambridge Press, Cambridge, 2007	1	5
Press, W.H., Taukolsky, S.A., Flannery, B.P., W.T.: Numerical recipes, Cambridge Press, 1986	1	5
Winston, W. L.: Operations Research Application and Algorithms, Duxbury Press, Belmont, 1993.	1	5
Kochenderfer M. J., Wheeler T. A.: Algorithms for Optimization, MIT Press, 2019.	1	5

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[5] **NOTE**: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Biserka Draščić Ban, PhD	
Course title	**Probability and Statistics**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The course objective is to acquire specific knowledge of statistics and mathematical modeling through familiarization with statistical terms and concepts, construction of statistical models and application of statistical methods to engineering, process management, quality control and solving similar practical problems, using open-source statistical programming language and environment for statistical calculations and graphics R, and to train students to use probability and statistics as a tool.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam, students will be able to do the following:

1. Collect and organize the data;
2. Recognize and analyse certain types of statistical series and their characteristics;
3. Distinguish theoretical distributions and connect theoretical and empirical distributions;
4. Use parametric estimating based on one variable to estimate the population parameters;
5. Use and interpret the conclusions obtained by statistical testing;
6. Distinguish between dependent and independent samples of two variables;
7. Use and interpret the t-test to compare parameters in dependent and independent samples;
8. Examine the dependence between variables and create a regression model;
9. Use the software platform R for statistical procedures.

1.4. Course content

Data collection and organization. Descriptive statistics. Fundamentals of probability theory. Statistical inference based on one variable. Statistical inference based on two variables. Basics of statistical modeling. Statistical inference based on multiple variables.

1.5. Teaching methods

☒ lectures	☒ individual assigment
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratories
☐ long distance education	☒ mentorship
☐ fieldwork	☐ other _____

1.6. Comments

1.7. Student's obligations

Class attendance (consultations), completing project tasks, preparing and presenting seminar papers.

1.8. Evaluation[6] of student's work

Course attendance	0,4	Activity/Participation		Seminar paper	2.6	Experimental work	
Written exam		Oral exam		Essay		Research	3
Project		Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Class attendance, project task, seminar paper.

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

1. M. Bencic, N. Šuvak, Uvod u vjerojatnost i statistiku, Sveučilište J.J. Strossmayera, Odjel za matematiku, Osijek, 2014.
2. M. Benšić, N. Šuvak, Primijenjena statistika, Sveučilište J.J. Strossmayera, Odjel za matematiku, Osijek, 2013.

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

1. D.C. Montgomery, G.C. Runger, Applied Statistics and Probability for Engineers, John Wiley & Sons, Inc., 2018.
2. D.J. Sheskin, Handbook of Parametric and Nonparametric Statistical Procedures, CRC Press
3. K. Härdle, L. Simar, Applied Multivariate Statistical Analysis, Springer
4. J.D. Jobson, Applied Multivariate Data Analysis, Volume I, Volume II, Springer
5. P.J. Brockwell, R.A. Davis, Introduction to Time Series and Forecasting, Springer

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*
M. Benšić, N. Šuvak, Uvod u vjerojatnost i statistiku, Sveučilište J.J. Strossmayera, Odjel za matematiku, Osijek, 2014.	e-book	1-10
M. Benšić, N. Šuvak, Primijenjena statistika, Sveučilište J.J. Strossmayera, Odjel za matematiku, Osijek, 2013	e-book	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[6] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

BASIC MODULE B

University of Rijeka
FACULTY OF MARITIME STUDIES

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General information		
Course coordinator	dr. sc. Dario Ogrizović	
Course title	**Selected topics in Generative Artificial Intelligence, Big Data Analysis and Distributed Computing Systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The application of generative artificial intelligence, big data analysis and distributed computing in scientific research to automate the data analysis process, improve testing, increase quality and predictions, and get faster and more meaningful results.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After finishing the course, the students will be able:

1. Classify models and applications of generative artificial intelligence
2. Define and analyze Large language models.
3. Analyze biases and hallucinations, and the differences between pre-trained and fine-tuned models.
4. Critically evaluate the social aspects of generative artificial intelligence.
5. Distinguish between problem types and categories of big data
6. Apply big data analysis methodology.
7. Create a computer system for data analysis and simulations
8. Compare architectures, service models, and performance models of cloud computing
9. Analyze security issues in distributed computing

1.4. Course content

Models and applications of generative artificial intelligence. Large language models (LLM). Analysis of bias and hallucinations. Analysis of differences between pre-learned and fine-tuned models. Techniques for developing applications with LLM (PEFT and LoRA). Retrieval-Augmented Generation (RAG). Explainable AI (XAI) applications. Social aspects of generative artificial intelligence. Types of problems and categories of big data. Collecting data from different sources. Customizing and reshaping data. Big data analysis methodology. Data visualization. Conception, design and implementation of data analysis systems. Classification of distributed computer architectures. Levels of parallelism and effects on the computer performance. Exploiting instruction-level parallelism. Multimedia instructions. Multiprocessor systems. Physical and logical interconnection of resources. Parallel programming models and tools. Multicore and manycore processors. Parallel graphics processor architecture. Distributed and decentralized algorithms. Scalability analysis. HPC, HTC, cluster, grid and cloud computing for data analysis and simulation. Virtualization. Cloud computing architectures, service models, and performance models. Major cloud computing service providers. Architectures, service models and

performance models of cloud computing. Security of distributed computing systems.		
1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assigment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other _____
1.6. Comments		

1.7. Student's obligations

Course attendance (consultations), preparing and presenting a seminar paper and project.

1.8. Evaluation[7] of student's work

Course attendance	0,4	Activity/Participation		Seminar paper	1	Experimental work	
Written exam		Oral exam		Essay		Research	2
Project	2,6	Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The learning outcomes are validated and evaluated by monitoring the students' work on the research, the obtained research results and the manner and quality of research and presentation of a seminar paper and project.

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

1. Bouchard, L-F., Peters, L. 2024. Building LLMs for Production, Towards AI.
2. Obembe, F., Engel, O. 2024. A Hands-on Introduction to Big Data Analytics, SAGE Publications.
3. Tanenbaum, A.S., Van Steen, M. 2016. Distributed Systems, Createspace Independent Publishing Platform.

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

1. Russell, S.J., Norvig, P. 2020. Artificial Intelligence: A Modern Approach, 4th Global ed. Pearson.
2. Leskovec, J., Rajaraman, A., Ullman, J. D. 2014. Mining of Massive Datasets, Cambridge University Press.
3. Comer, D.E. 2021. The Cloud Computing Book: The Future of Computing Explained, Chapman and Hall/CRC Press.

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*
Bouchard, L-F., Peters, L. 2024. Building LLMs for Production, Towards AI.	3	2
Obembe, F., Engel, O. 2024. A Hands-on Introduction to Big Data Analytics, SAGE Publications.	2	2
Tanenbaum, A.S., Van Steen, M. 2016. Distributed Systems, Createspace Independent Publishing Platform.	2	2

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[7] **NOTE**: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Alen Jugović, PhD	
Course title	**Port systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The overall objective is to show the existing models of port system management in the world and the role and importance of the individual ports for the whole system, but also its position and significance within the port system. At the same time, the aim is to show the relationship and the importance of determining the direction of development of each port, the necessary investments and the dynamics of investment in order to realistically and responsibly follow the real needs of individual ports, but also features of the individual port system. Special attention will be dedicated to the port system of the national port and port system of county and local ports, and organizational models of port authorities and the business environment within which the port operates. The course objective is to point out the importance of creating a comprehensive port policy, but also compatible port policy that has its support in the transport and economic policy. In this sense, a part of the lecture will relate to the definition of the role of logistics in the entire transport chain, which begins and ends with sea ports.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam, students will be able to do the following:
1. Connect and compare various features of the seaport management system,
2. Define and determine the significance and role of each entity in the port system,
3. Measure the effectiveness of the concession system in the port areas,
4. Identify problems and shortcomings in the operations of port authorities and port concessionaires,
5. Establish the importance of logistics in the development of seaports,
6. Introduce and implement modern logistic strategies to find appropriate solutions to the requirements of the carrier, the owner of the goods and the environment.

1.4. Course content

- Experiences/forms and features of port systems management in the world and Europe,
- Port management configuration and port management reorganization,
- Tasks of port management and management of concession relations in the port area in the function of economic and entrepreneurial development,
- Port clusters,
- The relationship between the port and the city,
- Strategic port planning,

▪ Presenting the effects of port logistics on the competitive profiling of the port and transport system.		
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☒ fieldwork	☒ individual assigment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Comments		

1.7. Student's obligations

Attending lectures and field work. Examination through activities in class and final oral exam.

1.8. Evaluation[8] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam	1.6	Essay		Research	1
Project		Continuous assessment		Report		Practical work	
Portfolio		Article	3				

1.9. Assessment and evaluation of student's work during classes and on final exam

The student is evaluated through activities during lectures, research, a submitted article (essay) and final oral exam.

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

1.) Jugović, Alen: Upravljanje morskom lukom, Rijeka: Pomorski fakultet; 2012.
2.) Hlača, Bojan: Lučka Logistika, Pomorski fakultet Sveučilišta u Rijeci, Rijeka, 2016.
3.) Wayne-K-Talley: Port Economics, Routledge, Taylor and Francis Group, London & New York, 2009.
4.) Cullinane, Wayne & Talley, Kevin: Port Economics, Jai Press (Elsevier), 2006.

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

1.) Coto-millán, Pablo, Pesquera, Miguel Angel, Castanedo, Juan: Essays on port economics, 2010, xviii.
2.) Hlača, Bojan: Upravljanje prometnim koridorima, Veleučilište u Rijeci, Rijeka, 2011.
3.) Zelenika, Ratko: Logistički sustavi, Ekonomski fakultet Sveučilišta u Rijeci, Rijeka, 2005.

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*
Jugović, Alen: Upravljanje morskom lukom, Rijeka, Pomorski fakultet, 2012.	50	20
Hlača, Bojan: Lučka Logistika, Pomorski fakultet Sveučilišta u Rijeci, Rijeka, 2016.	20	20

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[8] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	*Professor emeritus* Serđo Kos, PhD Dražen Žgaljić, PhD	
Course title	**Multimodal transport networks**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

One of the fundamental characteristics of today's global transportation system is multimodalism, which explores the dynamics and evolution in the legal, economic, technical and technological domain. The basic aim of this course is to introduce students of the PhD programme "Maritime Studies" to the relevant segment of multimodality in the technical and technological domain, which are "multimodal transportation networks" with an emphasis on "multi-modal logistic networks'', which are now the basis of all modern multimodal transport systems. In addition to current scientific solutions that are continuously developed and upgraded, the goal of the course is to indicate the specific target areas within the "multi-modal transport networks" and multi-modal logistic networks which are still subject of research, or are insufficiently investigated.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Course expected learning outcomes on the basis of which the students, after completing the course and passing the exam will be able to:

1. Analyse, synthesize and evaluate dynamical structure of multimodal transport networks,
2. Analyse and evaluate multimodal transport supply chains,
3. Analyse, synthesize and evaluate, based on the multi-criteria analysis, the productivity, cost-effectiveness and profitability of different types of transport in the multimodal transport networks,
4. Analyse and structure the forming of multimodal transport networks,
5. Model vertical and horizontal network structures,
6. Analyse and structure the forming of multimodal logistic networks,
7. Analyse, synthesize and evaluate hierarchical relationships and dual descriptions of multimodal networks,
8. Model and optimize project tasks of multimodal transport and logistic networks,
9. Analyse, synthesize and evaluate fundamental variables and characteristics of important types of multimodal transport networks,
10. Analyse, synthesize and evaluate sensitivity and reliability of multimodal transport networks,
11. Analyse and evaluate transport network flows (equilibrium, nodes and arches),
12. Analyse and evaluate characteristic elements of the multimodal logistic networks (sides, nodes, network eye)
13. Analyse, synthesize and evaluate network planning,
14. Analyse and evaluate longitudinal and radial multimodal transport networks.

1.4. Course content

Multimodality. Mobility of people and goods. Supply chain in the MM transport, evaluation of various transportation modes. The formation of multi-modal transportation and logistics network. Vertical and horizontal network structures, Types and categories of networks. Hierarchical relations in transport networks. Dual descriptions of MM networks. General formulation of MM transport and logistic network projects.
Fundamental variables and characteristics of major types of transport networks. Corridors and network patterns. Single-level and multi-level MM networks. Sensitivity and reliability of MM network. Transportation network flows. Network balance. Nodes and arches. Sides, nodes and network eye. One origin/more origins – one destination/ more destinations. Alternative routes. Multiple demands.
Network planning. Network planning architecture, longitudinal and radial MM networks.

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

1.6. Comments

1.7. Student's obligations

Attendance at lectures, individual assignment and research in one thematical segment.

1.8. Evaluation[9] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio		Project assignment	3				

1.9. Assessment and evaluation of student's work during classes and on final exam

Assessment and evaluation of student's work is conducted through research of specified topics related to the course and during consultations.

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

Bliemer, M.C.J. (2001). *Analytical Dynamic Traffic Assignment with Interacting User-Classes: Theoretical Advances and Applications using a Variational inequality Approach.* Delft: Delft university Press.
Kos, S. & Zenzerović, Z. (2003). Modelling the Transport Process in Marine Container Technology. *Promet - Traffic & Transportation*, 15(1), pp. 13-17.
van Nes, R. (2002). *Design of multimodal transport networks*. Delft: Delft University Press.

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

Kos, S., Vukić, L. & Brčić, D. (2017). Comparison of External Costs in Multimodal Container Transport Chain. *Promet - Traffic & Transportation*, 29(2), pp. 243-252.
Kos, S., Bakota, M. & Brčić, D. (2018). Analysis of the Impact of Transport Corridor Vc on the Port of Ploče. *Promet - Traffic & Transportation,* 30(4), pp. 465-477.
Hess, M., Hess, S. & Kos, S. (2008). On Transportation system with deterministic Service Time. *Promet - Traffic & Transportation*, 20(5), pp. 283-290.
Kos, S. (2003) Productivity of Full Container Ship and Energy-Economy of its Propulsion Plant. *Promet - Traffic*

[9] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

& Transportation, 15(2).
Kos, S., Brčić, D. & Karmelić, J. (2010). Structural Analysis of Croatian Container Seaports. *Pomorstvo: Scientific journal of maritime research,* 24(2), pp. 189-209.
Kos, S., Šamija, S. & Brčić, D. (2012). Multimodal transport in the function of the port system containerization development. *Proceedings of the 2012 International Conference on Transport Sciences (ICTS)*. Univerza v Ljubljani, Fakulteta za pomorstvo in promet. Portorož, Slovenija, 28. 5. 2012. 7 p.
Kos, S., Šamija, S. & Brčić, D. (2012). The impact of logistic systems performances on the quality of services in multimodal transport. *Proceedings of 4th International Maritime Science Conference (IMSC)*. University of Split, Faculty of Maritime Studies. Split, Hrvatska, 16-17. 6. 2012. pp. 50-61.
Kos, S., Vilke, S. & Brčić, D. (2017). Redirection of the World Traffic Flow Far East – Europe via the Adriatic Sea. *Athens Journal of Technology & Engineering*, 4(3), pp. 229-245.
Kos, S., Zenzerović, Z. (2004). Model of Optimal Cargo Transport Structure by Full Container Ship on Predefined Sailing Route. *Promet - Traffic & Transportation,* 16(1), pp. 15-20.
Vilke, S., Brčić, D. & Kos, S. (2017). Northern and Southern European traffic flow land segment analysis as part of the redirection justification. *TransNav - International Journal on Marine Navigation and Safety of Sea Transportation*, 11(4). pp. 673-679.

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*
Bliemer, M.C.J. (2001). *Analytical Dynamic Traffic Assignment with Interacting User-Classes: Theoretical Advances and Applications using a Variational inequality Approach.* Delft: Delft university Press.	1	2
Kos, S. & Zenzerović, Z. (2003). Modelling the Transport Process in Marine Container Technology. *Promet - Traffic & Transportation*, 15(1), pp. 13-17.	Available online	2
van Nes, R. (2002). *Design of multimodal transport networks*. Delft: Delft University Press.	1	2

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	*Professor emeritus* Pavao Komadina, PhD Davor Šakan, PhD	
Course title	**Systematic approach to maritime affairs**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to provide a systematic overview of maritime affairs, as well as to explain the notion and classification of the maritime system. Maritime affairs as a multidisciplinary system is analytically and synthetically elaborated, presenting some contemporary scientific research in the area.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Students are expected to be able to:

1. Analyse and define the maritime system through the different aspects of the maritime industry;
2. Analyse and interpret the maritime industry through the analyses of different systems and subsystems;
3. Define and apply the basics features of the maritime system as an disciplinary system;
4. Compare maritime systems with basic characteristics of maritime systems and subsystems;
5. Compare the economic and non-economic activities of the maritime system on the international level;
6. Analyse the maritime development on the basis of EU guidelines.

1.4. Course content

- The definition and classification of the maritime system;
- Maritime affairs as a technical, legislative, economical, social, biological, technological and ecological system;
- Basic features of maritime activities and subsystems;
- Economic and non-economic activities of maritime affairs;
- International aspects of maritime affairs; the European Union and the development of maritime affairs.

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

The students' obligations, in addition to class attendance, are based on research and a systematic approach to maritime affairs. Research results need to be presented in the form of a written seminar, showing the obtained results.

1.8. Evaluation[10] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	3	Experiment	
Written exam		Oral exam		Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio		Project work					

1.9. Assessment and evaluation of student's work during classes and on final exam

Active participation in class; analysis of maritime affairs as a multidisciplinary system with indications of modern scientific research. Learning outcomes are assessed through the research of the PhD student, obtaining relevant results and finally the preparation of a seminar paper on the basis of which the grade is defined.

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

1. Kovačić, M., Komadina, P. (2011). *Upravljanje obalnim područjem i održivi razvoj*. Rijeka: Sveučilište u Rijeci, Pomorski fakultet.
2. Leggate, H., McConville, J., Morvillo, A. (2005). *International Maritime Transport – Perspectives*. London: Routledge.
3. Wilson, J. (2010). *Carriage of Goods by Sea*. London: Longman.

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

1. Alderton, P. (2011). *Sea Transport: Operation and Economics.* London: Bloomsbury Publishing
2. Branch, A., Robarts M. (2014). *Branch's Elements of Shipping*. London: Taylor and Francis, Routledge
3. Brodie, P. (2015). *Commercial Shipping Handbook*. London: Routledge.
4. Ma, S. (2020). Economics of Maritime Business. London: Routledge.
5. McConville, J. (1999) *Economics of Maritime Transport, Theory and Practice*. London: Witherbys.

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*
Kovačić, M., Komadina, P. (2011). *Upravljanje obalnim područjem i održivi razvoj*. Rijeka: Sveučilište u Rijeci, Pomorski fakultet.	10	1-10
Leggate, H., McConville, J., Morvillo, A. (2005). *International Maritime Transport – Perspectives*. London: Routledge.	2	1-10
Wilson, J. (2010). *Carriage of Goods by Sea*. London: Longman.	2	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[10] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Dario Ogrizović, PhD	
Course title	**Interactive Multimedia Simulation Systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Creating real-time multimedia interactive simulations using virtual (VR), augmented (AR), mixed (MR), and extended reality (XR) technologies.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After finishing the course, the students will be able:

1. Critically assess the features of empirical methods and techniques for evaluating interactive systems.
2. Analyze the concepts of virtual, augmented, mixed, and extended reality.
3. Model interactive virtual environments.
4. Compare types of devices for virtual and augmented reality.
5. Apply software tools for creating virtual environments.
6. Organize and conduct empirical research to evaluate and formally compare multimedia interactive simulation systems.
7. Design and evaluate multimedia interactive simulation systems.

1.4. Course content

Elements of interactive systems. Theoretical foundations of virtual reality (VR), augmented reality (AR), mixed reality (MR) and extended reality (XR). Sensation, perception, movement, interaction and immersion. Virtual interactive environment (virtual scene and components). Modeling of an interactive virtual environment (graphical and programmable flow systems, rendering, polygonal structures and special rendering effects). Interaction design. Design, preparation and implementation of empirical evaluation of multimedia interactive simulation systems. General purpose graphics accelerators. Types of devices for virtual and augmented reality. Programming tools.

1.5. Teaching methods

☒ lectures	☒ individual assigment
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratories
☐ long distance education	☒ mentorship
☐ fieldwork	☐ other _____

1.6. Comments

1.7. Student's obligations

Course attendance (consultations), preparing and presenting a seminar paper and project.

1.8. Evaluation[11] of student's work

Course attendance	0,4	Activity/Participation		Seminar paper	1	Experimental work	
Written exam		Oral exam		Essay		Research	2
Project	2,6	Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The learning outcomes are validated and evaluated by monitoring the students' work on the research, the obtained research results and the manner and quality of research and presentation of a seminar paper and project.

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

1. LaValle, S. M. 2023. Virtual Reality, Cambridge University Press.

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

1. MacKenzie, I. S. 2013. Human-Computer Interaction: An Empirical Research Perspective, Morgan Kaufmann.

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*
LaValle, S. M. 2023. Virtual Reality, Cambridge University Press.	3	2

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[11] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Svjetlana Hess, PhD	
Course title	**Decision-making techniques in traffic**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The basic goal of this course is to enable students, as future employees in a transport company, can and know how to use certain quantitative and qualitative methods in planning traffic demand and optimizing transport services, for the purpose of optimal and competitive business.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

1. identify the factors that affect the demand for transport services, and determine possible inefficient functioning and poor capacity utilization
2. compare and consider the advantages and limitations of individual optimization or forecasting methods in a particular case
3. assess the demand for transport service or optimize the transport process / transport service through the application of an appropriate quantitative or qualitative method
4. design a travel route, schematically present and solve an illustrative example of a transport process (itinerary) by calculating all the necessary travel indicators
5. evaluate the results obtained for the real business environment and suggest possible solutions

1.4. Course content

- Optimal organization of the transport process and planning of transport services based on demand.
- One or more of the selected quantitative methods: regression analysis in traffic forecast, shortest path method, linear programming, transport problem, queue theory, assignment method, dynamic programming
- Decision-making models in transport systems: application of the selected method of transport process optimization, through the adoption of techniques, analytical calculation and analysis of results.
- Estimation and forecast of traffic demand (with qualitative and / or quantitative forecasting method).
- Case study: assessment of the current state of business of a particular transport company, which processes (system states) are key and which are critical, application of a certain method to solve the identified problem.

1.5. Teaching methods

☒ lectures	☒ individual assigment
☐ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratories
☐ long distance education	☒ mentorship
☐ fieldwork	☐ other _____

1.6. Comments

1.7. Student's obligations

Independent research and presentation of research results in the form of a scientific paper.

1.8. Evaluation[12] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	3.6	Experimental work	
Written exam		Oral exam		Essay		Research	2
Project		Continuous assessment		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Learning outcomes are checked and evaluated by monitoring student work on research, through the results obtained and the quality of research integrated into a seminar paper, which contains all the components of a scientific article.

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

1. Hess, S., Planiranje prometne potražnje, Pomorski fakultet u Rijeci, Rijeka, 2010.
2. Stanković, R., Pašagić Škrinjar, J., Logistika i transportni modeli, autorizirana predavanja, web izdanje, Fakultet prometnih znanosti, Zagreb, 2015.
3. Vuleta, J., Backović, M., Ekonomsko matematički metodi i modeli, Ekonomski fakultet Univerziteta u Beogradu, 2015.

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

1. Hess, S., Hess, M., Novaselić, M., Grbić, L., Assessment of the Position of North Adriatic Terminals in Container Market Based on Different Indices, Logistics 8(4), 97, 2024.
2. Babeli, K., Hess, S., Hess, M., Capacity utilization of the container terminal as multiphase service system, European Transport \ Trasporti Europei, 86(4), 2022.
3. Krljan, T., Grbčić, A., Hess, S., Grubišić, N., The Stochastic Frontier Model for Technical Efficiency Estimation of Interconnected Container Terminals, JMSE, 9(5): 1-20, 2021.
4. Hess, S., Grbčić, A., The multiphase queuing system of the Rijeka airport, Pomorstvo, 33(2), 2019.
5. Brajdić, I., Matematički modeli i metode poslovnog odlučivanja, Fakultet za menadžment u turizmu i ugostiteljstvu, Opatija, 2013.
6. Logistics Engineering Handbook, editor G. Don Taylor, CRC Press Taylor & Francis Group, 2008.
7. Bahovec, V., Erjavec, N., Uvod u ekonometrijsku analizu, Element d.o.o., Zagreb, 2009.
8. Babić, Z., Modeli i metode poslovnog odlučivanja, Ekonomski fakultet Split, Split, 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*
Hess, S., Planiranje prometne potražnje, Pomorski fakultet u Rijeci, Rijeka, 2010.	5	2
Stanković, R., Pašagić Škrinjar, J., Logistika i transportni modeli, autorizirana predavanja, web izdanje, Fakultet prometnih znanosti, Zagreb, 2015.	web	2
Vuleta, J., Backović, M., Ekonomsko matematički metodi i modeli, Ekonomski fakultet Univerziteta u Beogradu, 2015.	5	2

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[12] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

Basic description		
Course coordinator	Mirjana Borucinsky, PhD	
Course title	**Language technologies for improving written communication skills**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The main objective of the course is to acquaint students with language technologies (LT) and how to use LT in order to improve their written communication skills.

1.2. Course enrolment requirements

N/A

1.3. Expected course learning outcomes

Upon completion of the course students will be able to:

1. Define LTs and describe the difference between language resources, tools and commercial products.
2. Classify LTs according to their purpose and the linguistic level.
3. Identify key features of scientific texts.
4. Compile a representative corpus to be used as a resource for linguistic data.
5. Evaluate existing LTs for specific language samples.
6. Rewrite an abstract/introduction using selected LTs.

1.4. Course content

Definition of language technologies (LT). A brief overview of the development of LTs. Large language models (LLMs). Review of existing technologies for specific linguistic levels (spell checkers, writing editing programmes, vocabulary checkers (e.g., Sapling, Spellcheck Plus, Wordtune, Quillbot, InstaText, Linggle, JustTheWord, Ludwig,i dr.) and resources (corpora, terminology databases, Lexonomy), MT and CAT tools (ImTranslator, Memsource, etc.). Compiling a representative corpus that can be used as a resource.
Anyalysis of scientific texts and their linguistic features. Understanding language structures in specific texts. Identifying main structures and formulaic language in abstracts, titles, introductions, conclusions, discussion, arguments. Achieving coherence and cohesion in academic writing. Application of LTs to personal writing.

1.5. Teaching methods

☒ lectures	☒ individual assignment
☐ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratories
☒ long distance education	☐ mentorship
☐ fieldwork	☐ other _____

1.6. Comments

1.7. Student's obligations

Course attendance, discussions, glossaries
- research

- presentations of results from individual assignments

1.8. Evaluation[13] of student's work

Course attendance	0,4	Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	4
Project		Sustained knowledge check	0,6	Report	1	Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Preparing research questions that are to be discussed in a group or online meetings with the lecturer.
Examples of assessment:

1. Describe the difference between language technologies and large language models.
2. Which LTs can be used to check the accuracy of a linguistic patterns (e.g., 'in view of', 'to our knowledge' etc.)?
3. Rewrite an abstract by using LTs.
4. Based on the compiled corpus, extract multi-word expressions.
5. Draft a research question on problems pertaining to LTs and their application.
6. Write an abstract/introduction and report how LTs have helped you make your written communication more efficient.

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

1. Mohamed Khalifa, Mona Albadawy (2024). Using artificial intelligence in academic writing and research: An essential productivity tool, Computer Methods and Programs in Biomedicine Update, Volume 5, 2024, https://doi.org/10.1016/j.cmpbup.2024.100145.
2. Berez-Kroeker, A.; McDonnell, B.; Koller, E.; Collister, L., B. (2022). The Open Handbook of Liguistic Data Management. Massachusets: MIT Press.
3. Borucinsky, M. (2023). Primjena metoda korpusne lingvistike u jezikoslovnim istraživanjima. Pomorski fakultet, Sveučilište u Rijeci.
4. Borucinsky, M.; Kegalj, J. (2020). Notes on Written Communication in Marine Engineering. Pomorski fakultet, Sveučilište u Rijeci.
5. Wong, L. L. C. (2019). Implementing disciplinary data-driven learning for postgraduate thesis writing. U Hyland, K. & Wong, L. L. C. (ur.), str. Specialized English.

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

Additional reading is available at the Merlin platform.

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*
Titles from the main reading list are available online.		

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[13] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

NAUTICAL SCIENCES

General information		
Course coordinator	Josip Kasum, PhD	
Course title	**Hydrographic activity and safety of navigation**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The course provides a scientific methodological approach to study the relationship between hydrographic activity and safety of navigation. The specific objectives are related to: exploring the role of the International Hydrographic Organization (IHO) in the area of maritime safety, strengthening the knowledge about models hydrographic activities and the maintenance in that part of the safety of navigation, and exploration of methodological approaches in the hydrographic activity.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Students are expected to be able to:

1. Explain the relationship between hydrographic activity and safety of navigation;
2. Describe the characteristics of organized hydrographic activities;
3. Synthesize the relationship between hydrographic activity and safety of navigation in dynamic conditions;
4. Recommended the optimal way of establishing hydrographic activities;
5. Verify the activities of hydrography.

1.4. Course content

The role of the International Hydrographic Organization (IHO) and maritime affairs. The organizational structure of Hydrographic Organizations of IHO member states. The organizational structure of the Croatian Hydrographic Institute - HHI. Models of production of basic products of hydrographic organizations. The production of charts and nautical publications. National coordinators for maritime safety information and hydrographic organization. Structure and services of national coordinators. Methodological approaches to hydrographic activity and reambulation. Application of automation in the process of hydrographic 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

Attendance, research, exam

1.8. Evaluation[14] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam	3.6	Essay		Research	2
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

During class: research, modelling, simulating and presenting results.

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

1. Bowditch, N.: American Practical Navigator, DMAHC, USA, 2021.
2. Handbook of Maritime Conventions, Commite Maritime International. (2014)
3. International Hydrographic Organization (IHO). (2025).

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

1. Narodne novine, Zakon o hidrografskoj djelatnosti i Zakon o izmjenama i dopunama Zakona o hidrografskoj djelatnosti

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. Bowditch, N.: American Practical Navigator, DMAHC, USA, 2004.	Available online	1-10
2. Handbook of Maritime Conventions, Commite Maritime International, 2012.	Available online	1-10
3. International Hydrographic Organization (IHO). (2021). Online: http://www.iho.int/	Available online	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[14] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	*Professor emeritus* Pavao Komadina, PhD Igor Rudan, PhD	
Course title	**Integrated maritime safety and surveillance systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of the course is to provide students a systematic approach to integrated maritime safety and surveillance systems. Students should explore the settings of creating an integrated model of maritime management as part of integrated coastal and marine management that will coordinate the conservation of natural resources of the maritime domain, ensuring and enabling sustainable maritime economic development, while ensuring maximum economic gain. In order to be able to do this, it is necessary to analyze the establishment of a comprehensive system of monitoring the coast and the sea area in order to protect it against all forms of usurpation and devastation, as well as control the economic use of maritime domain.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After the course completion, students are expected to be able to:

1. Analyze and interpret state measures in the function of raising navigation safety;
2. Analyze the current development of the International Adriatic Monitoring System and the management of the entire coastline area;
3. Model and interpret the Technical Surveillance System for the Adriatic region;
4. Analyze the precondition for navigation of maritime traffic on the terminal and harbour areas;
5. Analyze the impacts of safety navigation parameters on the maritime navigation and control measures.

1.4. Course content

- Measures taken by states to achieve a certain level of navigation safety;
- Measures to prevent accidents and measures to reduce the consequences of marine casualties;
- Insurance at a satisfactory level of protection of human life at sea, particularly seafarers, fishermen, tourists, passengers on passenger ships, and other persons staying at sea for longer or shorter periods;
- Insurance of a satisfactory level of ecological protection of the sea, air and coastal areas, and the provision of material goods (ships and cargo) in the Adriatic Sea transport;
- The Adriatic international monitoring system and management of entire coastal and maritime areas;
- Creation of organizational and legal preconditions for the creation of the Adriatic Coast Guard, as an international system of maritime traffic control and monitoring system;
- Analysis and creation of preconditions for full direction of shipping at terminal directions and port areas;
- Modelling of a common technical system for the Adriatic navigation;
- Creation of a knowledge base and decision-making models, especially in terms of increasing security;
- Definition and determination of criteria for risk assessment, with the aim of determining metrics, levels of acceptable security of risks and effects of investments for risk reduction;

- Determination of preventive procedures for increasing the security of ports and maritime passenger traffic;
- Analysis of the impact on maritime traffic guidance and control measures for safety navigation parameters;
- The model of education system for employees.

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

The students' obligations, in addition to class attendance, are based on the research of integrated safety and monitoring systems in shipping and preparing a seminar paper presenting the obtained results.

1.8. Evaluation[15] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	3	Experiment	
Written exam		Oral exam		Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio		Project work					

1.9. Assessment and evaluation of student's work during classes and on final exam

Active participation in teaching and analysis of integrated safety and monitoring systems with indications of modern scientific research. Learning outcomes are checked through student's research, obtaining relevant results and finally the preparation of a seminar paper on the basis of which the grade is defined.

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

1. Beard, T. (2004). *The Coast Guard.* New York: Hugh Lauter Levin Associates.
2. Cicin - Sain, B., Knecht, R. (1998). *Integrated Coastal And Ocean Management, Concepts And Practices* Washington, DC: Island Press.
3. Clark, J. R. (1995) *Coastal Zone Management Handbook.* Boca Raton: CRC Press.

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

1. European Commission (EC). (2001). Towards a European Integrated Coastal Zone Management (ICZM) Strategy: General Principles and Policy Options. Bruxelles: EC.
2. European Commission (EC). (2021). Alphabetical list of studies and reports available on the Environment website (http://ec.europa.eu/environment/pubs/studies.htm)

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*
Beard, T. (2004). *The Coast Guard.* NY: Hugh Lauter Levin Associates.	2	1-10
Cicin - Sain, B., Knecht, R. (1998). *Integrated Coastal And Ocean Management, Concepts And Practices* Washington, DC: Island Press.	2	1-10
Clark, J. R. (1995) *Coastal Zone Management Handbook.* Boca Raton: CRC Press.	2	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[15] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Sandra Tominac Coslovich, PhD	
Course title	**Intercultural competence and communication in maritime industry**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Defining and understanding the concepts of culture and intercultural competence and their dimensions, as well as the most important models that enable the acquisition of intercultural competence. Understanding the role and place of intercultural competencies in communication in maritime industry. Developing critical thinking skills in evaluating the place and role of language and culture on board and in the maritime industry in general. Understanding the concepts of multilingualism, multinationalism and multiculturalism in the maritime industry and their impact on communication on board. Development and application of methodology in the research of multiculturalism and intercultural competencies and in the analysis of intercultural communication in maritime industry.

1.2. Course enrolment requirements

Completed undergraduate study programmes in Nautical studies/Marine Engineering/Logistics and Management in Maritime Industry and Transport

1.3. Expected course learning outcomes

After completing the course requirements, it is expected that the students will be able to:
1. correctly define, recognize and apply the concepts of multiculturalism and intercultural competencies in the maritime industry;
2. list and explain the most important cultural models/dimensions and apply them to the analysis of the most numerous nationalities on board;
3. state and explain the most important dimensions of intercultural competence;
4. recognize and analyze basic models of intercultural competence;
5. critically evaluate the impact of multiculturalism on communication and safety on board vessels manned by multinational and multicultural crew;
6. adopt elements, methodology and models of multicultural and multilingual research and studies in the organization of maritime business and employment of seafarers.

1.4. Course content

Definitions of culture, culture as "mental software", cultural dimensions/models, critical review of cultural models, sociolinguistic aspects of multicultural communication on board (communication in stressful situations, crisis management), research methods in culture and sociolinguistics: advantages and disadvantages, avoiding absolute statements about national culture, multinational crews: aspects of multilingualism and multiculturalism, the problem of communication; language and culture studies in the process of employment of seafarers, culture and authority, definition of intercultural competence, review, comparison and analysis of the most important elements of intercultural competence and their analysis,

intercultural communication competence in the maritime industry (verbal and nonverbal), developing awareness of the importance of human element and communication in the maritime industry and the importance of continuous education and training in the matters of communication in multicultural maritime environments.

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

1.7. Student's obligations

Participation in course activities and discussions, writing and presenting reports on the results of independent research

1.8. Evaluation[16] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam	0.6	Essay		Research	4
Project		Continuous assessment		Report	1	Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Writing and presenting a report, participating in course activities.
Examples of assessment and evaluation:

- Learning outcomes 1, 2, 5. Based on the text from the study "Case studies of life aboard" explain the impact of cultural differences on ship safety.
- Learning outcomes 2, 3, 4. Critically examine the shortcomings and limitations of different models of cultural dimensions/intercultural competence
- Learning outcomes 2, 5, 6. Apply one of the models of cultural dimensions in the analysis of one nationality on board and present the results and your own critical review in a report

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

1. *Cross Cultural Competency for Maritime Professionals through Education and Training* (CCUL.COMPET) (Phase II), IAMU 2011 Research Project No 2011-3 Final Report by James R. Parsons, Elaine Potoker & Maria Progoulaki, https://iamu-edu.org/download/final-report-of-research-project-fy2011/
2. *Cross-Cultural Training* - course developed within the project KNOWME by Dorina Pörksen (author) and oncampus, e-learning department of Lübeck University of Applied Sciences, Germany – designed for developing intercultural competency in the maritime industry, https://www.oncampus.de/weiterbildung/wirtschaft/cross-cultural-training
3. *Multicultural Crew Management* (Topic 7), in book "A Good Working Life at Sea - A manual for creating and maintaining welfare and well-being aboard", Copenhagen: Seahealth Denmark, 2008, https://shw.dk/en/page/multicultural-crews or https://iamu-edu.org/download/final-report-of-research-project-fy2011/ (pp. 110-117)

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

[16] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

1. Arasaratnam, L. A., & Deardorff, D. K. (Eds.). (2015). Intercultural competence [Special issue]. *Internation Journal of Intercultural Relations*, *48*
2. Arasaratnam, L. A. (2014). Ten years of research in intercultural communication competence (2003–2013): A retrospective. *Journal of Intercultural Communication*, *35.*
3. Bennett, J. M. (Ed.). (2015). *The SAGE encyclopedia of intercultural competence*. Thousand Oaks, CA: SAG
4. Deardorff, D. K. (2006) , The Identification and Assessment of Intercultural Competence as a Student Out of Internationalization at Institutions of Higher Education in the United States, Journal of Studies in International Education10:241-266
5. Hofstede, Geert (1997/2004) Cultures and Organizations: Software of the Mind
6. Horck, J. (2005) Can shipping people communicate? A human factor aspect on multicultural communicat and ethnic stereotyping in Shipping. Journal of Maritime Studies. Vol. 2. World Maritime University
7. Jeknić, Ranka (2006) Individualističke i kolektivističke kulture u kontekstu globalizacije: Hofstedeov mode njegova kritika. Revija za sociologiju, Vol XXXVII (2006), No 3-4, 205-2255.
8. Knudsen, F. (2005) Seamanship –between techniques and practical wisdom. Proceedings of NoFS6.
9. Lutsenko, O. & Stok, H. (2008) Cultural awareness in Maritime English. Proceedings of IMLA-IMEC Confer on Maritime English, Rotterdam
10. Andres, T. Q. D. (2006) Understanding the Filipino Seaman: His Values, Attitudes and Behavior, Our Lady Manaoag Publishers, Manila, Philipines
11. Barnett, M.L (2005) Searching for the Root Causes of Maritime Casualties: Individual Competence or Organisational Culture? Maritime Research Centre, Warsash, Southampton,UK, WMU Journal of Maritim Affairs, 2005, Vol. 4, No.2, 131–1452.
12. Benton, G. Multicultural crews and the culture of globalization, Department of Global and Maritime Stud The California Maritime Academy. www.Multicultural crews and the culture of globalization.mht
13. Čulić-Viskota, A. & Bielić, T. (2008) Cultural and linguistic differences as factors of ineffective communica Proceedings of IMLA-IMEC 20, Rotterdam
14. Froholdt, L.L. (2007) Seamanship -Between Techniques And Practical Wisdom Imec 2007 The Human ele in Maritime Accidents and disasters –a matter of communication
15. Galešić, A.-Dž., Tominac Coslovich, S. (2019) Working with Multinational and Multicultural Crews: a Croa Seafarers' Perspective, Scientific Journal of Maritime Research 33 2019, pp. 56-62, Faculty of Maritime S Rijeka, https://doi.org/10.31217/p.33.1.6
16. Hofstede, G. Culture's consequences: international differences in work-related values, Abridged version, London: Sage, 1984/2001.
17. Hofstede Geert 1997 (1991) Cultures and organizations Software of the mind. Intercultural cooperation its importance for survival. McGraw-Hill NY, London m.fl.
18. Horck, Jan (2005) Getting the best out of multi-cultural manning. BIMCO GA 2005 in Copenhagen
19. Horck, J. (2003) Cultural Diversity in Shipping. The Internatonal Martime Human Element Bulletin, No. 18
20. Katunarić, Vjeran (2004) Od distance prema srodnosti: model "nacionalne kulture" Geerta Hofstedea. Pedagogijska istraživanja, 1(1):25–39.9.
21. Knudsen F. (2004): "If you are a good leader I am a good follower". Working and leisure relations betwee Danes and Filipinos on board Danish vessels. Arbejdsog Maritimmedicinsk Publikationsserie, rapport nr. 9
22. Knudsen, F. (2007) Are we really programmed by our culture? A critical approach to culture as software mind. Syddansk Universitet
23. Knudsen, F. (2008) Conceptions of 'culture' in inter-national communication - Limits to cultural explanati Proceedings of IMLA-IMEC Conference on Maritime English, Rotterdam
24. McSweeney, Brendan (2002): Hofstede's model of national cultural differences and their consequences: triumph of faith—a failure of analysis. Human Relations 55 (1), pp. 89–118.
25. Pritchard (1998) Report on Current Approved Standards of Maritime English Communication and Recommendation – Deliverable No. 6 –In: The Impact ofMulticultural and Multinational Crews on MARit COMmunication", The MARCOM Project), European Union (1996-1998), Malmo: 1-6813.

26. Pritchard, B. (1998) 'Norma i jezične varijacije u pomorskim komunikacijama', Zbornik HDPL-a, ur. B. Prit L. Badurina, D. Stolac), Zagreb, 457-470 14.
27. Pritchard, B. (2003) Maritime English syllabus for the modern seafarer: comprehensive or safety-related courses, WMU Journal of Maritime Affairs, 2003, Vol. 2, No. 2, Malmö: 149-16615.
28. Pritchard, B. (2000) 'Maritime VHF Communications: Standards versus Practice', In: Proceedings of Work on Maritime English (WOME 2A), IMLA, Dalian Maritime University, Dalian, China, 44-5410.
29. Pritchard, B. (1998) On Some Cultural Issues in Translating Lexical Sets, British Studies Conference -Cross Cultural Challenges, The British Council, 84-103 16.
30. Taylor. P. T. (2008) The culture of safety onboard!. Proceedings of IMLA-IMEC Conference on Maritime English, Rotterdam
31. Wiseman, R. L., & Koester, J. (1993). *Intercultural communication competence*. Thousand Oaks, CA: SAGE.

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*
Cross Cultural Competency for Maritime Professionals through Education and Training (CCUL.COMPET) (Phase II) by James R. Parsons, Elaine Potoker & Maria Progoulaki	Available online https://iamu-edu.org/download/final-report-of-research-project-fy2011/	1-10
Cross-Cultural Training - course developed within the project KNOWME by Dorina Pörksen– designed for developing intercultural competency in the maritime industry	Available online https://www.oncampus.de/weiterbildung/wirtschaft/cross-cultural-training	1-10
Multicultural Crew Management (Topic 7), in book "A Good Working Life at Sea - A manual for creating and maintaining welfare and well-being aboard", Copenhagen: Seahealth Denmark, 2008,	Available online https://shw.dk/en/page/multicultural-crews I https://iamu-edu.org/download/final-report-of-research-project-fy2011/ (pp. 110-117)	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Nermin Hasanspahić, PhD Đani Šabalja, PhD	
Course title	The Role of the Human Factor in Maritime Accidents	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The course covers theoretical and practical aspects of the human factor, analysis of maritime accidents, and the development of safety strategies in accordance with international standards and practices. The aim of the course is to provide students with a comprehensive understanding of the impact of the human factor on maritime safety and to develop their ability to analyze and propose strategies for reducing human errors in the maritime industry.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Upon completion of the course, students will be able to:

1. Analyze the role of the human factor in maritime accidents using appropriate scientific methods and accident reports.
2. Identify key human, environmental, technological, and organizational factors influencing human performance in the maritime industry.
3. Classify human factors within the context of the applied methodology for maritime accident analysis.
4. Critically evaluate existing safety systems and strategies based on conducted research.
5. Apply risk analysis methods and human factor management techniques in the maritime context.
6. Develop measures to improve maritime safety based on risk analysis in the context of the human factor.

1.4. Course content

Introduction to the human factor and maritime accidents. Definition and significance of the human factor, historical analysis of maritime accidents caused by human error. Statistical data and trends. Psychological aspects of the human factor. Perception and decision-making at sea. Stress, fatigue, and their impact on work performance. Situational awareness and cognitive workload. The role of ergonomics in the design of navigation bridges. Fatigue and circadian rhythms (watchkeeping schedule). Application of artificial intelligence and automation in navigation. Physical health and decision-making ability. Alcohol, drugs, and their role in maritime accidents. Safety culture in the maritime industry. Shipboard leadership and team dynamics on board. The impact of organizational structure on human errors. Methods of analyzing accidents caused by the human factor: SHELL model (Software, Hardware, Environment, Liveware), HFACS (Human Factors Analysis and Classification System), Event Tree Analysis (ETA), Fault Tree Analysis (FTA). Risk assessment of human error.

Methods for investigating maritime accidents. STCW Convention and the human factor. IMO guidelines on the human factor. Strategies for reducing human errors. Education and training of seafarers (use of simulators).		
1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assigment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other _____
1.6. Comments	None.	

1.7. Student's obligations

Attendance at lectures and preparation and presentation of a seminar paper. The preparation and presentation of a seminar paper can be replaced by the preparation and publication of a scientific paper in an appropriate journal or the preparation and presentation of a paper at a relevant scientific conference.

1.8. Evaluation[17] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2.6	Experimental work	
Written exam		Oral exam		Essay		Research	3.0
Project		Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

1. Research (60%) - Learning Outcomes: 1, 2, 3, 4
Evaluation Criteria:
Application of maritime accident analysis methodology – Use of scientific methods (HFACS, SHELL, or others) (15%).
Clear identification and description of key factors affecting human performance with relevant industry examples (15%).
Correct application of methodology (HFACS, SHELL, IMO models) and categorization of factors (15%).
Critical evaluation of safety measures and procedures, identifying weaknesses in existing systems (15%).
2. Seminar Paper (40%) - Learning Outcomes: 4, 5, 6
Evaluation Criteria:
Logical problem development and critical analysis based on research (10%).
Application of human error risk analysis with clearly defined factors and influences (15%).
Development of proposals for improving safety systems, based on risk analysis and case studies (15%).

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

1. Gregory, D., Shanahan, P. (2010). The human element: A guide to human behaviour in the shipping industry. The Stationery Office. ISBN: 9780115531200.
2. International Maritime Organization (2006). MSC-MEPC.7/Circ.4. The organization's strategy to address the human element.
3. International Maritime Organization (2007). MSC-MEPC.7/Circ.5. Guidelines for the operational implementation of the International Safety Management (ISM) Code by companies.
4. International Maritime Organization (2008). MSC-MEPC.7/Circ.7. Guidance on Near-Miss Reporting.
5. International Maritime Organization (2008). Resolution MSC.255(84). Adoption of the code of the international standards and recommended practices for a safety investigation into a marine casualty or

[17] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

marine incident (Casualty Investigation Code)
6. Chen, S.-T., Wall, A., Davies, P., Yang, Z., Wang, J., Chou, Y.-H. (2013). A human and organisational factors (HOFs) analysis method for marine casualties using HFACS-Maritime Accidents (HFACS-MA). Safety Science, 60, 105–114. https://doi.org/10.1016/j.ssci.2013.06.009
7. Lee, Y.-C. (2016). A study on maritime casualty investigations combining the SHEL and Hybrid model methods. Journal of the Korean Society of Marine Engineering. 40. 721-725.

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

1. American Bureau of Shipping (2014) Guidance notes on the investigation of marine incidents.
2. International Maritime Organization (2008.) MSC-MEPC.3/Circ.3 (Revised harmonized reporting procedures) Casualty-related matters reports on marine casualties and incidents.
3. International Maritime Organization Casualty analysis procedure (document FSI 17/WP.1, annex 2)
4. Bielić, T., Hasanspahić, N., Čulin, J. (2017). Preventing marine accidents caused by technology-induced human error. Pomorstvo, 31 (1), 33-37. https://doi.org/10.31217/p.31.1.6
5. Hasanspahić, N., Vujičić, S., Frančić, V., Čampara, L. (2021) The role of the human factor in marine accidents. Journal of Marine Science and Engineering, 9(3), 261. https://doi.org/10.3390/jmse9030261

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*
All titles from the list of assigned reading are available online.	--	5

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	*Professor emeritus* Serđo Kos, PhD David Brčić, PhD	
Course title	**Research into environmental impacts on satellite navigation systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The basic aim of the course is to acquaint PhD students with the physical and technical intentional and natural environmental impacts that affect the satellite navigation systems performance and respective services. Among other, those are LAIC coupling and its influence on GNSS, structural analysis of ionosphere, effects of ionospheric and geomagnetic disturbances and phenomena on satellite navigation systems, systemic and random errors that occur when determining positions using satellite navigation systems, monitoring of ionosphere and troposphere state parameters, tropospheric refraction of EM satellite signals, multiple reflection of EM signals (multipath), methods and procedures of mitigating: ionospheric effects on satellite navigation systems, tropospheric refractions, multiple reflections of EM signals (multipath effect).

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Course expected learning outcomes on the basis of which the students, after completing the course and passing the exam will be able to:
1. Analyze, synthesize and evaluate the relationships between LAIC coupling and GNSS system,
2. Analyze, synthesize and evaluate structural elements of ionosphere dynamics,
3. Analyze, synthesize and evaluate relevant solar disturbances, geomagnetic environment, vertical profile of the ionosphere - basic ionospheric models and vertical profile of the troposphere,
4. Explain measurement techniques for monitoring the state of the ionosphere and troposphere,
5. Analyze and evaluate in situ measurements,
6. Analyze and evaluate ionospheric and tropospheric effects on satellite positioning characteristics,
7. Model local ionospheric dynamics,
8. Explain the procedures for mitigation of ionospheric/tropospheric effects and the effects of multiple reflection of EM signals on satellite navigation systems/Model the multicriteria analysis of the results of satellite and terrestrial monitoring,
9. Model advanced digital signal processing,
10. Analyze and evaluate subsidiary and augmented satellite navigation systems,
11. Analyze, synthesize and evaluate the identification of disturbances in the positioning service by satellite systems (risk assessment),
12. Analyze, synthesize and evaluate correction models of satellite navigation systems.

1.4. Course content

Ionosphere dynamics and geomagnetic elements (nature and causes of solar disturbances, solar-terrestrial relations, geomagnetic environment, formation and dynamics of ionospheric layers, vertical ionospheric profile, ionosphere models). Influence of LAIC (Lithosphere-Atmosphere-Ionosphere) coupling on GNSS systems. Ionospheric/Tropospheric effects on the operation of satellite navigation systems. GNSS architecture, satellite component, control component, user component, transmission medium, calculation of positioning errors by satellite systems). Ionospheric measurement techniques. Radio wave techniques. Coherent and incoherent scattering waves. Optical techniques. Lidar. In situ measurements – probes, mass spectrometers, Fluxgate magnetometers. Ionospheric effects on satellite positioning characteristics (positioning error by satellite systems due to ionosphere action, ionospheric delay of GNSS signals, ionospheric scintillation, local ionospheric dynamics, other sources of GNSS signal disturbances). Multiple reflection of EM satellite signal – attenuation methods. Monitoring of the ionosphere from the point of view of effects on satellite navigation systems (basic parameters of solar activity, geomagnetic environment and ionospheric dynamics, measuring instruments, satellite monitoring, terrestrial monitoring, online archives of observation results, principles and procedures of analysis of observation results). Procedures for mitigating ionospheric effects on satellite navigation systems (modernization and improvement of basic satellite navigation systems, advanced digital signal processing, subsidiary and augmented satellite navigation systems, identification of satellite positioning service disturbances, correction models, alarms on temporary reduction of satellite positioning service quality).

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

1.7. Student's obligations

Lectures, individual assignment and research.

1.8. Evaluation[18] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	2.6
Project		Continuous assessmen		Report		Practical work	
Portfolio		Project assignment	3				

1.9. Assessment and evaluation of student's work during classes and on final exam

Assessment and evaluation of student's work is conducted through research of specified topic related to the course content, with obligatory attendance.

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

American Meteorological Society (AMS). (2011). *Satellite Navigation & Space Weather: Understanding the Vulnerability & Building Resilience*. Massachusetts: AMS. Available online: https://www.ametsoc.org/ams/assets/file/spacwx_gps_2010.pdf

Blagojević, D. (2014). *Uvod u satelitsku geodeziju*. (in Serbian) Beograd: Građevinski fakultet Univerziteta u Beogradu. Available online:

[18] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

https://www.grf.bg.ac.rs/p/learning/uvod_u_satelitsku_geodeziju_1406052540553.pdf

Brčić, D. (2015). *A model of non-specific daily pattern of the satellite positioning signal ionospheric delay.* Doctoral thesis (in Croatian). Rijeka, Croatia: University of Rijeka, Faculty of Maritime Studies. Available online: https://repository.pfri.uniri.hr/en/islandora/object/pfri%3A175

Parkinson, B.W. i Spilker Jr., J. J. (eds.). (1996). *Global Positioning System: Theory and Applications*. Volume I. Washington, DC: AIAA. Available online: https://arc.aiaa.org/doi/book/10.2514/4.866388

Subirana, J. S., Zornoza, J. J. M. i Hernandez-Pajares, M. (2013). *GNSS Data Processing. Volume I: Fundamentals and Algorithms*. Noordwijk: ESA Communications. Available online: https://gssc.esa.int/navipedia/GNSS_Book/ESA_GNSS-Book_TM-23_Vol_I.pdf

Subirana, J. S., Zornoza, J. J. M. i Hernandez-Pajares, M. (2013). *GNSS Data Processing. Volume II: Laboratory Exercises*. Noordwijk: ESA Communications. Available online: https://gssc.esa.int/navipedia/GNSS_Book/ESA_GNSS-Book_TM-23_Vol_II.pdf

Thomas, M. et al. (2011). *Global Navigation Space Systems: reliance and vulnerabilities*. London: The Royal Academy of Engineering. Available online: https://www.raeng.org.uk/publications/reports/global-navigation-space-systems

u-Blox. (2009). *Essentials of Satellite Navigation*. Thalwil: u-Blox AG. Available online: https://www.u-blox.com/sites/default/files/products/documents/GPS-Compendium_Book_%28GPS-X-02007%29.pdf

European GNSS Agency (GSA). (2018). GNSS User Needs and Requirements: Report Series. Prague: GSA. Available online: https://www.gsa.europa.eu/gnss-applications/user-needs-and-requirements

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

Brčić, D. (2012). Ensuring sustainability through utilisation of satellite navigation technology. *Proceedings of the 2012 International Conference on Transport Sciences (ICTS)*. Univerza v Ljubljani, Fakulteta za pomorstvo in promet. Portorož, Slovenia, 28. 5. 2012. 14 pg.

Brčić, D., Ćelić, V. and Valčić, S. (2020). Reconstruction of Geomagnetic Event as Observed in Northern Adriatic Region and Its Correlation with GPS Single-frequency Positioning Deviations. *TransNav - International Journal on Marine Navigation and Safety of Sea Transportation*. 14(2). pg. 349-357. doi: 10.12716/1001.14.02.11

Brčić, D., Filjar, R., Kos, S. and Valčić, M. (2019). On Global Ionospheric Maps based winter-time ionospheric delay with reference to the Klobuchar model: Case study of the Northern Adriatic. *Pomorstvo – Multidisciplinary Journal of Maritime Research.* 33 (2). pg. 210-221. doi: 10.31217/p.33.2.11

Brčić, D., Kos, S. and Filjar, R. (2013). An assessment of geomagnetic activity-related technology failure risk based on patterns of Kp index dynamics in 2012. *Proceedings of the 7th Global Navigation Satellite Systems Vulnerabilities and Solutions Conference.* The Royal Institute of Navigation, London & University of Rijeka, Faculty of Maritime Studies. Baška, Croatia, 18-20. 4. 2013. pg. 61-82. Available at: https://www.pfri.uniri.hr/web/hr/zs_baska_rin_gnss.php

Brčić, D., Pongračić, B. and Kos, S. (2016). Vernal TEC behaviour in correlation with GPS coordinate deviations. *Proceedings of the 10th Annual Baška GNSS Conference.* The Royal Institute of Navigation, London & University of Rijeka, Faculty of Maritime Studies. Baška, Hrvatska, 8-10. 5. 2016. pg. 63-78. Available at: https://www.pfri.uniri.hr/web/hr/zs_baska_rin_gnss.php

Capderou, M. (2005). *Satellites, Orbits and Missions*. Paris: Springer Verlag France.

Davis, K. (1990). *Ionospheric Radio*. London: Peter Peregrinus Ltd.

Dow, J.M., Neilan, R. E., and Rizos, C. (2009). The International GNSS Service in a changing landscape of Global Navigation Satellite Systems. *Journal of Geodesy*. 83, pg. 191–198. doi: 10.1007/s00190-008-0300-3

European GNSS Agency (GSA). (2017). *Using GNSS raw measurements on android devices: White Paper*. Luxembourg: ESA. Available at: https://www.gsa.europa.eu/system/files/reports/gnss_raw_measurement_web_0.pdf

Filjar, R., Brčić, D. and Kos, S. (2013). Single-frequency Horizontal GPS Positioning Error response to a moderate Ionospheric storm over Northern Adriatic. In: Weintrit, A. (ur). *Advances in Marine Navigation.* London, UK: Taylor & Francis Group. pg. 49-56.

Filjar, R., Brčić, D. and Kos, S. (2014). Jamming-Spoofing-Meaconing resilient GNSS operation at the open sea. *Proceedings of the 8th Global Navigation Satellite Systems Vulnerabilities and Solutions Conference.* The Royal Institute of Navigation, London & University of Rijeka, Faculty of Maritime Studies. Baška, Hrvatska, 7-9. 5. 2014. pg. 25-32. Available at: https://www.pfri.uniri.hr/web/hr/zs_baska_rin_gnss.php

Filjar, R., Kos, S. and Brčić, D. (2011). Single-frequency GPS positioning performance around the time of the Chilean 2010 earthquake. *Pomorstvo: Scientific journal of maritime research*. 25 (2). pg. 287-306.

Filjar, R., Kos, S. and Krajnović, S. (2013) Dst Index as a Potential Indicator of Approaching GNSS Perfomance Deterioration. *Journal of navigation*. 66 (1). pg. 149-160.doi: 10.1017/S037346331200029X

Filjar, R., Kos, T. and Kos, S. (2009). Klobuchar - Like Local Model of Quiet Space Weather GPS Ionospheric delay for Northern Adriatic. *Journal of Navigation*. 62 (3). pg. 543-554. doi: 10.1017/S0373463309005281

Hapgood, M. and Thomson, A. (2010). *Space Weather: Its Impact on Earth and Implications for Business*. London: Lloyd's 360 Risk Insight.

Kaplan, E. D. and Hegarty, C.J. (eds.) (2006). *Understanding GPS: Principles and Application*. Second edition. Boston: Artech House.

Klobuchar, J. (1987). Ionospheric Time-Delay Algorithms for Single-Frequency GPS Users. *IEEE Transactions on Aerospace and Electronic Systems*. 3, pg. 325-331.

Kos, S., Bakota, M. and Brčić, D. (2019). Particularities of determining vessel position, course and speed and the ionospheric error by using dual-band GLONASS receivers. *Proceedings of 12th Annual Baška GNSS Conference.* The Royal Institute of Navigation, London & University of Rijeka, Faculty of Maritime Studies. Baška, Croatia, 7-9. 5. 2018. pg. 97-108. Available at: https://www.pfri.uniri.hr/web/hr/zs_baska_rin_gnss.php

Kos, S., Brčić, D. and Musulin, I. (2013). Smartphone application GPS performance during various space weather conditions: A preliminary study. *Proceedings of the 21nd International Symposium on Electronics in Transport (ISEP)*. Electrotechnical Association of Slovenia & ITS Slovenia. Ljubljana, Slovenia, 25-26. 3. 2013. 4 pg.

Kos, S., Filjar, R. and Brčić, D. (2012). GPS Performance Degradation Caused by Single Satellite Outage: a GPS PRN24 Croatia Case Study. *Pomorstvo: Scientific journal of maritime research.* 26 (1), pg. 165-179.

Kos. S., Pongračić, B. and Brčić, D. (2019). A study on multi-constellation GNSS positioning performance in terms of maritime requirements. *Proceedings of 12th Annual Baška GNSS Conference.* The Royal Institute of Navigation, London & University of Rijeka, Faculty of Maritime Studies. Baška, Croatia, 7-9. 5. 2018. pg. 69-84. Available at: https://www.pfri.uniri.hr/web/hr/zs_baska_rin_gnss.php

Musulin, I., Brčić, D. and Kos, S. (2014). A study of smartphone satellite positioning performance at sea using GPS and GLONASS systems. *Proceedings of the 22nd International Symposium on Electronics in Transport (ISEP)*. Electrotechnical Association of Slovenia & ITS Slovenia, Ljubljana, Slovenija, 24-25. 3. 2014. 7 pg.

Pongračić, B., Brčić, D. and Kos. S. (2018). Spatial assessment of GPS ionospheric delay model during St. Patrick's geomagnetic storm. *Proceedings of 11th Annual Baška GNSS Conference.* The Royal Institute of Navigation, London & University of Rijeka, Faculty of Maritime Studies. Baška, Croatia, 7-9. 5. 2018. pg. 75-91. Available at: https://www.pfri.uniri.hr/web/hr/zs_baska_rin_gnss.php

Pongračić, B., Wu, F., Fathollahi, L. and Brčić, D. (2019). Mid-latitude Klobuchar correction model based on the k-means clustering of ionospheric daily variations. *GPS Solutions.* 23(3). 13 pg. doi: 10.1007/s10291-019-0871-x

Šakan, D., Kos, S., Draščić Ban, B. and Brčić, D. (2021). On linear and Circular Approach to GPS Data Processing: Analyses of the Horizontal Positioning Deviations Based on the Adriatic Region IGS Observables. *Data*. 6 (2), 9. 18 pg. doi: 10.3390/data6020009

Schunk, R. and Nagy, A. (2009). *Ionospheres: Physics, Plasma Physics and Chemistry (2nd ed)*. Cambridge: Cambridge University Press.

Toman, I., Brčić, D. and Kos, S. (2021). Contribution to the Research of the Effects of Etna Volcano Activity on the Features of the Ionospheric Total Electron Content Behaviour. *Remote Sensing*. 13 (5), 1006. 18 pg. doi: 10.3390/rs13051006

Toman, I., Kos. S. and Brčić, D. (2019). On long-term solar activity impact on GPS single-frequency 3D

positioning accuracy in the Adriatic Region. *Proceedings of 12th Annual Baška GNSS Conference.* The Royal Institute of Navigation, London & University of Rijeka, Faculty of Maritime Studies. Baška, Croatia, 7-9. 5. 2018. pg. 27-49. Available at: https://www.pfri.uniri.hr/web/hr/zs_baska_rin_gnss.php

Žic A., Pongračić, B., Kos, S. and Brčić, D. (2020). GPS single frequency positioning errors estimation based on reference station observations in the Adriatic Region. *Pomorski zbornik - Journal of Maritime & Transportation Sciences*. 58 (1). pg. 169-184. doi: 10.18048/2020.58.11

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*
All titles provided under the heading 'Assigned reading' (1.10) are available online.		

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Srđan Žuškin, PhD David Brčić, PhD	
Course title	**Concepts and capabilities of navigation information systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The basic objective of the course is to analyze the concepts and development possibilities of navigation information systems in order to improve navigation safety and protection of the marine environment. The following objective is based on the analysis of system problems and the knowledge of the identified difficulties, problems and systematic anomalies of the navigating bridge information systems. The objective of the course is also the adoption of analytical methods and data processing in order to attain relevant knowledge about integrated electronic information that will enhance voyage monitoring in a coordinated, consistent and systematic way. Critical thinking, possibilities for the development of new integrated maritime information systems and new, additional functions (with the realization of the same) also act as scientific goals/contributions of the course.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Students are expected to be able to:

1. Describe the concept of navigation information systems, interpret the current relevant rules and international regulations;
2. Describe and analyze the peculiarities of modern navigation guidance (e-navigation);
3. Analyze and interpret the presentation of navigation information and the possibility of systematic development;
4. Analyze the differences of information systems and show the advantages and limitations;
5. Analyze and explain system issues and identify difficulties, system anomalies and key limitations;
6. Interpret and explain operational procedures including: collection of navigation and other information, development and verification, execution and monitoring, and voyage optimization;
7. Analyze navigation information systems as a direct or indirect cause of maritime accidents;
8. Analyze and interpret future development possibilities of additional information systems;
9. Describe the software tools and applications of the system and analyze the possibility of developing a user interface (integrated bridge) in the function of optimizing the voyage;
10. Describe and analyze the connection of navigation devices, databases and other standardized and non-standardized information within the integration;
11. Develop a critical opinion based on the above research of maritime accidents and related cases;
12. Develop decision-making processes in various navigation situations when using maritime information systems.

1.4. Course content

- Relevant international maritime regulations and legal framework with mandatory application requirements and relationship with the other navigation information system stakeholders;
- Relevant IHO, IMO and IEC standards related to the maritime information systems;
- Concepts and analysis of the navigation information system architecture and the possibilities of further development;
- Overview of the navigation and non-navigation information;
- Data model analysis according to associated organization standards;
- System issues valorisation and key constraints synthesis with analysis
- Interpretation of sensory data (purpose, features, advantages and limitations);
- Interpretation of vector data (purpose, features, advantages and limitations);
- Analysis of various factors for the system functionality;
- Improper use of a particular system;
- Concepts and creation of new conditions to reduce marine accidents;
- Analysis of integrated system elements (Integrated Navigation System, Integrated Bridge, e-Navigation) – purpose, features, advantages and limitations;
- Analysis of the existing software tools and future development for voyage planning optimisation;
- User interface interpretation and future development for raising navigation safety.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assigment ☐ multimedia and network ☒ laboratories ☒ mentorship ☐ other _____
1.6. Comments	TRANSAS MARINE NAVI TRAINER PROFESSIONAL (NT-Pro 5000) and ECDIS TRANSAS Navi Sailor 4000 are used for research purposes.	

1.7. Student's obligations

The students' obligations, in addition to class attendance, are based on research into possibilities for navigation information system development. Research results are to be presented in the form of a seminar paper and a project assignment.

1.8. Evaluation[19] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio		Project assignment	3				

1.9. Assessment and evaluation of student's work during classes and on final exam

Active class participation with navigation laboratory usage is essential for evaluating the learning outcomes during the course. Learning outcomes are assessed through the research by obtaining relevant results, data analyses and written project work submission. The course grade will be based on the submitted project work.

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

1. Brčić, D. & Žuškin, S. 2019. The ECDIS EHO Report, University of Rijeka, Faculty of Maritime Studies
2. Bole, G. A., Wall, D. A. & Norris, A. 2014. *RADAR and ARPA manual – Radar, AIS and Target Tracking for Marine Radar Users*, 3rd Edition, Butterworth-Heinemann
3. International Maritime Organization (IMO). 2021. Index of IMO Resolutions. IMO, London, UK. Available at: https://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/Pages/Default.aspx

[19] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities

4. International Hydrographic Organisation. 2021. Current IHO ECDIS and ENC Standards. IHO, Monaco. Available at: https://iho.int/mtg_docs/enc/ECDIS-ENC_StdsIn_Force.htm
5. Norris, A. 2008. *Integrated Bridge Systems – RADAR and AIS.* Vol 1. London: The Nautical Institute
6. Norris, A. 2010. ECDIS *and positioning*. London: The Nautical Institute
7. Weintrit, A. 2009. *The Electronic Chart Display and Information System (*ECDIS*): An Operational Handbook*, CRC Press, Taylor & Francis Group, LLC

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

1. Kristić, M., Žuškin, S., Brčić, D, Car, M. 2021. Partial Analysis of ECDIS EHO Research: Port State Control. *International Journal of Maritime Science & Technology "Our Sea"*. 68(2). Pg. 93-101. DOI: 10.17818/NM/2021/2.5
2. Car, M., Brčić, D., Žuškin, S. & Svilicic, B. 2020. The Navigator's Aspect of PNC Before and After the ECDIS Implementation: Facts and Possible Implications Towards Navigation Safety Improvement. *Journal of Marine Science and Engineering*. 8(11), 842. 12 pg. doi: 10.3390/jmse8110842
3. Sviličić, B., Kristić, M., Žuškin, S. & Brčić, D. 2020. Paperless Ship Navigation: Cyber Security Weaknesses. *Journal of Transportation Security*. 12 pg. doi: 10.1007/s12198-020-00222-2
4. Kristić, M., Žuškin, S., Brčić, D. & Valčić, S. 2020. Zone of Confidence Impact on Cross Track Limit Determination in ECDIS Passage Planning. *Journal of Marine Science and Engineering*. 8 (8), 566. 12 pg. doi:10.3390/jmse8080566
5. Škrobonja, A., Valčić, S., Žuškin, S. & Brčić, D. 2020. On VDES/ECDIS Integration. *Pomorstvo – Multidisciplinary Journal of Maritime Research.* 34 (1). pg. 195-200. doi: 10.31217/p.34.1.21
6. Brčić, D., Žuškin, S., Valčić, S. & Rudan, I. 2019. ECDIS transitional period completion: Analyses, observations and findings. *WMU journal of maritime affairs.* 18(2). pg. 359-377. doi: 10.1007/s13437-019-00173-z
7. Sviličić, B., Brčić, D., Žuškin, S. & Kalebić, D. 2019. Raising Awareness on Cyber Security of ECDIS. *TransNav - International Journal on Marine Navigation and Safety of Sea Transportation*13(1). pg. 231-236. doi: 10.12716/1001.13.01.24
8. Brčić, D. & Žuškin, S. 2018. Towards paperless vessels: A Master's perspective. *Pomorski zbornik - Journal of Maritime & Transportation Sciences*. 55 (1). pg. 183-199. doi: 10.18048/2018.00.12
9. Šakan, D., Rudan, I., Žuškin, S. & Brčić, D. 2018. Near real-time S-AIS: Recent developments and implementation possibilities for global maritime stakeholders. *Pomorstvo – Multidisciplinary Journal of Maritime Research.* 32 (2). pg. 211-218. doi: 10.31217/p.32.2.6
10. Žuškin, S., Brčić, D. & Valčić, S. 2017. ECDIS possibilities for Ballast Water Exchange adoption. *TransNav - International Journal on Marine Navigation and Safety of Sea Transportation*. 11(3). pg. 477-482. doi: 10.12716/1001.11.03.13
11. Car, M., Vujičić, S., Žuškin, S. & Brčić, D. 2019. Human Machine Interface: Interaction of OOWs with the ECDIS system. U: Koboević, Ž. (ur) *Proceedings of the 1st International Conference of Maritime Science & Technology – Naše More 2019*. Dubrovnik: University of Dubrovnik, Maritime Department. Dubrovnik, 17-18.10.2019. pg. 74-85.
12. Šakan, D., Žuškin, S., Brčić, D., Valčić, S. 2019. Analysis of Primary Position Validation in ECDIS system. In: Weintrit, A & Neumann, T. (ed) *Advances in Marine Navigation and Safety of Sea Transportation: Proceedings of 13th International Conference on Marine Navigation and Safety of Sea Transportation.* Leiden: CRC Press, Taylor & Francis Group. Gdynia, Poland, 12-14.06.2019. pg. 5-15.
13. Brčić, D., Žuškin, S., Valčić, S. & Frančić, V. 2018. Implementation of the ECDIS system: An OOW perspective as an integral part of educational improvement. *Proceedings of 19th IAMU AGA Conference*. UPC/CIMNE, Barcelona, Spain, 17-19.10.2018. pg. 121-128.
14. Brčić, D., Žuškin, S. & Barić M. 2017. Observations on ECDIS education and training. *Proceedings of 12th International Conference on Marine Navigation and Safety of Sea Transportation*. London: CRC Press, Taylor & Francis Group. Gdynia, Poland, 21-23.06.2017. pg. 29-36.
15. Žuškin, S., Brčić, D. & Kos, S. (2016). Partial structural analysis of the ECDIS EHO research: The safety

contour. *Proceedings of 7th International Conference on Maritime Transport*. Universitat Politecnica de Catalunya, Barcelona. Barcelona, Spain, 27-29. 6. 2016. pg. 246-262.

16. Brčić, D., Kos, S. & Žuškin, S. 2016. *Partial structural analysis of the ECDIS EHO research: The handling part*. Proceedings of the 24nd International Symposium on Electronics in Transport (ISEP). Electrotechnical Association of Slovenia & ITS Slovenia, Ljubljana, Slovenia.
17. Brčić, D., Kos, S. & Žuškin, S. 2015. *Navigation with ECDIS: Choosing the proper secondary positioning source*, International Journal on Marine Navigation and Safety of Sea Transportation. 9(3): 317-326.
18. Kos, S., Pušić, D. & Brčić, D. 2013. *Protection and Risks of ENC Data regarding Safety of Navigation*. Advances in Marine Navigation / Weintrit, Adam (ed.). London : Taylor & Francis Group: 165-170.
19. Kos, S., Valčić, S. & Žuškin, S. 2014. *Updating of ECDIS System in Polar Regions*, Proceedings of 22nd International Symposium on Electronics in Transport, ISEP 2014, Electrotechnical Association of Slovenia & ITS Slovenia, Ljubljana.
20. Kos, S., Žuškin, S. & Valčić, M. 2011. *On-line ECDIS system updating*, Proceedings of the 19th International Symposium on Electronics in Traffic, ISEP 2011, Electrotechnical Association of Slovenia & ITS Slovenia, Ljubljana, Slovenia 2011.
21. Žuškin, S., Brčić, D. & Šabalja, Đ. 2013. *A contribution to improving the standards of ECDIS training*. Scientific Journal of Maritime Research. 27(1): 131-148.
22. Žuškin, S., Valčić, M. & Rudan, I. 2011. *ECDIS System in Function of Sea Environment Protection*. Proceedings: Shaping Climate Friendly Transport in Europe: Key Findings and Future Directions, REACT, University of Belgrade, Belgrade, Serbia.
23. Žuškin, S., Brčić, D. & Kos, S. (2016) *Partial structural analysis of the ECDIS EHO research: The safety contour.* 7th International Conference on Maritime Transport. Universitat Politecnica de Catalunya, Barcelona. Barcelona.
24. Relevant international conventions, legal standards, norms and regulations related to the navigation information systems (international conventions, IMO reolutions, IHO publications, IEC).

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*
Brčić, D. & Žuškin, S. 2019. The ECDIS EHO Report, University of Rijeka, Faculty of Maritime Studies	Available online	1
Bole, G. A., Wall, D. A. & Norris, A. 2014. RADAR and ARPA manual – Radar, AIS and Target Tracking for Marine Radar Users, 3rd Edition, Butterworth-Heinemann	2	1
International Maritime Organization (IMO). 2021. Index of IMO Resolutions. IMO, London, UK. dostupno na: https://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/Pages/Default.aspx	Available online	1
International Hydrographic Organisation. 2021. Current IHO ECDIS and ENC Standards. IHO, Monaco. Dostupno na: https://iho.int/mtg_docs/enc/ECDIS-ENC_StdsIn_Force.htm	Available online	1
Norris, A. 2008. Integrated Bridge Systems Vol 1. – RADAR and AIS. London: The Nautical Institute.	2	1
Norris, A. 2010. Integrated Bridge Systems Vol 1. – ECDIS and positioning. London: The Nautical Institute.	2	1
Weintrit, A. 2009. The Electronic Chart Display and Information System (ECDIS): An Operational Handbook, CRC Press.	2	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Renato Ivče, PhD	
Course title	**Containerization in the function of maritime transport**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The objective of the course is to familiarize the students with the importance of container shipping on a global and regional scale, as well as with forms of container shipping companies association, in order to provide a competitive maritime transport service. Students will also be introduced to the technical and technological characteristics of modern container ships and the conducted research in order to optimize their capacity for improved competitiveness on the shipping market.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Students are expected to be able to:

1. Evaluate the importance of container shipping on a global scale;
2. Evaluate the importance of container shipping on a regional scale;
3. Assess the impact of container shipping companies' association on the valorisation of a competitive maritime transport service;
4. Assess the impact of technical and technological characteristics of modern container ships on competitiveness;
5. Predict the capacity trend of modern container ships.

1.4. Course content

The importance of containerization and its role in the global and regional scale of maritime transport. Forms of container shipping companies' association, systematic review of significant effects of association. Technical and technological features of modern container ships. The trend of the container fleet, defining the criteria and their evaluation with regard to the limitations and set requirements for greater efficiency of maritime transport. Container ship capacity optimization. Analysis and valorisation of the obtained indicators of optimal capacity.

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

Preparation of scientific or professional paper based on the conducted research and individual assignment.

1.8. Evaluation[20] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2.6	Experiment	
Written exam		Oral exam		Essay		Research	3
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Assessment of knowledge and skill of writing a scientific or professional paper in the field of doctoral research is appointed 2 ECTS (35%). Work on a scientific research project and research in the domain of the PhD student's interest is appointed 3 ECTS (50%).

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

1. Cudahy, B. (2006). *Box boats: How Container Ships Changed the World*. New York: Fordham University Press.
2. Ivče, R. (2008). A contribution to the efficiency of container carriage on smaller feeder ships at short sea. Doctoral thesis. Rijeka: University of Rijeka, Faculty of Maritime Studies.
3. Levinson, M. (2006). *The box: how the shipping container made the world smaller and the world economy bigger*. Princeton: Princeton University Press.
4. Maglić, L. (2016). *Optimisation of container relocation problem in port container terminal*. Doctoral thesis. Rijeka: University of Rijeka, Faculty of Maritime Studies.
5. Perason, R. (1988) *Container ship and shipping*. London: Fairplay Publication.
6. Stopford, M. (2000) *Maritime economics, 2nd edition.* London: Rutledge.
7. Žuškin S. (2015). *Optimization of container storage allocation for minimising stowage time*. Doctoral thesis. Rijeka: University of Rijeka, Faculty of Maritime Studies.

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

1. Greve, M., Hansen, M. W., Schaumburg-Muller, H. (2007). *Container Shipping and Economic Development: A Case Study of A.P. Moller*. Copenhagen: Copenhagen business school press.
2. The National Magazine Company. (1995). *Containerisation International*. Michigan: The National Magazine Company.
3. Global Container Terminal Operators. (2012). *Annual Review and Forecast*. London: Drewry Publishing.
4. Kos, S. (2003). Productivity of Full Container Ship and Energy-Economy of its Propulsion Plant. *Promet*, 15 (2).
5. Yap, W. Y. (2009). *Container shipping services and their impact on container port competitiveness*. Antwerp: UPA University Press.
6. Science Direct. (2021). Container Ship. Online: https://www.sciencedirect.com/topics/engineering/container-ship
7. Port Economics, Management and Policy. (2021). Ports and Contained Shipping. Online: https://porteconomicsmanagement.org/pemp/contents/part1/ports-and-container-shipping/
8. Change. (2021). Shipping Alliances: 2M, Ocean Alliance & The Alliance. Online: https://container-xchange.com/blog/shipping-alliances/

[20] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities

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*
Cudahy, B. (2006). *Box boats: How Container Ships Changed the World*. New York: Fordham University Press.	1	3
Ivče, R. (2008). Doprinos učinkovitosti prijevoza kontejnera manjim feeder brodovima u zatvorenim morima. Doktorska disertacija. Rijeka: Sveučilište u Rijeci, Pomorski fakultet.	1	3
Levinson, M. (2006). *The box: how the shipping container made the world smaller and the world economy bigger*. Princeton: Princeton University Press.	Available online	3
Maglić, L. (2016). *Optimizacija raspodjele kontejnera na slagalištu lučkoga kontejnerskog terminala*. Doktorska disertacija. Rijeka: Sveučilište u Rijeci, Pomorski fakultet.	Available online	3
Perason, R. (1988) *Container ship and shipping*. London: Fairplay Publication.	2	3
Stopford, M. (2000) *Maritime economics, 2nd edition.* London: Roatledge.	3	3
Žuškin S. (2015). *Optimizacija rasporeda tereta na kontejnerskim brodovima u funkciji skraćenja prekrcajnog procesa*. Doktorska disertacija. Rijeka: Sveučilište u Rijeci, Pomorski fakultet.	Available online	3

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Robert Mohović, PhD	
Course title	**Maritime safety of the ship**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of the course is to analyze the factors that affect the maritime safety of the ship. It is especially important to critically analyze and define elements important for planning and design of ports and waterways in particular the waterways in confined areas, which affect the maritime safety of the ship. The next goal is reflected in the defining criteria for the design from the standpoint of safety and protection of the marine environment, with special emphasis given to defining a measure of safety. The main objective of the course is the adoption of analytical method for calculation of design parameters as well as the recent methodologies for achieving these goals with the elements of maritime risk management.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Students are expected to be able to:
1. To demonstrate a systematic understanding of the course and mastery of the skills and methods related to maritime safety of the ship;
2. To demonstrate the ability to understand, design, implement and customize research process, thereby contributing to spreading the knowledge of maritime navigational risks which the students confirm by preparing a paper to pubish their research results in renowned journals;
3. Acquire a capacity for critical analysis, evaluation and synthesis of existing and new ideas in the field of maritime safety of the ship;
4. Critically judge and be able to communicate with peers, the scientific community and the broader csocial ommunity in their area of expertise about maritime ship safety;
5. Defend the hypotheses and be able in academic and professional contexts to promote technological, social and cultural progress in the society of knowledge through proposals to improve the maritime safety of the ship beneficial to society as a whole.

1.4. Course content

The definition of maritime safety of the ship and the analysis of influential factors. Comparative analysis of the impact of the types (technologies) of the ship to ship maritime safety. Maritime aspect of the planning and design of ports and waterways in confined areas. Defining criteria for the design and their weighting. Analysis and evaluation methodology in the field of maritime safety of the ship. Development of analytical method for calculation of design parameters. Human factor and analysis of its impact on maritime safety of the ship. Using the methods of risk analysis. Determination of criteria for maritime safety of the ship and research measures

for its improvement with elements of risk management.		
1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☐ exercises ☒ long distance education ☐ fieldwork	☒ individual assignment ☒ multimedia and network ☐ laboratories ☒ mentorship ☒ other simulators_____
1.6. Comments	It is expected that students who enroll in this course are experts from particular areas of navigational safety at sea.	

1.7. Student's obligations

Student obligations, in addition to course attendance, seminar papers and workshops are based on their research of various aspects of maritime safety of the ship in the field of nautical sciences and preparing a paper presenting the obtained research results.

1.8. Evaluation[21] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	3
Project		Continuous assessment		Report		Practical work	
Portfolio		Preparing and writing a paper	2.6				

1.9. Assessment and evaluation of student's work during classes and on final exam

The learning outcomes are assessed and evaluated through the monitoring of student research, the research results, the manner and quality of preparing a paper or presenting the obtained research results.

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

1. Mohović, R., Mohović Đ., Maritimno projektiranje luka i plovnih putova – teaching materials on the website of the Faculty of Maritime Studies, University of Rijeka Faculty of Maritime Studies, 2020.
2. McBride, M., Boll, M., & Briggs, M., Harbour approach channels—Design guidelines. PIANC Report No. 121., 2014.
3. G.P. Tsinker, Marine Structures Engineering, Specialized Applications, Chapman & Hall, ITP An International Thomson Publishing Company, New York, 1995.
4. PIANC Bulletins relating to the field of maritime ship safety, Permanent International Association of Navigation Congresses - PIANC, Brussels - valid editions.

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

1. Mohović, Đ., Mohović R., Upravljanje rizikom u pomorstvu – teaching materials on the website of the Faculty of Maritime Studies, University of Rijeka Faculty of Maritime Studies, 2020.
2. House, D. J., Ship handling: theory and practice, Routledge, 2007.
3. Bertram, V., Practical ship hydrodynamics, Elsevier, 2012.
4. Barić, M., Model određivanja širine ograničenih plovnih putova, University of Rijeka - Faculty of Maritime Studies, Rijeka, 2017.
5. Mohović, R. , Model manevriranja brodom u ograničenim plovnim područjima u funkciji sigurnosti i zaštite morskog okoliša, University of Rijeka Faculty of Maritime Studies, 2002.
6. Delefortrie, G., Geerts, S., & Vantorre, M., The towing tank for manoeuvres in shallow water. In 4th

[21] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities

MASHCON-International Conference on Ship Manoeuvring in Shallow and Confined Water with Special Focus on Ship Bottom Interaction), 2016. (pp. 226-235).
7. Baric, M., Mohovic, R., & Mohovic, D. (2019). Determining Restricted Fairway Additional Width due to Bank Effect for Fine Form Vessels. The Journal of Navigation, 72(6), 1435-1448
8. R.W. Rowe, The Shiphandler's Guide, The Nautical Institute, London, 2000.
9. H. Hensen, Tug Use in Port, A practical guide, The Nautical Institute, London, 1997.
10. Mooring Equipment Guidelines, Oil Companies International Marine Forum, Witherby and Co. Ltd., London, 2018.
11. Squat, Interaction, Manoeuvering, The Nautical Institute, London, 1995.
12. P. Bruun, Port Engineering, Harbour Planning, Breakwaters and Marine Terminals, Volume 1 i 2, Gulf Publishing Company,Houston, 1989.
13. P. Bruun, Mooring and Fendering Rational Principles in Design, The International Harbour Congress, Antwerp,1983.
14. H. Agerschou i dr., Planning and Design of Ports and Marine Terminals,John Wiley&Sons,Chichester, 1985.
15. M. Chernjawski, Mooring of Surface Vessels to Piers, Marine Technology, Vol. 17. No.1., 1980., str.1.-7.
16. I.W. Dand - P.R. Lyon, The Element of Risk in Approach Channel Design, International Conference on Maritime Technology, Challenges in Safety and Environmental Protection, Singapore, 1993.
17. I. Petković, Prikaz numeričkih vrijednosti krivulja brzina i specifičnih pritisaka vjetra iznad mora na bok broda u novim mjernim jedinicama, Simpozij «Teorija i praksa brodogradnje», Split, pg. 4.193 – 4.203.
18. T. Tabain, Standard Wind Wave Spectrum for the Adriatic Sea Revisited (1997 – 1997), Brodogradnja, 45, 1997, str. 303.– 313.
19. Underkeel Clearance for Large Ships in Maritime Fairways with Hard Bottom, Report of a Working Group of the Permanent Technical Committee II, Supplement to Bulletin No. 51, Permanent International Association of Navigation Congresses - PIANC, Brussels, 1985.
20. M. McBride, Safety assessment for ships manoeuvring in ports, The Dock & Harbour Authority, Vol. 79., No. 889, 890, 891,892.

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*
Mohović, R., Mohović Đ., Maritimno projektiranje luka i plovnih putova – teaching materials on the website of the Faculty of Maritime Studies, University of Rijeka Faculty of Maritime Studies, 2020.	unlimited	2
McBride, M., Boll, M., & Briggs, M., Harbour approach channels—Design guidelines. PIANC Report No. 121., 2014.	unlimited	2
G.P. Tsinker, Marine Structures Engineering, Specialized Applications, Chapman & Hall, ITP An International Thomson Publishing Company, New York, 1995.	unlimited	2
Objave PIANC Bulletin koje se odnose na područje maritine sigurnosti broda, Permanent International Association of Navigation Congresses - PIANC, Brussels.	unlimited	2

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Vlado Frančić, PhD	
Course title	**International maritime safety and environment protection systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The main objective of the course is to familiarize students with the organization, legal framework, principles, and activities of entities, and how they operate at the international level aiming to improve the safety of navigation and environmental protection. More specifically, students will be familiar with:

- the organization and organizational structure of the International Maritime Organization (IMO), the way of working and the way of adopting internationally acceptable regulations, and the relationship with other international organizations,
- the organization of the European Maritime Safety Agency (EMSA), the way of working and executing activities, as well as defining the scope of work.
- Methodological procedures used to ensure technological consistency or to assess the adequacy of implemented regulations in the field of maritime safety and environmental protection at the international level,
- Possibilities of application of procedures at the regional or national level, i.e. in the field of safety and environmental protection.

Finally, students will be introduced to the current state of development of maritime safety and environmental protection system in the EU and in the Adriatic Sea, with a breakdown of the possibilities for further improvement.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

It is expected that, after passing the exam, PhD students will be able to:

1. Explain the role and activities of the International Maritime Organization in improving the safety of navigation and the protection of the marine environment,
2. Describe the features, specifics and the role of the European Maritime Safety Agency as well as evaluate its efficiency in improving maritime safety,
3. Explain the implementation of international regulations in the domain of safety of navigation within the framework of national maritime administrations,
4. Present and assess the role and importance of recognized organizations in the development of the safety of navigation and the protection of the marine environment
5. Critically asses the way in which ship inspections are carried out in order to improve safety of navigation.

1.4. Course content

– International Maritime Organization - Organization, Legal Basis, Proposing and Decision Making, Obligation to Implement, Relationship with Other Subjects of International Maritime Affairs,

- The European Maritime Safety Agency - organization, the scope of work and activities aimed at improving the safety of navigation and the protection of the marine environment,
- the procedure for adopting regulations in the area of maritime safety and pollution protection,
- Hazard Identification, Risk Assessment, Analysis of Management Options, Cost and Benefit Estimation, Decision Making
- application of other related methods of risk assessment and their application in drafting regulations and their application (FTA, ETA, HAZOP, etc.)
- the application of international regulations in the field of safety and their implementation in national maritime legislation, the obligations of states and their maritime administrations,
- the role of Recognized Organizations in maintaining targeted marine safety standards and their relationship with maritime administrations,
- inspection system as a means of maintenance, improvement, and harmonization of established safety standards.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☐ exercises ☒ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other _____
1.6. Comments	Teaching is performed through consultations and online, as necessary.	

1.7. Student's obligations

Active participation in the teaching process and independent research work.

1.8. Evaluation[22] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	5.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

- Application of research work, presentation of independent work.
- Solving Problem Tasks.
- Checking the acquisition of knowledge.

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

1) SOLAS 1974 Convention, as amended.
2) IMO conventions, as amended
3) Resolutions, circular letters and various IMO recommendations

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

1. Maritime Governance and Control - Rights and Obligations of States in Maritime Safety, Security and Environmental Protection, Jorgen Rasmussen, WMU 2016.
2. MARITIME TRANSPORTATION AND OCEAN POLICIES, Nov 17, 2020 Publisher: World Maritime University
3. Instruments relevant to port State control 2021, 2022 Edition.
4. Analysis of the implementation of the International Safety Management Code using motivation theory: the seafarer's views Tem Suzie-Solange Mbong, Despena Andrioti Bygvraa, International Maritime Health, DOI:10.5603/IMH.2021.0033, 2021

[22] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities

5. IMO Member States Audit Scheme, 2015 Edition.
6. Formal Safety Assessment in Maritime Industry - Explanation to IMO Guidelines, 2013.
7. Maritime human factors and IMO policy, Jens-Uwe Schröder-Hinrichs ,Erik Hollnagel,Michael, Baldauf,Sarah Hofmann &Aditi Kataria, Pages 243-260 | Published online: 17 May 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*
all titles	available online	

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

Basic description		
Course coordinator	*Professor emeritus* Damir Zec, PhD	
Course title	**Modelling and analysis of maritime traffic flow**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The main goal is to introduce the students to the purpose, ways, limitations and possibilities in describing and exploring sea-traffic flows as a prerequisite for increasing the safety of navigation and its optimization. In addition, PhD students will be introduced to using discrete simulation models in describing sea-traffic flows.
More specifically, the students will be familiar with:
- theory of maritime traffic flows,
- the characteristics of maritime traffic flows in different traffic conditions, in unlimited and limited waterways,
- ways of collecting, processing and evaluating data describing traffic flows to quantify navigation safety,
- discrete simulation models with application in analysis and definition of maritime traffic,
- ways of exploiting and applying the results of simulation modelling maritime traffic flows in order to optimize maritime traffic and increase the safety of navigation and environmental protection.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

It is expected that after passing the exam PhD students are able to:
1. Explain the concept of maritime-traffic flow,
2. Describe the characteristics and specifics of the maritime organization,
3. Explain the criteria for maritime traffic optimization from the standpoint of navigation safety,
4. Apply a discrete simulation model in the examination of the characteristics of the maritime-traffic flow,
5. Outline the maritime-traffic flow model in relation to the different navigable areas and characteristics of selected vessels.

1.4. Course content

Traffic flows:
- definition, types, characteristics from the point of view of maritime safety and pollution protection,
- a description of the structure of maritime traffic flows,
- optimization of maritime traffic from the point of view of safety of navigation,
- dynamic characteristics of ships, manoeuvring, mutual influence, domain theory, impact on maritime traffic,

The basics of discrete simulation models:
- basic features, programme conditions, advantages and disadvantages in relation to other continuous and quasi-continuous simulation models, display and verification of stochastic processes; mixed approaches;
- familiarization with the appropriate programme package,

Discrete simulation models of maritime traffic:

- Goals, scope of application, features,
- Modelling and testing the characteristics of maritime traffic flows,
- Determining the characteristics of ships and determining dynamic parameters,
- Modelling of the traffic flow in relation to restricted waters,
- Verification of the maritime-traffic flow model.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☐ exercises ☒ long distance education ☐ fieldwork	☒ individual assigment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other _____
1.6. Comments	If necessary, the lessons can be consultative or performed as long-distance education.	

1.7. Student's obligations

Active participation in the teaching process and independent research work.

1.8. Evaluation[23] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	5.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

- Application of research work, presentation of independent work.
- Solving problem tasks.
- Checking the integrity of the adopted knowledge.

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

1.Ortuzar, J. D., Willumsen, L. G., Modelling Transport, 4th ed., West Sussex, John Wiley and Sons, 2011.
2.Law, A. Kelton, W., Simulation Modelling and Analysis, McGraw Hill, 2000.

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

1.Karayanakis, N. M, Advanced System Modelling and Simulation with Block Diagram Languages, CRC 1995.
2.Woolfson, M. M, Pert , G. J, An Introduction to Computer Simulation, Oxford University Press, 1999
3.Harrell, R, Simulation Using Promodel, McGraw-Hill Science/Engineering/Math; 2000.
4.Henscher, D. A., Kenneth J. B., Handbook of Transport Modelling, Oxford, Pergamon, 2000.
5.Bucklew J. A. Introduction to Rare Event Simulation, Springer, 2004.
6.Drew, J, Traffic Flow Theory and Control, McGraw Hill,1968.
7.Leutzbach, W, Introduction to the Theory of Traffic Flow, Springer, 1988.

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*
All titles	1	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[23] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities

Basic description		
Course coordinator	Mirano Hess, PhD	
Course title	**Sea shipping optimization**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

To enable students to understand the correlation of key technological-market influences in the maritime market, including segments of freight, shipbuilding, second-hand ships and ships for demolition, and to instruct them in the process of researching the optimization of shipping business and setting a fleet management strategy.

1.2. Course enrolment requirements

/

1.3. Expected course learning outcomes

1. Explain the movement, and identify the elements and evaluate the organization of the maritime market
2. Analyze and compare cycles, and judge future movements of the maritime market
3. Identify, review and evaluate the correlation of maritime market segments
4. Collect, evaluate and select data in the process of determining market-technological parameters and ship valuation
5. Assess and test influential parameters and optimize the ship / fleet / shipowner's business regime
6. Design, compare and review, and select the optimal shipping business regime

Create and critically evaluate the process of making key business decisions of shipowners in the field of fleet management

1.4. Course content

1. Future movements of the maritime market
   - analysis of factors influencing the movement of the maritime market
   - maritime market oscillations and equilibrium
   - correlation of the dynamics of maritime market and economic indices
2. Forecasting maritime trade trends
   - world trade and its cycles, correlation of trade and GDP index
   - world maritime trade and its future
3. Freight segment and segmentation of the merchant fleet of ships
   - analysis of freight cycles and hire of ship space
   - world fleet - segmentation, development and future
   - shipping cycles, comparison with freight and economic cycles
4. Segments of new ships, second-hand ships and ships for demolition

- World shipbuilding, cycles, competition, development and forecasting
- correlation of the cycle of segments of second-hand ships and ships for demolition with the cycles of other segments of the maritime market
- fleet heterogeneity, share and value of orders

5. Optimization processes
   - data collection, evaluation and selection
   - determination of market and technological parameters, and valuation of the ship
   - analysis of parameters and optimization of the ship / fleet / shipowner business regime
   - comparison of business regimes and evaluation of results
   - selection of the optimal ship charter regime, optimal route and selection of the most profitable cargo in transport
   - correlation of costs and earnings of shipowners

methodology of key business decisions of shipowners and fleet management at the expert level

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

Research aimed at presenting the results in the form of scientific work.

1.8. Evaluation[24] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	5.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Demonstration of understanding the items listed in the course content through discussion with the student. Assessment of the quality of the scientific research, and assessment of the value of the obtained results from the theoretical and practical aspect.

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

1. Shipbroking and Chartering Practice, Informa Law form Routledge, Oxon, 2024
2. Ship Operations and Management, Institute of Chartered Shipbrokers, London, 2022
3. Ship Sale & Purchase, Institute of Chartered Shipbrokers, London, 2022
4. Wilford, Michael and Coghlin, Terence and Kimball, J D, Time Charters, Informa, London, 2023
5. Cooke, J and Taylor, A and Young, T and Kimball, J D, Voyage Charters, Informa, London, 2023
6. Kavussanos, M.G., Tsouknidis, D.A., Visvikis, I.D., Freight Derivatives and Risk Management in Shipping, Routledge, London, 2021

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

[24] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities

1. Collins, N., The Essential Guide to Chartering and the Dry Freight Market, Clarkson Research Studies, 2022
2. Tanker Chartering, Institute of Chartered Shipbrokers, London, 2021
3. Dry Cargo Chartering, Institute of Chartered Shipbrokers, London, 2023
4. Shipping Business, Institute of Chartered Shipbrokers, London, 2023
5. Formisano, R.A., Managers Guide to Strategy, McGraw-Hill, London, 2019
6. Dykstra D., Commercial Management in Shipping, The Nautical Institute, London, 2023
7. Bacal, R., Manager's Guide to Performance Reviews, McGraw-Hill, London, 2018
8. Geman, H., Risk Management in Commodity Markets: From Shipping to Agriculturals and Energy, Wiley, New York, 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*
Shipbroking and Chartering Practice, Informa Law form Routledge, Oxon, 2019	Web	1
Ship Operations and Management, Institute of Chartered Shipbrokers, London, 2022	Web	1
Ship Sale & Purchase, Institute of Chartered Shipbrokers, London, 2022	Web	1
Wilford, Michael and Coghlin, Terence and Kimball, J D, Time Charters, Informa, London, 2023	Web	1
Cooke, J and Taylor, A and Young, T and Kimball, J D, Voyage Charters, Informa, London, 2023	Web	1
Kavussanos, M.G., Tsouknidis, D.A., Visvikis, I.D., Freight Derivatives and Risk Management in Shipping, Routledge, London, 2021	Web	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Đani Mohović, PhD	
Course title	**Assessment and management of maritime navigational risks**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of the course is to provide students with structured training in matters of maritime navigational risk so they gain sufficient scientific background to be engaged in research work. Students become familiar with current research on risks in shipping as well as international and national regulations relating to the risks in shipping. Through the presentation of existing models of maritime traffic, the students will be able to develop the ability to critically evaluate research of others. By being introduced to existing methods of risk assessment students will become competent in conducting research using scientific methodology. Finally, students will be given the opportunity to conduct research on a specific problem and to determine the acceptable maritime navigational risks, and students should work in an interdisciplinary manner to achieve this goal.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Upon completion of the course students will be able to:
1. To demonstrate a systematic understanding of the field of course and mastery of the skills and methods related to marine navigation risks.
2. To demonstrate the ability to understand, design, implement and customize serious research process, thereby contributing to the dissemination of knowledge on maritime navigational risks which students confirm by preparing and writing a paper presenting the obtained research results.
3. Gain the ability to critically analyze, evaluate and synthesize existing and new ideas on marine navigational risks.
4. Communicate with peers, the scientific community and the broader social community in their area of expertise.
5. Promote technological, social and cultural progress of knowledge through proposals for maritime navigational risk reductions as benefits to the whole society.

1.4. Course content

General information on risks in shipping. The application of the theory of risk in the maritime industry. Rating previous research risks in shipping. Legal foundations of risk assessment (IMO, EU, the Republic of Croatia). Defining maritime risk. Distribution of maritime accidents. Analysis of accident statistics. Presentation and evaluation of current methods of risk assessment. Analysis of the maritime transport model. Modelling of maritime navigational accidents. The probability of maritime navigational accidents. The methodology for determining the consequences of maritime navigational accidents. The methodology for determining the acceptability of maritime navigational risks. Risk management measures in the maritime industry. Long-term monitoring of risk level. Application of the theory of risk in order to enhance safety of maritime navigation.

1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☐ exercises ☐ long distance education ☒ fieldwork	☒ individual assignment ☒ multimedia and network ☐ laboratories ☒ mentorship ☒ other simulators
1.6. Comments	It is expected that students who enrol in this course are experts from particular areas of navigational safety at sea.	

1.7. Student's obligations

In addition to attending class, seminars and workshops, the students's duties include researching the maritime navigational risks in the field of nautical science, preparing and writing a paper presenting the obatained research results.

1.8. Evaluation[25] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam	1	Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio		Preparing and writing a paper	2				

1.9. Assessment and evaluation of student's work during classes and on final exam

The learning outcomes are reviewed and assessed through monitoring student research, research results, preparing and writing a paper presenting the obtained research results.

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

1. "Managing risk in shipping" - The Nautical Institute, London, 1999.
2. "Safety Management and Risk Analysis" – Svein Kristiansen, Butterworth-Heinemann, 2005.

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

1. Risk and reliability in marine technology - COMETT Programme, Wegemt, 1993.
2. Kemshall, H., Pritchard, J, Good practice in risk assessment and risk management 1, Jessica Kingsley, 1996.
3. Acceptable risk- Baruch Fischoff, Cambridge, Cambridge University Press, 1981.
4. Procjena opasnosti za opasne tvari - Janeš V., Čavrak B., ZIRS, Intergrafika, Zagreb 1999.
5. Risk analysis and its applications - David B. Hertz and Howard Thomas, Chichester: Wiley, 1983.
6. Quantitative risk analysis: a guide to Monte Carlo simulation modeling – Vose, D., Wiley, 1996.
7. Chicken, J. C., Hayns, M. T., The risk ranking technique in decision making, Oxford: Pergamon Press, 1989.
8. Reliability, maintainability and risk - Smith J. David, 2001.
9. Offshore Risk Assessment - Vinnem J. Erik, Trondheim, Kluwer Academic Publisher, 1999.
10. Risk and reliability in marine technology - COMETT Programme, Wegemt, 1993.
11. Metode procjene i upravljanja rizikom u procesnoj industriji, Enconet International, Zagreb, 1999.

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*
"Managing risk in shipping"	1	2
"Safety Management and Risk Analysis"	1	2

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[25] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities

General information		
Course coordinator	Robert Mohović, PhD Mate Barić, PhD	
Course title	**Simulation planning and modelling of ship manoeuvring**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The course objective is to analyse and investigate the impact of internal and external factors using ship simulation models. Also, the aims are to analyse the effect of ship form coefficients on external forces and moments which act on ship movement, and to improve methods for assessing safety of navigation by comparing empirical expressions with simulated data.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

It is expected that after passing the exam PhD students are able to:
- Classification of all important factors which affect ship movement;
- Identification of the parameters which act on ship trajectory, correct application of defined simulation settings;
- Recognising model limitations and simulations set-up;
- Critical evaluation of data collected from simulations;
- Simulated data evaluation and comparison with similar research.

1.4. Course content

Identification and definition of forces and moments which act on a ship. Representation of ship movement using simulation modelling and data interpretation. Calculation analysis using specific model adjustments. Model modification in order to adjust influence of external forces and moments. Correct simulation adjustment and recognising simulation modelling limitations. Comparison of gathered data with empirical expressions and towing tank experiments. Application of gathered data in determining the level of safety of navigation and risk assessment.

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

Participation in workshops and seminars on simulators that enable the completion of individual assignments. Individual assignment includes the application of simulation modelling in research on the safety of navigation

levels and preparation of data for publication.

1.8. Evaluation[26] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	3
Project	2.6	Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Assessment is conducted through evaluation of a project in the area of ship manoeuvring. The project includes research problem definition, previous research analysis, preparation and conducting the research of the defined problem, data analysis and interpretation of results, presenting the conclusions and finally preparation for publication.

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

House, D. J. (2007). Ship handling: theory and practice. Routledge.
Bertram, V. (2012). Practical ship hydrodynamics. Elsevier.
McBride, M., Boll, M., & Briggs, M. (2014). Harbour approach channels—Design guidelines.

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

Wilson, P. A., Squire, M. A., & Seakins, A. P. (1990). Enhanced Preliminary Design Ship Manoeuvring Simulator Techniques.
Quy, N. M. et al. (2020). Towards generalized ship's manoeuvre models based on real time simulation results in port approach areas. *Ocean Engineering*, *209*, 107476.
Olba, X. B., Daamen, W., Vellinga, T., & Hoogendoorn, S. P. (2018). State-of-the-art of port simulation models for risk and capacity assessment based on the vessel navigational behaviour through the nautical infrastructure. *Journal of Traffic and Transportation Engineering (English Edition)*, *5*(5), 335-347.
Barić, M. (2017). *Model određivanja širine ograničenih plovnih putova* (Doctoral dissertation, University of Rijeka. Faculty of Maritime Studies, Rijeka.).
Mohović, R. (2002). Model manevriranja brodom u ograničenim plovnim područjima u funkciji sigurnosti i zaštite morskog okoliša.
Delefortrie, G., Geerts, S., & Vantorre, M. (2016). The towing tank for manoeuvres in shallow water. In *4th MASHCON-International Conference on Ship Manoeuvring in Shallow and Confined Water with Special Focus on Ship Bottom Interaction* (pp. 226-235).
Baric, M., Mohovic, R., & Mohovic, D. (2019). Determining Restricted Fairway Additional Width due to Bank Effect for Fine Form Vessels. *The Journal of Navigation*, *72*(6), 1435-1448

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*
House, D. J. (2007). Ship handling: theory and practice. Routledge.	1	1
Bertram, V. (2012). Practical ship hydrodynamics. Elsevier.	1	1
McBride, M., Boll, M., & Briggs, M. (2014). Harbour approach channels—Design guidelines. PIANC Report No. 121.	1	1
Other relevant literature	Online	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[26] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities

University of Rijeka
FACULTY OF MARITIME STUDIES

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MARINE POWER AND ENGINEERING SYSTEMS

Basic description		
Course coordinator	Radoslav Radonja, PhD	
Course title	**Alternative fuels and emissions of harmful substances from marine energy systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Knowledge and understanding of the systematic approach to emission of harmful substances from marine energy systems (causes of their occurrence and consequences for the environment), legal regulations, available technological and technical solutions for emission reductions, current tendencies, alternative fuels, and possible limitations in their application.

1.2. Course enrolment requirements

Graduate studies in "Marine Engineering and Maritime Transport Technology" completed.

1.3. Expected course learning outcomes

It is expected that after passing the exam PhD students are able to:
- Interpret global trends and possibilities of using alternative fuels in shipping;
- Explain the emission criteria for harmful substances of the ship's energy systems and interpret international regulations in that context;
- Compare and differentiate the eligibility criteria for the energy systems of the ship by: energy, safety, ecological and economic efficiency;
- Structure and characterize emissions of harmful substances when applying classical and alternative fuels;
- Determine and evaluate development strategies for energy systems with regard to emissions of harmful substances;
- Plan and form models for electing the ship's energy system with regard to eligibility criteria;
- Set up and verify the scientific hypothesis and present research results in the form of a scientific article.

1.4. Course content

Course content:
- world trends in the application of alternative fuels and new concepts of ship's energy systems;
- definition of alternative fuels and criteria for emission of harmful substances from energy systems on board;
- defining criteria for the eligibility of energy systems for energy, safety and environmental protection;
- selection of criteria and characteristics of the ship's energy system when using alternative fuels and permitted emissions of pollutants;
- achieving safety, profitability, ecological acceptability, exploitation manageability and ship's readiness for different alternative fuels and energy systems;
- the emission of harmful substances from the ship's energy systems when using conventional and alternative fuels;
- measures and procedures for reducing emissions of harmful substances when applying classical and

alternative fuels;
- forming a model for selection of the ship's energy system with regard to the suitability criteria.

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

Students are expected to master the subject content, carry out research and seminar paper on a given topic from the course content (presentation of research results in the form of scientific articles).

1.8. Evaluation[27] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1.6	Experiment	
Written exam		Oral exam	1	Essay		Research	3
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Knowledge of terminology and facts: 20% (What are harmful emissions? What are alternative fuels? What are the tendencies? ...)
Independence in research and processing of data and information from various sources: 20% (Reference data sources?)
Ability to set criteria and critical selection: 40% (The analysis of research content through oral exam?)
Ability to present results and make an appropriate conclusion: 20% (Synthesis of research results?)

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

1. Tireli, E., Goriva i njihova primjena na brodu, Faculty of Maritime Studies in Rijeka, 2005.
2. Peyton, K., Fuel field manual-success and solutions to performance problems, McGraw-Hill, New York, 1997.
3. Van Erp, Richman, M.H., Technical Challenges Associated with the Development of Advanced Combustion Systems, paper 3 in RTO-MP-14, New York, 1999.
4. Kuiken, K. Diesel Engines I and II, target Global Training, Onnen, 2008.

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

1. MARPOL 73/78, consolidated edition 2013.
2. Revised MARPOL annex VI, NOx Technical Code 2008, IMO, London 2009
3. Eyring, V., Corbett, J.J., Lee, D.S., Winebrake, J.J., Brief summary of the impact of ship emissions on atmospheric composition, climate, and human health, Document submitted to the Health and Environment sub-group of the International Maritime Organization on 6 November 2007.
4. EMEP/EEA, Trozzi, C. and De Lauretis, Air pollutant emission inventory guidebook 2009 - Technical guidance to prepare national emission inventories; EEA Technical Report No. 9/2009, Copenhagen, updated 2011.
5. Radonja, R., Bebić, D., Glujić, D., Methanol and Ethanol as Alternative Fuels for Shipping, Promet - Traffic & Transportaion, Vol. 31, No. 3 (2019),pg. 321-327.

[27] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities

6. Vorkapić, A., Radonja, R., Zec, D., Cost Efficiency of Ballast Water Treatment Systems Based on Ultraviolet Irradiation and Electrochlorination, Promet - Traffic & Transportaion, Vol. 30/3 (2018), pg. 343-348
7. Pelić, V., Mrakovčić, T., Radonja, R., Valčić, M., Analysis of the Impact of Split Injection on Fuel Consumption and NOx Emissions of Marine Medium-Speed Diesel Engine, Journal of Marine Science and Engineering, 2020, 8, 820; doi:10.3390/jmse8100820
8. Radonja, R., Pelić, V., Pavić, D., Glujić, D., Methodological approach on optimizing the speed of navigation to reduce fuel consumption and increase energy efficiencyof the cruising ship, Pomorstvo – Scientific Journal of Maritime Research, Vol. 33/2 (2019), pg. 222-231
9. Vorkapić, A., Radonja, R.; Babić, K., Martinčić-Ipšić, S., Machine learning methods in monitoring operating behavior of marine two-stroke diesel engine // Transport, 35 (2020), 5; 474-485 doi:10.3846/transport.2020.14038
10. Radonja, R., Ivče, R., Zekić, A., Catela, L., Emission Inventory of Marine Traffic for the Port of Rijeka , Pomorstvo – Scientific journal of maritime research, 34 (2020), 2; 387-395 doi:10.31217/p.34.2.19
11. Radonja, R., Pelić, V., Pavić, D., Tomac, N., Cost efficiency of optimizing automatic temperature control parameters in a diesel engine cooling system on a cruising vessel – a case study, Journal of Applied Engineering Science, Vol.18/2 (2020), str. 251-256

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*
All references online available in electronic form.		

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Goran Vukelić, PhD Darko Pastorčić, PhD	
Course title	The structural integrity of marine structures	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Adoption of theoretical knowledge and developing practical skills necessary for solving problems of numerical construction modelling, strength analysis, dimensioning and experimental fracture and fatigue analysis of marine structures.

1.2. Course enrolment requirements

Previous knowledge of basic strength of materials.

1.3. Expected course learning outcomes

After passing the exam, the student will be able to:

1. Analyse the distribution of stress and strain of structures made of materials that exhibit linear or nonlinear material behaviour.
2. Analyse the distribution of stress and strain of linear, planar and axially symmetric engineering problems.
3. Assess the service life of a structure.
4. Analyse the causes of mechanical damage and failure.
5. Critically interpret the results of the performed analysis.

1.4. Course content

Introduction. Stress theories. Strain theories. Stress and strain dependence. Numerical solving of elasticity problems. Elasticity and plasticity theories. Fracture mechanics fundamentals: crack occurrence and propagation, linear elastic and elastic-plastic fracture mechanics. Fracture initiated by stress corrosion, high-cycle and low-cycle fatigue, and thermally induced stress. Experimental and numerical fracture analysis. Examples of construction strength 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

Attending the lectures, solving the assigned problem and presenting the solution.

1.8. Evaluation[28] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experiment	1
Written exam		Oral exam		Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Assessment and evaluation of student's work is done by the presentation of individually solved assigned tasks at the final exam, where 100% of learning outcomes are evaluated.
Examples of assessing the learning outcomes:

1. By using numerical methods, determine the stress and strain of structures made of materials that exhibit linear or nonlinear material behaviour.
2. By using numerical methods, determine the stress and strain of linear, planar and axially symmetric engineering problems.
3. By using numerical methods, assess the service life of a given structure.
4. By using experimental and numerical methods, analyse the causes of mechanical damage and failure.
5. Interpret analysis results.

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

J. Brnić: Analysis of Engineering Structures and Material Behavior, Wiley&Sons, Chichester, 2018.
L.S. Etube: Fatigue and Fracture of Offshore Structures, Wiley&Sons, New Jersey, USA, 2001.

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

B. Mihaljec, G. Vukelić, Ž. Božić, R. Bakhtiari: Pressure vessel failure analysis and numerical optimization of a composite repair patch with experimental validation, International Journal of Pressure Vessels and Piping, 2025
D. Pastorčić, G. Vukelić, J. Parunov, Ž. Božić: Fatigue life estimation of corroded welded steel joint using probabilistic approach, International Journal of Fatigue, 2024
G. Vukelić, G. Vizentin, Š. Ivošević: Tensile strength behaviour of steel plates with corrosion-induced geometrical deteriorations, Ships and Offshore Structures, 2022
G. Vizentin, G. Vukelić: Marine environment-induced failure of FRP composites used in maritime transport Engineering Failure Analysis, 2022

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*
Analysis of Engineering Structures and Material Behavior	1	1
Fatigue and Fracture of Offshore Structures	1	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[28] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities

General information		
Course coordinator	Anton Turk, PhD	
Course title	**Dynamic effects on ship stability**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Familiarization with problem areas of ship stability in intact and damaged condition, with a focus on the dynamic effects on stability. Mathematical formulation of problems related to the stability of floating objects and their solution using appropriate methods and software. Fundamental knowledge related to the specifics of dynamic effects and the definition and / or implementation of specific technical requirements.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

It is expected that after passing the exam PhD students are able to:
Formulate the problem related to dynamic loading of vessels and the impact on the stability of the ship. Analyse possibilities of application of numerical methods to the corresponding example, compare and select a numerical method. Investigate the possibility of solving the problem by applying the existing software and / or write their own program. Investigate and analyse the given project assignment related to specific case of stability of ship.

1.4. Course content

The motion stability. Structure interaction with the waves. Parametric rolling. The effects of bifurcation. Broaching effects. Excessive acceleration. Pure loss of stability. Dead ship stability. Control systems. Criteria. The impact of the application of classification rules. Numerical methods. Time domain calculation.

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

The students are required to attend the classes (consultations), complete a project assignment, prepare and present a seminar paper.

1.8. Evaluation[29] of student's work

Course attendance	0.2	Activity/Participation	0.2	Seminar paper	2.6	Experiment	
Written exam		Oral exam		Essay		Research	3
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Assessment and evaluation of students' work is based on the results they achieve during their research project and the seminar work.

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

Vassalos D , Hamamoto M., Molyneux D., Papanikolaou A.: Contemporary Ideas on Ship Stability, Elsevier Science 2000
Clayton B. R., Bishop R.E.D.:(Mechanics of Marine Vehicles, Gulf Publishing Company, 1982
Faltinsen, O. M.: Sea Loads on Ships and Offshore Structures, University Press, Cambridge, 1998.

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

Jensen, J. J.: Load and Global Response of Ships, Elsevier Ocean Eng. Book Series, Oxford, 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*
Vassalos D , Hamamoto M., Molyneux D., Papanikolaou A.: Contemporary Ideas on Ship Stability, Elsevier Science 2000.	1	1
Clayton B. R., Bishop R.E.D.:(Mechanics of Marine Vehicles, Gulf Publishing Company, 1982	1	1
Faltinsen, O. M.: Sea Loads on Ships and Offshore Structures, University Press, Cambridge, 1998.	1	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[29] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities

General information		
Course coordinator	Tomislav Senčić, PhD Dean Bernečić, PhD	
Course title	**Selected chapters on marine diesel engines**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Introduce students to the problems of injection and combustion in marine diesel engines, analyze existing fuel injection systems, as well as problems and difficulties associated with them. Furthermore, the aim is to present the functionalities of the engine simulator as well as other computer models for injection and combustion simulation. Select or create an appropriate mathematical model for solving the identified problems and difficulties and suggest improvements to the existing systems.

1.2. Course enrolment requirements

Completed undergraduate and graduate study of marine engineering at the Faculty of Maritime Studies or module Naval Engineering or Process and Energy Mechanical Engineering at the graduate study of mechanical engineering at the Faculty of Engineering. Professional experience as engine officer and / or engine factory work and / or marine engines maintenance work desirable.

1.3. Expected course learning outcomes

After passing the exam, it is expected that the students will be able to:
1. Analyze the issue of fuel injection and combustion in large bore marine diesel engines;
2. Create and evaluate the development possibilities of individual injection systems;
3. Develop critical thinking based on previous system analysis;
4. Properly select or create a simulation model;
5. Develop self-awareness and the importance of proper analysis and interpretation of simulation results.

1.4. Course content

- Injection and combustion theory,
- Chemical properties of the fuel important for engine processes,
- Modern injection systems and exhaust valve opening and closing control systems,
- Simulation and research possibilities of ship engine plant models of Kongsberg's K-Sim simulator,
- Different categories of process models in the engine: 0D, QD and 3D models,
- Modeling the formation of harmful products.

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

1.6. Comments	The ship engineering simulator is located at the Faculty of Maritime Studies in Rijeka - Kongsberg K-Sim with six (6) different models of engine rooms on LNG, LPG, Oil Tankers and Container ships.

1.7. Student's obligations

Class attendance (consultations), study of literature, research of problems and completing project tasks according to lecturer's instructions.

1.8. Evaluation[30] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1	Experiment	
Written exam		Oral exam		Essay		Research	1
Project		Continuous assessment		Report		Practical work	
Portfolio		Project asignement	3.6				

1.9. Assessment and evaluation of student's work during classes and on final exam

Active participation in classes using laboratory equipment. Learning outcomes are assessed by monitoring the results of doctoral research, obtaining relevant results, writing a seminar paper or creating a simulation model through the project task.
Examples:
1. Model the operation of one combustion cycl; change the commencement of injection and interpret the results.
2. Calculate the indicated power from the actual indicated diagrams and analyze the problems.

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

1. Heywood, J.B.: Internal Combustion Engine Fundamentals, McGrow Hill Book Co., New York, 1988.
2. Stiesch, G.; Modeling Engine Spray and Combustion Processes, Springer, Berlin, 2003.

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

1. Baumgarten, C.: Mixture Formation in Internal Combustion Engines, Springer, Berlin, Heidelberg, 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*
1. Heywood, J.B.: Internal Combustion Engine Fundamentals, McGrow Hill Book Co., New York, 1988	2	1-10
2. Stiesch, G.; Modeling Engine Spray and Combustion Processes, Springer, Berlin, 2003.	2	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[30] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities

General information		
Course coordinator	Predrag Kralj, PhD	
Course title	**Selected chapters on marine auxiliary systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The course objective is to provide students with advanced knowledge on marine microclimate systems in the most general point of view, in relation to changes in marine environment protection regulation and changes in technology, based on latest scientific and technological achievements that could serve in furthering the process of both energy and environmentally more efficient systems.

1.2. Course enrolment requirements

Determined by the rules and regulations of the Doctoral study programme *Maritime Studies*

1.3. Expected course learning outcomes

The students will be able to:

- Perform techno-economic analysis of microclimate systems and to recognize faults in operation;
- Critically evaluate the system's condition and select efficient methods of repairing or changing/upgrading the system;
- Evaluate the condition of regulation system and create a more efficient method;
- Analyze the refrigerant removal/change process to implement environmentally friendly refrigerant;
- Create the heat process model as an introduction to energy and/or environmentally more efficient system project;
- Optimize existing and new auxiliary systems.

1.4. Course Outline

1. Approaches to marine auxiliary systems management, effect on exploitation costs and possibilities of improvement.
2. Exchange of refrigerant, filling and refilling with refrigerant and compressors' oil and heat characteristics of refrigerants, analysis of its properties and approaches to management methods.
3. Fault diagnostics, repairs, redundant systems.
4. Marine auxiliary system optimization.
5. Auxiliary system or its element modelling, variable conditions operation simulation and the effect on efficiency.

1.5. Teaching methods

☒ lectures	☒ individual assigment
☒ seminars and workshops	☐ multimedia and network
☒ exercises	☒ laboratories
☒ long distance education	☐ mentorship
☐ fieldwork	☐ practical work

1.6. Comments	

1.7. Student's obligations

Lectures and exercises attendance, laboratory work resulting with the essay and scientific paper preparation that eventually could be published.

1.8. Evaluation[31] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	1
Written exam		Oral exam	2	Essay	1	Research	1.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Assessment of learning outcomes will be performed through an essay, resulting from student research and experimental work on the refrigerator and engine room simulator and, through the oral exam.

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

1. Glujić, D., Kralj, P., Martinović, D., A Simple Mathematical Model for Refrigerating Compressor Optimization, Pomorstvo, Rijeka, 2018., 32(1), pp. 146-151.
2. Knak, Ch., Diesel Motor Ships –Engines and Machinery, GEC-GAD Publishers, Copenhagen, 1979.
3. Martinović, D., Brodski rashladni uređaji, Školska knjiga, Zagreb, 1994.
4. Kralj, P. – Šegulja, I., Brodski cjevovodi, Sveučilište u Rijeci, Rijeka, 2018
5. Kralj, P. – Martinović, D. – Tudor, M.: Analysis of thermodynamic and technological basics of the marine fresh water generator model, Desalination and water Treatment, (2017) 1-6, doi:10.5004/dwt.2017.21552
6. Glujić, D., Kralj, P., Dujmović, J., Considerations on the Effect of Slow-Steaming to Reduce Carbon Dioxide Emissions from Ships, , Journal of Marine Science and Engineering (MDPI) – 10, doi.org/10.3390/jmse10091277
7. Kralj, P., Martinović, D., Tudor, M., Lenac, D., Optimized Marine Fresh Water Generator Control System. // Naše more : znanstveni časopis za more i pomorstvo, 68 (2021), 1; 28-34 doi:10.17818/NM/2021/1.3

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

1. Kralj, P. Bukša, A. Martinović, D., Razvoj brodskih rashladnih sustava -utjecaj propisa o zaštiti okoliša, Pomorstvo, Rijeka, god. 13 (1999), pp. 211-222.
2. Kralj, P., Brodski sustavi mikroklime – automatizacija i optimizacija, Zbornik Pomorskog fakulteta u Rijeci, Rijeka, god. 12 (1998), pp. 197-203.
3. Kralj, P., Prilog raspravi o zaštiti morskog okoliša, Zbornik radova Pomorskog fakulteta, Rijeka, Godina 11 (1997), pp. 119-128.
4. Kreyszig, E., Advanced Engineering Mathematics, John Wiley and sons, New York, 1993.
5. Lalić, D., Kolombo, M., Produktivnost u procesnoj industriji, Zagreb, NIRO Privredni vjesnik, 1987.
6. Lalić, D., Kolombo, M., Upravljanje projektima u procesnoj industriji, Zagreb, NIP Privredni vjesnik, 1990.
7. Schafär, M., Computational Engineering, Springer, Berlin, 2006.
8. Turk, S., Budin, L., Analiza i projektiranje računalom, Školska knjiga, Zagreb, 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*
Glujić, D., Kralj, P., Martinović, D., A Simple Mathematical Model for Refrigerating Compressor Optimization, Pomorstvo, Rijeka, 2018., 32(1), pp. 146-151.	Available online	1
Knak, Ch., Diesel Motor Ships –Engines and Machinery, GEC-GAD Publishers, Copenhagen, 1979.	1	1

[31] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

Martinović, D., Brodski rashladni uređaji, Školska knjiga, Zagreb, 1994.	5	1
Kralj, P. – Šegulja, I., Brodski cjevovodi, Sveučilište u Rijeci, Rijeka, 2018	5	1
Kralj, P. – Martinović, D. – Tudor, M.: Analysis of thermodynamic and technological basics of the marine fresh water generator model, Desalination and water Treatment, (2017) 1-6, doi:10.5004/dwt.2017.21552	Available online	
Glujić, D., Kralj, P., Dujmović, J., Considerations on the Effect of Slow-Steaming to Reduce Carbon Dioxide Emissions from Ships, , Journal of Marine Science and Engineering (MDPI) – 10, doi.org/10.3390/jmse10091277	Available online	
Kralj, P., Martinović, D., Tudor, M., Lenac, D., Optimized Marine Fresh Water Generator Control System. // Naše more : znanstveni časopis za more i pomorstvo, 68 (2021), 1; 28-34 doi:10.17818/NM/2021/1.3	Available online	

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Josip Orović, PhD	
Course title	**Ship propulsion plant optimisation**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of this course is that PhD students acquire the necessary knowledge for scientific and technical research in the field of ship propulsion plant optimisation with an emphasis on marine propulsion machinery, equipment and their systems.
The course focuses on the application of theoretical methods, numerical solution of practical problems, simulation of various conditions in marine engine room simulators, data analysis, mathematical modeling and practical application of the results obtained in the field of marine engineering.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam, it is expected that the students will be able to:
- Identify and analyse the parameters that affect the efficiency of each propulsion plant.
- Simulate different conditions on engine room simulators and analyse the impact on efficiency and total cost of the plant.
- Calculate optimal working parameters of marine propulsion machinery, equipment and their systems.
- Choose, develop and solve mathematical models for optimisation of ship propulsion plants.

1.4. Course content

Energy balance of operating plants. Efficiency of marine propulsion machinery, equipment and their systems. Analysis of the interrelation of certain parameters on the efficiency and the total cost of the plant. Ship Energy Efficiency Management Plan (SEEMP). Simulation of different states on diesel engine, steam turbine and diesel-electric propulsion plant simulators. Optimisation of propulsion plants, individual components and processes within the plant. Mathematical models for optimisation of ship propulsion plants.

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

1.7. Student's obligations

Course attendance, research, seminar paper and oral exam.

1.8. Evaluation[32] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experiment	
Written exam		Oral exam	0.6	Essay		Research	3
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

- Research (identify and analyse the parameters that affect the efficiency of each propulsion plant);
- Seminar paper and oral exam (calculate optimal working parameters of marine propulsion machinery, equipment and their systems)

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

- Achille Messac: Optimization in Practice with MATLAB® For Engineering Students and Professionals, Cambridge University Press, 2015;
- Ibrahim Dincer, Marc A. Rosen, Pouria Ahmadi: Optimization of Energy Systems, Wiley, 2017

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

- Matlab: Optimization toolbox, User's Guide;
- Manuals;
- S.S. Rao: Engineering Optimization: Theory and Practice; John Wiley & Sons, Inc., 2020

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*
Achille Messac: Optimization in Practice with MATLAB® For Engineering Students and Professionals, Cambridge University Press, 2015	Available online	1-10
Ibrahim Dincer, Marc A. Rosen, Pouria Ahmadi: Optimization of Energy Systems, Wiley, 2017	Available online	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[32] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Mate Jurjević, PhD	
Course title	**Simulations of the ship systems condition using system dynamics**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The primary objective of this course is to acquaint the students with the benefits of applying system dynamics in a comprehensive analysis of the conditions of complex ship systems during exploitation.
The ultimate objective is to compare the simulation model obtained using the system dynamics with practice and to draw conclusions with the aim to improve, optimize, increase reliability and efficiency, and to propose guidelines for the strategy of selection and monitoring of the system during exploitation.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

With the knowledge acquired in this course, students will be able to more easily and thoroughly approach the monitoring, forecasting, and solving the potential operational problems of the ship's systems. This acquired knowledge will guide them through the development of a system dynamics simulation model, which consists of a quantitative and a qualitative model, and enable them to monitor the dynamics of the system behaviour during exploitation. In order to achieve this, students will learn to create:

1. a qualitative model (consisting of the mental verbal model, the structural model, and the flow diagram),
2. a quantitative model (consisting of the mathematical model and the computer model).

With the acquired knowledge of the system dynamics, the simulation will help avoid some of the unforeseen conditions (failures, delays, and averages) in the design of the ship's system and will help improve the system.

1.4. Course content

Introduction to system dynamics.
Defining the ship system behaviour during exploitation.
Presentation of the model making process that describes the ship system behaviour using system dynamics.
The application of a system dynamics simulation model on the selected ship system behaviour during exploitation.
Verification of the obtained data by means of comparison with reality.
The analysis of modelled results.

1.5. Teaching methods

☒ lectures	☒ individual assignment
☐ seminars and workshops	☐ multimedia and network
☒ exercises	☐ laboratories
☐ long distance education	☒ mentorship
☐ fieldwork	☐ other _____

1.6. Comments

1.7. Student's obligations

Students must meet the following requirements:
1. attendance at classes
2. attendance at exercises
3. active participation
4. preparation and presentation of a seminar paper.

1.8. Evaluation[33] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1.6	Experiment	
Written exam		Oral exam		Essay		Research	4
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The evaluation of learning outcomes is carried out through activities in classes and exercises, through the presentation of a seminar paper and through independent assignments.

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

1. Munitić, A. , Ristov, P.: Sistemska dinamika, Pomorski fakultet, Sveučilište u Splitu, 2009.
2. Forrester, J. W.:PRINCIPLES OF SYSTEMS, MIT Press, Cambridge, Massachuesetts-USA, 980.
3. Embleton, William. O.B.E., :Reed`s applied heat for engineers, Thomas Reed Publications, UK, 2000.
4. Embleton, W: Reed`s applied mechanics for engineers, Thomas Reed Publications, UK, 1999.
5. Thomas D. Morton, Leslie Jackson, :Reed`s motor engineering knowledge for marine engineers, Thomas Reed Publications, UK, 2006.

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

1. Denis Griffiths,: Marine Low speed Diesel Engines, IMareEST, London, UK , This updated edition 2015.
2. Čerić,V.: Simulacijsko modeliranje, Školska knjiga-Zagreb, 1993.
3. Aldrich, C.: Simulations and the Future of Learning, Pfeiffer, USA,2005.
4. Munitić, A.: Kompjuterska simulacija uz pomoć Sistemske Dinamike, Brodosplit, BIS Split, 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*
Munitić, A. , Ristov, P.: Sistemska dinamika, Pomorski fakultet, Sveučilište u Splitu, 2009.	1	5
Forrester, J. W.:PRINCIPLES OF SYSTEMS, Ninth printing, MIT Press, Cambridge, Massachuesetts-USA, and London, England,1980.	1	5
William Embleton O.B.E., :Reed`s applied heat for engineers, Thomas Reed Publications, UK , reprinted 2000.	1	5
William Embleton O.B.E., :Reed`s applied mechanics for engineers, Thomas Reed Publications, UK , reprinted 1999.	1	5
Thomas D. Morton,Leslie Jackson, :Reed`s motor engineering knowledge for marine engineers, Thomas Reed Publications, UK , reprinted 2006.	1	5

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[33] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities

General information		
Course coordinator	Igor Poljak, PhD Ivica Glavan, PhD	
Course title	**Thermodynamic analysis of marine steam turbine plants**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

To make a thermodynamic analysis of the marine turbine system from the selected chapters of steam turbine plants and to optimize energy and exergy flows in these systems.
Connect the elements of the steam circuit into one ensemble and solve the problem of energy and mass balance in the plants in relation to the given power of the plant. Make a
thermodynamic analysis of selected elements in the steam circuit which includes;
steam generators, steam turbines, auxiliary devices, control elements and steam pipelines and insulation.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam, it is expected that the students will be able to:
- use the methodologies of applied (practical) research and direct the acquired knowledge towards the analysis and optimization of the observed plant;
- set the thermodynamic formulation of the problem of energy and mass exchange for the analyzed element of the ship steam turbine plant;
- explore the possibilities of solving problems by using ready-made and/or writing their own program;
- analyse the obtained results and make concrete conclusions and explanations;
- present the results of research in the form of a research paper.

1.4. Course content

Ship propulsion power and steam circuit elements. Specific steam consumption, on the main propulsion turbine. Specific steam consumption on turbo generators. Specific steam consumption in a regenerative feedwater heating system. Specific steam consumption for auxiliary systems. Steam production and selection of marine steam generator. Calculation of mass consumption of steam when changing the load of the plant in the selected area of operation of the plant. Treatment of classical thermodynamics by statistical methods. Optimization of steam plant and steam consumption by one of the selected mathematical optimization methods. Analysis and optimization of the operation of a selected element of a marine steam turbine plant. Analysis and optimization of marine auxiliary steam systems in motor drives.

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

1.6. Comments	

1.7. Student's obligations

Attendance at classes (consultations), completing a project task and preparing and presenting seminars and writing a scientific paper for a selected journal.

1.8. Evaluation[34] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	0.5	Experiment	
Written exam		Oral exam		Essay	0.5	Research	0.6
Project	4	Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Class attendance, project assignments, seminar and a scientific paper.

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

1. Angola, M., Cengel, Y. A., Dincer, I.: Efficiency Evaluation of Energy Systems, Springer, 2012.
2. Kam W. Li, A. Paul Priddy: Power Plant System Design, John Wiley & Sons, Inc., 1985.
3. A. Ravindran, K. M. Ragsdell, G. V. Reklaitis; Engineering Optimization Methods and Applications, John Wiley & Sons, Inc., 2006.
4. P.K. Nag: Power Plant Engineering Forth Edition, McGraw Hill Education, 2014.
5. R. Yadav: Steam & Gas Turbines and Power Plant Engineering, Central Publishing House, Allahabad, 2004
6. Edgar, Thomas F: Optimization of chemical processes, second edition, McGraw-Hill, 2001.

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

1. Raja, A. K., Srivastava, A.P., Dwivedi, M; Power Plant Engineering, New Age International, 2006
2. Ishigai, S.: Steam Power Engineering: Thermal and Hydraulic Design Principles, Cambridge University Press, 2010.
3. HASELI, Y.; Entropy analysis in thermal engineering systems, Academic Press, Elsevier Inc. 2020.
4. A. Ravindran, K. M. Ragsdell, G. V. Reklaitis; Engineering optimization, Methods and Applications Forth Edition, John Wiley & Sons, Inc., 2009.
5. Ryszard Bartnik, Zbigniew Buryn: Conversion of Coal-Fired Power Plants to Cogeneration and Combined-Cycle Thermal and Economic Effectiveness, 2011.
6. Swapan Basu. S., Ajay Kumar D. A.: Power Plant Instrumentation and Control Handbook, Elsevier, 2015.
7. HILLIER, F.S: Introduction to operations research Tenth Edition, McGraw-Hill Education, 2015.

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*
Kanoglu, M., Cengel, Y. A., Dincer, I.: Efficiency Evaluation of Energy Systems	1	1
Kam W. Li, A. Paul Priddy: Power Plant System Design	1	1
A. Ravindran, K. M. Ragsdell, G. V. Reklaitis; ENGINEERING OPTIMIZATION Methods and Applications SECOND EDITION	1	1
R. Yadav: Steam & Gas Turbines and Power PLant Engineering, 7th Revised Edition (SI Units)	1	1
Edgar, Thomas F: OPTIMIZATION OF CHEMICAL PROCESSES, SECOND EDITION	1	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[34] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Vladimir Pelić, PhD	
Course title	**Selected chapters on energy systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Acquiring the necessary knowledge based on relevant scientific knowledge in the field of energy systems. Application of knowledge with the aim of optimisation and analysis of efficiency and sustainability of energy systems.

1.2. Course enrolment requirements

Passed courses in the fields of thermodynamics, thermoenergetics, and heat engines at the previous level of studies of Marine engineering or Mechanical engineering.

1.3. Expected course learning outcomes

After fulfilling the study obligations of the course, students will be able to:
- analyse the efficiency and sustainability of energy systems;
- select and apply a model for energy system analysis;
- determine the criteria for the evaluation of energy systems;
- select a methodology for comparing different energy systems;
- choose and apply a model for energy system optimisation.

1.4. Course content

Introduction: work, power, energy, entropy, exergy, and anergy. Energy resources and energy transformations. Conventional and alternative energy sources and energy systems. Hybrid energy systems. Characteristics of energy systems on land, offshore installations, and ships. Selection and application of criteria for assessing sustainability and optimising energy systems. Modelling an energy system or subsystem and analysing efficiency and sustainability under different operating conditions.

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

1.7. Student's obligations

Teaching (consultative), selecting, defining, and solving the task; presentation and explanation of the solution (seminar paper and/or scientific paper).

1.8. Evaluation[35] of student's work

Course attendance	0,4	Activity/Participation		Seminar paper	2.6	Experimental work	
Written exam		Oral exam		Essay		Research	3,0
Project		Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Determine the efficiency and assess the sustainability of an energy system.
Select relevant criteria and conduct a comparison of energy systems.
Improve the existing or develop a new numerical model for analysing the sustainability of an energy system.
Propose a model and conduct optimisation of an energy system.
Analyse the possibility of applying alternative energy systems and energy sources.

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

Bošnjaković, F.: Nauka o toplini, Graphis, Zagreb, 2012.
Labudović, B.: Obnovljivi izvori energije, Energetika marketing, Zagreb, 2002.
Požar, H.: Osnove energetike 1, 2 i 3, Školska knjiga, Zagreb, 1992.
Prelec, Z.: Energetika u procesnoj industriji, Školska knjiga, 1994.

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

Wark, K.: Advanced thermodynamics for engineers, McGraw-Hill, New York, 1995.
Bejan, A.: Advanced Engineering Thermodynamics, John Wiley & Sons, New Jersey, 2016.
Goswami, D. Y.; Kreith, F.: Energy Conversion, Taylor & Francis Group, Boca Raton, 2017.
Nag, P. K.: Power Plant Engineeering, Tata McGraw-Hill, New Delhi, 2008.

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*
Bošnjaković, F.: Nauka o toplini, Graphis, Zagreb, 2012.	1	1
Labudović, B.: Obnovljivi izvori energije, Energetika marketing, Zagreb, 2002.	1	1
Požar, H.: Osnove energetike 1, 2 i 3, Školska knjiga, Zagreb, 1992.	1	1
Prelec, Z.: Energetika u procesnoj industriji, Školska knjiga, 1994.	1	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[35] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Fran Torbarina, PhD	
Course title	**Application of Numerical Methods in Thermodynamics**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Gaining theoretical knowledge and development of practical skills for analyzing physical problems of fluid flow and heat transfer in heat exchangers using numerical methods such as the finite volume method; analysis of energy efficiency and design of heat exchangers; and analysis of pressure drop due to fluid flow through heat exchangers.

1.2. Course enrolment requirements

Completed course(s) in the field of thermodynamics and numerical methods at the previous level of study.

1.3. Expected course learning outcomes

After successfully completing this course, students will be able to:
Formulate mathematical models of physical problems involving fluid flow and heat transfer;
Analyze temperature distributions and velocity vector fields in various heat exchangers;
Evaluate energy efficiency of various heat exchangers;
Assess the influence of key parameters on heat transfer in heat exchangers;
Critically evaluate the results obtained from numerical analyses.

1.4. Course content

Introduction. Theory of fluid flow and heat transfer. Heat exchangers. Numerical approach to the analysis of heat transfer in heat exchangers. Fundamentals of the finite volume method. Mathematical steady-state, one-dimensional model of heat conduction. Fundamentals of similarity theory. Dimensionless parameters. Analytical, experimental, and numerical analysis of heat transfer in heat exchangers. Validation of the mathematical model. Examples of heat transfer and fluid flow analysis in different types of heat exchangers.

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

Students are expected to master the course content, conduct research, and prepare a seminar paper on an assigned topic from the course syllabus, including presentation of the research results in the form of a scientific article.

1.8. Evaluation[36] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experimental work	1
Written exam		Oral exam		Essay		Research	2.6
Project		Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Determine temperature distribution and velocity vector fields in finned tube heat exchangers;
Determine temperature distribution in passive heat exchangers;
Calculate heat transfer rate and the energy efficiency of heat exchangers;
Identify and explain possible improvements in the energy efficiency of heat exchangers;
Synthesize the results of the conducted analyses.

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

1. Versteeg, H., Malalasekera, W., An Introduction to Computational Fluid Dynamics: The Finite Volume Method, 2007.
2. Yunus A. Cengel and Afshin J. Ghajar, Heat and Mass Transfer: Fundamentals and Applications, 2025.

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

1. F. Torbarina, K. Lenić, A. Trp, *Computational Model of Shell and Finned Tube Latent Thermal Energy Storage Developed as a New TRNSYS Type*, Energies 15(7), 2434, 2022.
2. F. Torbarina, A. Trp, K. Lenić, *Numerical Analysis of Geometry Influence on Heat Transfer in a Slotted Fin and Tube Heat Exchanger*, Heat Transfer Engineering 44 (5), 2023.
3. M. Kirinčić, A. Trp, K. Lenić, F. Torbarina, Numerical analysis of the influence of geometry parameters on charging and discharging performance of shell-and-tube latent thermal energy storage with longitudinal fins // Applied thermal engineering, 236 (2024), A; 121385, 19.

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*
Versteeg, H., Malalasekera, W., An Introduction to Computational Fluid Dynamics: The Finite Volume Method, 2007.	1	1
Yunus A. Cengel and Afshin J. Ghajar, Heat and Mass Transfer: Fundamentals and Applications, 2025.	1	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted, and appropriate measures are adopted accordingly.

[36] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Fran Torbarina, PhD	
Course title	**Computer Modeling of Thermal Systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Gaining theoretical knowledge and development of practical skills for analyzing energy efficiency of various thermal systems, which involve the generation, distribution, and consumption of thermal energy, through the use of dynamic simulation models. Practical skills include identifying potential applications of this approach in analyzing the energy efficiency of different shipboard thermal systems such as waste heat recovery systems, computer modeling of parts of a plant using a commercial program for creating dynamic simulation models – TRNSYS, graphical representation of analysis results, and their interpretation.

1.2. Course enrolment requirements

Completed course(s) in the field of thermodynamics at the previous level of study.

1.3. Expected course learning outcomes

After completing this course, students will be able to:
Compare the main characteristics of systems to which the approach of energy efficiency analysis using dynamic simulation models can be applied;
Analyse energy flows within a system, including boundary energy flows;
Construct a computer model of a part of a thermal system.
Interpret and analyze results obtained from simulation models.
Evaluate the influence of various parameters on the energy efficiency of the system.

1.4. Course content

Introduction. Energy and power. Definition of energy flows. Advantages of analyzing the energy efficiency of thermal systems using dynamic simulation models. Example of developing a dynamic simulation model for a selected thermal system. Validation of dynamic simulation model. Strategies for improving the energy efficiency of thermal systems. Interpretation of the results obtained with dynamic simulation models.

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

Students are expected to master the course content, conduct research, and prepare a seminar paper on an assigned topic from the course syllabus, including presentation of the research results in the form of a scientific article.

1.8. Evaluation[37] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experimental work	1
Written exam		Oral exam		Essay		Research	2.6
Project		Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Determine the transient temperature variations in different parts of a thermo-energetic plant.
Determine the transient heat flow variations, such as waste heat generation, the required thermal energy for heating heavy fuel, domestic hot water consumption, and similar energy flows.
Calculate the total amounts of generated/consumed energy and the overall energy efficiency of the system.
Identify and explain potential improvements in the energy efficiency of a thermal system.
Synthesize the results of the conducted analysis.

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

Y. A. Çengel and M. A. Boles, Thermodynamics: an engineering approach, New York: McGraw-Hill Education, 2015.
Munitić, A. , Ristov, P.: Sistemska dinamika, Pomorski fakultet, Sveučilište u Splitu, 2009.

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

F. Torbarina, K. Lenic, A. Trp, and M. Kirincic, "Parametric analysis of system performance and cost of heating systems with heat pump and latent thermal energy storage," Applied Thermal Engineering, vol. 252, p. 123717, Sep. 2024, doi: 10.1016/j.applthermaleng.2024.123717.
F. Torbarina, K. Lenic, A. Trp, and M. Kirincic, "Numerical Model of System with Heat Pump and Latent Thermal Energy Storage," in Proceedings of the ISES Solar World Congress 2021, Virtual: International Solar Energy Society, 2021, pp. 943–949. doi: 10.18086/swc.2021.36.02.

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*
Y. A. Çengel and M. A. Boles, Thermodynamics: an engineering approach, New York: McGraw-Hill Education, 2015.	10	
Munitić, A. , Ristov, P.: Sistemska dinamika, Pomorski fakultet, Sveučilište u Splitu, 2009.	5	

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted, and appropriate measures are adopted accordingly.

[37] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

University of Rijeka
FACULTY OF MARITIME STUDIES

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MARINE ELECTRICAL ENGINEERING

General information		
Course coordinator	Aleksandar Cuculić, PhD	
Course title	**Battery and hybrid power plants on marine vessels**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

- Obtaining the required knowledge for research in the field of battery and hybrid propulsion system on board marine vessels, as well as other systems with a significant share of fuel cells, batteries, and energy storage technologies.
- Introduction to the methods of battery and hybrid drives modelling and optimization with a focus on fuel saving, reduction of greenhouse gas emissions and increasing the power plant availability.
- The final goal of the course is to enable PhD students to contribute to the scientific component of vessels power system design.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam, it is expected that the students will be able to:

1. Understand the basic concepts of battery and hybrid drives on floating units.
2. Know the theoretical foundations of technologies used in these systems.
3. Analyse power flows in the power system of floating units with hybrid and battery propulsion.
4. Assess the electricity needs that must be met by the supporting land infrastructure.
5. Know the techniques of modeling and optimization of battery and hybrid drives using appropriate software solutions (Matlab, Simulink, HOMER).
6. Evaluate the simulation results in order to select the optimal power system topology.
7. Apply the acquired knowledge for the purpose of pre-project definition of the electric power system of the vessel with battery and hybrid systems.

1.4. Course content

Theoretical concepts of the electrical power system on board battery and hybrid driven vessels. Types, characteristics and theoretical basis of electrochemical batteries, fuel cells, supercapacitors, and energy storage technologies. Optimizing of vessels power management system in order to increase the economic and environmental efficiency of the vessel and to maximize the utilization of electrical energy available from the battery and other sources. Modelling battery and hybrid propulsion systems using the Matlab and Simulink software. Project defining of electrical power systems on board vessels with battery and hybrid drives.

1.5. Teaching methods		
	☒ lectures	☒ individual assignment
	☒ seminars and workshops	☐ multimedia and network
	☐ exercises	☐ laboratories

	☐ long distance education ☐ fieldwork	☐ mentorship ☐ other _____
1.6. Comments		

1.7. Student's obligations

Attendance (lectures or consultations), conducting research and writing a seminar paper, oral exam.

1.8. Evaluation[38] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1	Experiment	1
Written exam		Oral exam	1	Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Attending classes, seminar paper, conducting research and experimental work, and an oral exam.

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

1. European Maritime Safety Agency: Study on electrical energy storage for ships - battery systems for maritime applications – technology, sustainability and safety, EMSA 2020.
2. O'hayre, R., Cha, S.W., Colella, W. and Prinz, F.B., 2016. Fuel cell fundamentals. John Wiley & Sons.
3. Rahn, C.D. and Wang, C.Y., 2013. Battery systems engineering. John Wiley & Sons.
4. Teaching materials prepared and papers published by the course coordinator.

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

1. Díaz-González, F., Sumper, A. and Gomis-Bellmunt, O., 2016. Energy storage in power systems. John Wiley & Sons.

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*
European Maritime Safety Agency: Study on electrical energy storage for ships - battery systems for maritime applications – technology, sustainability and safety, EMSA 2020.	Available online	1
O'hayre, R., Cha, S.W., Colella, W. and Prinz, F.B., 2016. Fuel cell fundamentals. John Wiley & Sons.	1	1
Rahn, C.D. and Wang, C.Y., 2013. Battery systems engineering. John Wiley & Sons.	1	1
Teaching materials and published papers of lecturers	Available online	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[38] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

Geneal information		
Course coordinator	Ivan Panić, PhD	
Course title	**Electric propulsion**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12+0+0

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of course is the acquisition of relevant knowledge required for scientific research on the field of vessel electric propulsion systems and electric power systems with dominant or significant share of power electronic devices in total consumption in general, with the special interest in the analyses and measures for the improvement of the electric energy quality. Final aim of course is enabling the doctoral PhD student for his scientific contribution in the field of vessel electric power and electric propulsion systems preliminary design.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam, it is expected that the students will be able to:
Understand and use exploitation advantages of ship electric propulsion.
Analyse, evaluate and optimize integrated electric propulsion system and subsystems.
Knowledge of relevant rules and regulations.
Understand electric energy quality influence on ship's electrical devices.
Analyse voltage harmonic distortion in high voltage, low voltage and lighting electric power networks.
Understanding the causes of distortions and electric energy quality indicators.
Identify sources of non-sinusoidal currents on board a ship.

1.4. Course content

Exploitation advantages of electric propulsion. Analysis and evaluation of electric propulsion system. Meaning, causes of distortions and electric energy quality indicators. Sources of non-sinusoidal currents on board a ship. Influence of the electric energy quality on ship electrical devices. Relevant rules and regulations. Analysis of voltage harmonic distortion in high voltage and low voltage electric power network. Analysis of non-linear loads in ship lighting network. Analysis of voltage harmonic distortion in lighting network. Electric power system optimization.

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

Seminar paper, oral exam

1.8. Evaluation[39] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1.6	Experiment	
Written exam		Oral exam	4	Essay		Research	
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Course attendance (10%) Seminar paper 25%, Final exam 65%

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

1. Vučetić D.; Električna propulzija, lectures.
2. Vučetić, D., Electric Propulsion Optimization Model on a Commercial Vessel with Electric Propulsion, doctoral dissertation, Faculty of Maritime Studies, University of Rijeka, Rijeka, 2006.
3. Vučetić, D., Tomas, V., Cuculić A., Electric Propulsion Optimization Model Based On Exploitation Profile and Energy Price, Brodogradnja, 62(2011)2, pp 130-135.
4. Vučetić D., Čekada I. Eksploatacijske prednosti električne propulzije, Pomorstvo, 20, pp. 129-145, Rijeka 2006.

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

1. Vlahinić, I., Električni sistemi plovnih objekata, Sveučilište u Rijeci, Pomorski fakultet, Rijeka 2004.
2. Skalicki B., Grilec J., Brodski električni uređaji, Sveučilište u Zagrebu, FSB, Zagreb 2000.
3. J.Arrillaga et al, Power System Harmonic Analysis, John Willey&Sons Ltd, Chichester, 1998.
4. G.J.Wakileh, Power Systems Harmonics - Fundamentals, Analysis and Filter Design, Springer, Berlin, 2001.
5. W.E.Kazibwe, M.H.Sendaula, Electrical Power Quality Control Techniques, Springer, Berlin,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*
1. Vučetić D.; Električna propulzija, predavanja	1	1-10
2. Vučetić, D., Model optimizacije elektroenergetskog sustava trgovačkog broda s električnom propulzijom, doktorska disertacija, Pomorski fakultet u Rijeci, Sveučilište u Rijeci, Rijeka, 2006.	1	1-10
3. Vučetić, D., Tomas, V., Cuculić A., Electric Propulsion Optimization Model Based On Exploitation Profile and Energy Price, Brodogradnja, 62(2011)2, pp 130-135.	1	1-10
4. Vučetić D., Čekada I.; Eksploatacijske prednosti električne propulzije, Pomorstvo, 20, str. 129-145, Rijeka 2006.	1	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[39] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Boris Sviličić, PhD	
Course title	**Maritime cyber risk management**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The objective of this course is to familiarize students with the multidisciplinary problem of cyber risks related to maritime systems on the basis of the guidelines of the *International Maritime Organisation* (*IMO MSC Guidelines on Maritime Cyber Risk Management*). The term maritime systems includes: ship bridge navigation and communications systems (ECDIS, ARPA, AIS...), propulsion and machineries (control, monitoring and alarm systems for the driver, shaft, gear, propeller...), power generation and distribution (control, monitoring and alarm systems for the engine, turbine, generator...), cargo management systems (control, monitoring and alarm systems for the cargo pumps, valves, pressure, temperature...), access control systems (surveillance systems, CCTV systems, electronic personnel-on-board systems, shipboard security alarm systems...), passenger servicing and management systems (boarding and access control, property management, electronic health records, flooding detection systems...), vessel traffic management and information system (VTMIS)... The course is focused on the detection of potential cyber risks that are specific to the cyber maritime systems, their prevention by applying available measures and mechanisms and the development of new systems with higher cyber security level.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam, it is expected that the students will be competent for:
General knowledge acquisition in the multidisciplinary domain of recognition and management of cyber risks specific for the maritime systems. Specific knowledge and skills acquisition for cyber security improvement and enhancement of the maritime systems.

1.4. Course content

IMO MSC guidelines on maritime cyber risk management. Cyber risks of the maritime systems. Categorizing cyber risks. Analysis of cyber risks. Reliability and availability of cyber maritime systems. Mechanism and safety measures for cyber risks management. Security policies. Identification and authorization. Physical security and safety of working environment. Fail-over systems and redundant architectures. Data encryption. Privacy protection. Malicious code detection. Intrusion detection system. Procedure for recognizing the signs of cyber risks exploitation. Cyber risk assessment of the maritime systems.

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

	☐ fieldwork	☐ other _____
1.6. Comments	-	

1.7. Student's obligations

Attending classes, independent implementation of scientific research (practical and experimental work) with the aim of creating a seminar paper, and taking an oral exam.

1.8. Evaluation[40] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experiment	1
Written exam		Oral exam	1	Essay		Research	1
Project		Continuous assessment		Report		Practical work	0.6
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Assesment through the final exam.

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

1. M. Egan, T. Mather. "The Executive Guide to Information Security: Threats, Challenges, and Solutions", Addison – Wesly, 2004.
2. R. Anderson. "Security Engineering", J. Wiley & Sons, 2001.
3. ISO 27002 (ISO 17799), "Information Technology - Security Techniques - Code of Practice for Information Security Management", Standards Direct - International Standards and Documentation, 2007.

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

1. H. Timpton, M. Krause. "Information security Management", Auerbach, 1998.
2. J. Crume. "Inside Internet Security", Addison – Wesly, 2000.
3. Publications of the course coordinator.

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*
M. Egan, T. Mather. "The Executive Guide to Information Security: Threats, Challenges, and Solutions", Addison – Wesly, 2004.	1	1-10
R. Anderson. "Security Engineering", J. Wiley & Sons, 2001.	1	1-10
ISO 27002 (ISO 17799), "Information Technology - Security Techniques - Code of Practice for Information Security Management", Standards Direct - International Standards and Documentation, 2007.	1	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[40] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Jasmin Ćelić, PhD	
Course title	**Cooperative intelligent transportation systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

- understand the key concepts of intelligent transport systems, analysing their advantages and disadvantages; describe data processing systems, their types and applications, and the architecture and concept of existing systems; analyse various applied technologies of intelligent transport systems;
- ensure an understanding of the basic components of cooperative intelligent transport systems and related services, and the techniques used in operation, including communication and information infrastructure;
- ensure an understanding of all the elements that make ITS systems and related services through practical examples, critically examine the various implementation options and policies for which they are designed;
- understand the technology of autonomous and connected vehicles within the vehicles themselves and in conjunction with the infrastructure, real-time sensors in the transport infrastructure, the application of artificial intelligence for data analysis and information;
- understand various ITS applications / systems at local, national and international level such as advanced traffic management systems, automatic road regulation (variable speed limit, electric toll collection), cooperative public transport systems, management transport demand, cooperative management of parking systems, multi-modal passenger information systems, etc.;
- synthesize and analyse local and global policies related to intelligent transport systems and understand technological challenges;
- develop practical experiences of ITS concepts by applying them to local and global scenarios;
- understand and interpret data presented in verbal, numerical and graphical forms;
- relevant transfer of information, knowledge and insights;
- provide appropriate material for PhD students to improve, consolidate and expand their skills in solving numerical and practical tasks in the development of intelligent transport systems;
- develop PhD students reading and observation skills that will enable them to make the proper text review in search of certain information, interpret and draw appropriate conclusions from the context.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam, it is expected that the students will be able to:

- distinguish the basic principles of ITS;
- compare ways of managing communication and information networks;
- discuss the development of cooperative ITS;

- recommend procedures for the implementation of cooperative ITS in transport infrastructure;
- justify the reasons for the implementation of cooperative ITS and their benefits;
- determine the principles of operation of electronic systems in vehicles;
- evaluate and differentiate the use of navigation systems within ITS and traffic monitoring using GNSS;
- evaluate telematic solutions of cooperative transport systems;
- distinguish the principles of automatic supervision for the purpose of road safety;
- set conditions for the development and implementation of cooperative ITS services.

1.4. Course content

Basic concepts of intelligent transport systems; ITS standards; basics of systems theory and cybernetics; physical and logical architecture of ITS; development of ITS and related technologies; implementation of ITS in transport infrastructure; reasons for implementing C-ITS and their benefits; C-ITS communication technologies; traffic modeling and simulation; expert systems and artificial intelligence in transport systems; C-ITS and management systems; electronic systems in vehicles; creating conditions for the implementation of C-ITS; navigation systems; vehicle monitoring and diagnostics; expert maintenance systems; advanced C-ITS.

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

1.6. Comments

1.7. Student's obligations

Class attendance (lectures or consultative classes), work on the project task, conducting research and writing a seminar paper, presentation of the obtained results.

1.8. Evaluation[41] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1	Experiment	
Written exam		Oral exam		Essay		Research	2.6
Project	2	Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

- Class attendance activity (lectures or consultative classes) - learning outcomes from 1 to 10;
- Assessment and evaluation of work on the project task;
- Assessment and evaluation of research, preparation and presentation of a seminar paper.

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

1. Group of authors. (2000.). Intelligent Transportation Primer, Institute of Transportation Engineers, Washington, USA,
2. Williams, B. (2008.). Intelligent Transport Systems Standards, Artech House, Boston, USA.

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

1. A. Zilouchian, M. Jamshidi: "Intelligent Control Systems Using Soft Computing Methodologies", CRC Press, London, 2001.,
2. Ronald K. Jurgen, "Navigation and Intelligent Transportation Systems", str 211-290, Society of

[41] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

Automotive Engineers, Inc. 1998.,
3. M. Gupta, N. K. Sinha: "Intelligent Control Systems - Concept and Applications", IEEE Press, 1995.
4. Journals:
   a) Traffic Technology International, Transportation research (part A and B);
   b) IEEE Vehicular Technology Magazine;
   c) IEEE Intelligent Transportation Systems Magazine;
   d) IEEE Transactions On Intelligent Transportation Systems;
   e) Journal of Intelligent Transportation Systems
5. Internet:
   a) https://www.pcb.its.dot.gov/eprimer.aspx
   b) http://www.iteris.com/itsarch/index.htm
   c) http://www.itsoverview.its.dot.gov/
   d) http://www.fhwa.dot.gov/publications/publicroads/14marapr/index.cfm
   e) http://www.ornl.gov/ORNLReview/v33_3_00/smart.htm
   f) http://www.etsi.org/technologies-clusters/technologies/intelligent-transport

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. Group of authors. (2000.). Intelligent Transportation Primer, Institute of Transportation Engineers, Washington, USA.	1	5
2. Williams, B. (2008.). Intelligent Transport Systems Standards, Artech House, Boston, USA.	1	5

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Nikola Lopac, PhD	
Course title	**Advanced digital signal processing methods in transport**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The main objectives of the course are to develop the ability for critical analysis and integration of advanced digital signal processing methods in the analysis of transport data, synthesize mathematical tools for time-frequency signal analysis and assess their application in transport problems, create and evaluate methods for noise removal, feature extraction, image processing, and pattern recognition, implement and enhance artificial intelligence, machine learning, and deep learning algorithms for transport data analysis and prediction, as well as design and optimize deep and convolutional neural network models for object classification and recognition in transport systems.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After completing the course, students will be able to:

1. Critically evaluate advanced methods of digital signal processing and integrate them into the analysis of data from transport systems.
2. Synthesize mathematical and programming tools for time-frequency analysis of non-stationary signals and assess their application by evaluating results on specific transport problems.
3. Develop methods for noise removal and feature extraction from signals in transport systems and critically analyze their effectiveness.
4. Create advanced algorithms for digital image processing and pattern recognition, tailored to the specific requirements of transport systems.
5. Implement and evaluate artificial intelligence algorithms and machine learning and deep learning techniques for transport data analysis and prediction, synthesizing results to improve traffic management systems.

Design and optimize models based on deep and convolutional neural networks and assess their applicability in object recognition and data classification in transport systems.

1.4. Course content

Advanced methods of digital signal processing and analysis. Non-stationary signals. Time-frequency signal analysis. Noise removal methods. Feature extraction. Digital image processing and analysis. Pattern recognition. Artificial intelligence (AI) algorithms in digital signal processing and analysis. Machine learning. Deep learning. Deep neural networks. Convolutional neural networks. Computer vision. Practical applications on real-world examples from transport systems (sensor measurements, video recordings, satellite images, AIS

data).

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 (consultations), independent research on a selected topic, and preparation and presentation of a seminar paper.

1.8. Evaluation[42] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experiment	
Written exam		Oral exam		Essay		Research	3.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Evaluation of learning outcomes is conducted based on the assessment of the preparation and presentation of the seminar paper as a result of independent research. The assessment criteria include the quality of the paper, presentation, and knowledge of the subject matter.

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

1. Course materials provided by the course coordinator
2. B. Jeren: Signali i sustavi, Školska knjiga, 2021.
3. I. Goodfellow, Y. Bengio, A. Courville: Deep Learning, MIT Press, 2016.
4. A. Géron: Hands-on Machine Learning with Scikit-Learn, Keras & TensorFlow – Concepts, Tools, and Techniques to Build Intelligent Systems, O'Reilly, 2019.

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

1. B. P. Lathi, R. A. Green: Essentials of Digital Signal Processing, Cambridge University Press, 2014.
2. B. Boashash: Time-Frequency Signal Analysis and Processing: A Comprehensive Reference, Academic Press, 2016.
3. C. Solomon, T. Breckon: Fundamentals of Digital Image Processing: A Practical Approach with Examples in MATLAB, Wiley Blackwell, 2011.
4. N. Lopac, I. Jurdana, J. Lerga, N. Wakabayashi: Particle-Swarm-Optimization-Enhanced Radial-Basis-Function-Kernel-Based Adaptive Filtering Applied to Maritime Data, Journal of Marine Science and Engineering, 2021, 9, 4, 439.
5. I. Jurdana, N. Lopac, N. Wakabayashi, H. Liu: Shipboard Data Compression Method for Sustainable Real-Time Maritime Communication in Remote Voyage Monitoring of Autonomous Ships, Sustainability, 2021, 13, 15, 8264.
6. H. Liu, I. Jurdana, N. Lopac, N. Wakabayashi: BlueNavi: A Microservices Architecture-Styled Platform Providing Maritime Information, Sustainability, 2022, 14, 4, 2173.
7. N. Lopac, F. Hržić, I. P. Vuksanović, J. Lerga: Detection of Non-Stationary GW Signals in High Noise From

[42] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

Cohen's Class of Time–Frequency Representations Using Deep Learning, IEEE Access, 2022, 10, str. 2408-2428.
8. N. Lopac, I. Jurdana, A. Brnelić, T. Krljan: Application of Laser Systems for Detection and Ranging in the Modern Road Transportation and Maritime Sector, Sensors, 2022, 22, 16, 5946.
9. H. Nguyen, L. M. Kieu, T. Wen, C. Cai: Deep learning methods in transportation domain: a review, IET Intelligent Transport Systems, 2018, 12, 9, str. 998-1004.

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*
Course materials provided by the course coordinator	Available online	1
B. Jeren: Signali i sustavi, Školska knjiga, 2021.	2	1
I. Goodfellow, Y. Bengio, A. Courville: Deep Learning, MIT Press, 2016.	Available online	1
A. Géron: Hands-on Machine Learning with Scikit-Learn, Keras & TensorFlow – Concepts, Tools, and Techniques to Build Intelligent Systems, O'Reilly, 2019.	2	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Robert Baždarić, PhD	
Course title	**Advanced technologies in diagnostics and control systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The course objective is to further encourage students in acquiring quality attitudes and additional knowledge important for understanding new technologies in diagnostics and management, and to help students effectively engage in scientific work in this field. Within the content of this course, thematic units are processed that enable PhD students of Maritime Studies to gain insight into the problems of new technologies and scientific methods in diagnostics and management of real maritime technical systems in order to increase efficiency and safety.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam, students will be able to do the following:

1. present and analyse the features of diagnostic systems;
2. define the organization of the diagnostic process;
3. apply structural diagnostic techniques;
4. apply functional diagnostic techniques;
5. show and explain redundancy management;
6. apply diagnostic system evaluation methods;
7. calculate the impact of diagnostics on the reliability and safety of marine engine and device controllers;
8. present and explain the application of diagnostics in marine control systems.

1.4. Course content

Reliability and availability of marine systems and processes. State and tendencies of development of diagnostic methods and control algorithms in marine processes. Application of software and hardware technologies in fault detection and identification. Sensor fusion. Circuit (HW) and analytical (SW) redundancy in management and diagnostics. Structural analysis and redundancy. Procedures and schemes for diagnostics and management of continuous systems. Procedures and schemes of diagnostics and management of discrete systems. Schemes and algorithms for diagnostics and fault response management. Examples of application of diagnostic and control schemes in conditions of system failure (marine propulsion system, auxiliary machines, electrical network).

1.5. Teaching methods		
	☒ lectures	☒ individual assignment
	☒ seminars and workshops	☐ multimedia and network
	☐ exercises	☐ laboratories

	☐ long distance education ☐ fieldwork	☒ mentorship ☐ other _____
1.6. Comments		

1.7. Student's obligations

Course attendance, solving the project task and preparation and presentation of seminar paper.

1.8. Evaluation[43] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1.6	Experimental work	
Written exam		Oral exam		Essay		Research	1
Project	3	Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Class (consultations) attendance, completing the project task and preparation and presentation of seminar work

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

Tomas, V., 2021. Advanced technologies in diagnostics and management; Lecture Notes, Faculty of Maritime Studies Rijeka, University of Rijeka, Rijeka, Croatia.

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

1. Blanked, M., Kinnaert, M., Lunze, J., Staroswiecki, M., Diagnosis and Fault-Tolerant Control, Springer, Berlin, 2016.
2. Saran, V. H., Mishra, Rakesh Kumar (Eds.): Advances in Systems Engineering, Springer, London, 2021.

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*
Tomas, V., 2021. Advanced technologies in diagnostics and management; Lecture Notes, Faculty of Maritime Studies Rijeka, University of Rijeka, Rijeka, Croatia.	e-learning	1-2
Blanke, M., Kinnaert, M., Lunze, J., Staroswiecki, M., Diagnosis and Fault-Tolerant Control, Springer, Berlin, 2016.	2	1-2
Saran, V. H., Mishra, Rakesh Kumar (Eds.): Advances in Systems Engineering, Springer, London, 2021.	1	1-2

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[43] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

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General information		
Course coordinator	Sanjin Valčić, PhD	
Course title	New technologies in maritime communications	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The main objective of the course is to acquire knowledge on the latest trends in the development of communication technologies that enable the connection of ships and land facilities and methodologically analyse, assess and compare their specific advantages and disadvantages.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam, it is expected that the students will be able to:

1. compare the basic characteristics and performance of various current and future maritime radio networks and technologies;
2. compare current and future land and maritime radio networks and technologies;
3. compare data transmission using different current and future maritime radio networks and technologies;
4. argue the need for introduction of terrestrial 5G networks in maritime communications;
5. assess the quality of service when using Wi-Fi and WiMAX mobile technologies at sea;
6. suggest potential applications using new radio technologies and networks;
7. classify and categorize VSAT's (Very Small Aperture Terminal) used in maritime communications.

1.4. Course content

Maritime terrestrial communication systems: VHF Data Exchange System - Terrestrial (VDES - Ter), GSM, Wi-Fi, WiMAX, etc. Application of fourth and fifth generation mobile networks in maritime communications. Satellite communication systems: VSAT - C, Ku and Ka frequency bands, Inmarsat, Iridium, Thuraya, Orb COMM, VHF Data Exchange System - Satellite (VDES - Sat), etc. New communication systems and innovations in terrestrial and satellite maritime communications.

1.5. Teaching methods

☒ lectures	☒ individual assignment
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratories
☐ long distance education	☒ mentorship
☐ fieldwork	☐ other _____

1.6. Comments

1.7. Student's obligations

Class attendance, independent research and academic writing and presentation of seminar paper.

1.8. Evaluation[44] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	3	Experiment	
Written exam		Oral exam		Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Evaluation of learning outcomes is performed during the presentation of conducted research in the form of a seminar paper.

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

[1] Låg, S. (2015) Ship Connectivity, DNV GL Strategic Research & Innovation, Position Paper, DNV GL AS, Norway, online: https://www.dnv.com/Images/DNV%20GL%20-%20Ship%20Connectivity_tcm8-56026.pdf
[2] Pavur, J.; Moser, D.; Strohmeier, M.; Lenders, V. and Martinovic, I. (2020) A Tale of Sea and Sky On the Security of Maritime VSAT Communications, in 2020 IEEE Symposium on Security and Privacy (SP), San Francisco, CA, US, 2020 pp. 1384-1400., online: https://www.computer.org/csdl/proceedings-article/sp/2020/349700b025/1j2Lg3MvKpi
[3] Inmarsat (2020) MARITIME VSAT: Connectivity certainty that's made to measure, White paper, online: https://www.inmarsat.com/content/dam/inmarsat/corporate/documents/maritime/insights/MBU_Maritime_VSAT_Explained_WhitePaper.pdf
[4] Gradiant (2019) The digitalisation of maritime communications, Study of the evolution of maritime communications: from voice to e-Navigation, 1st edition, Gradiant 2019, Vigo, Pontevedra, Spain, online: https://www.cellnextelecom.com/content/uploads/2020/01/The_digitalisation_of_maritime_communications_1stEd_EN.pdf

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

[1] Kolawole, M. O. (2014) Satellite Communication Engineering, 2nd edition, CRC Press, Taylor & Francis Group, Boca Raton, FL, US
[2] Sun, Z. (2005) Satellite Networking: Principles and Protocols, John Wiley & Sons Ltd, West Sussex, UK
[3] Maral, G. (2003) VSAT Networks, 2nd edition, John Wiley & Sons Ltd, West Sussex, 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*
Låg, S. (2015) Ship Connectivity, DNV GL Strategic Research & Innovation, Position Paper, DNV GL AS, Norway	Available online	5
Pavur, J.; Moser, D.; Strohmeier, M.; Lenders, V. and Martinovic, I. (2020) A Tale of Sea and Sky On the Security of Maritime VSAT Communications, in 2020 IEEE Symposium on Security and Privacy (SP), San Francisco, CA, US, 2020 pp. 1384-1400.	Available online	5
Inmarsat (2020) MARITIME VSAT: Connectivity certainty that's made to measure, White paper	Available online	5
Gradiant (2019) The digitalisation of maritime communications, Study of the evolution of maritime communications: from voice to e-Navigation, 1st edition, Gradiant 2019, Rúa Fonte das Abelleiras, s/n. Edificio CITEXVI, 36310 Vigo, Pontevedra, Spain	Available online	5

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[44] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Irena Jurdana, PhD	
Course title	**Optical technologies in maritime industry**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The students will be familiarized with new developments in the application of optical technology in the maritime industry. The course presents selected topics in the field of optical communication and optical sensor networks. The course is focused on training students for independent analysis, design, modelling and constructing data transmission systems, measurement systems and submarine communications networks based on fibre optic technology. This course builds on previously acquired basic knowledge of fibre optic communications, principles of propagation of light, optical passive and active components and measuring methods and devices used in optical communication and sensor networks.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam, it is expected that the students will be able to:
Describe and understand the elements, structures, operation of optical communication and sensor systems in maritime industry. Interpret and give examples of new trends in technology as well as follow the developments in optical technology. Using computer programs to create models of fibre optic systems, analyse the results and evaluate the contribution of such models in real systems. Compare and distinguish different types of system models with respect to their use in real information systems.

1.4. Course content

Communication networks in the ship's systems by using optical technology: the application of a mathematical model, reliability. Optical sensor systems for measuring electrical and non-electrical values: components, measurement methods and devices. Electronic navigation devices based on fiber optic technology. Wireless fiber optic systems (Free Space Optics). Transmission of radio-signal over optical fibre (Radio-over-Fiber). Submarine optical networks: construction, safety and protection, the impact on the marine environment, technical and legal aspects.

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 (consultations) attendance, work on the project assignment and preparation and presentation of a seminar paper / project assignment

1.8. Evaluation[45] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experiment	
Written exam		Oral exam		Essay		Research	1
Project	2.6	Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Attendance at classes (consultations), the continuity of work on the project task, research and preparation of seminar paper. The presentation of the seminar paper and/or research task performed orally.

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

1. G.P. Agrawal: Fiber-Optic Communication Systems, John Wiley, 2010.
2. J.M. Lopez-Higuera (editor): Optical Fibre Sensing Technology, John Wiley & Sons, 2002.
3. R. Ramaswami, K.N. Sivarajan, G.H. Saski: Optical Networks: A Practical Perspective, 3rd ed., Elsevier, 2010.
4. J. Chesnoy: Undersea Fiber Communication Systems, Academic Press, 2002.
5. J.P.Dakin, Handbook of Optoelectronics, Taylor&Francis Group, 2006.
6. Bažant, A. i dr.: Telekomunikacije - tehnologija i tržište, Element, Zagreb, 2007.
7. Bažant, A. i dr.: Osnovne arhitekture mreža, Element, Zagreb, 2014.
8. Teaching materials for lectures available on the e - learning system - Merlin (https://moodle.srce.hr)

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

1. W.D. Grover, Mesh-based Survivable Networks: Options and strategies for Optical, MPLS, SONET and ATM networking, Prentice Hall PTR, 2004.
2. J.P. Vasseur, M. Pickavet, P. Demeester, Network recovery: Protection and Restoration of Optical, SONET-SDH, IP, and MPLS, Elsevier, 2004.
3. Yincan, Y., et al: Submarine Optical Cable Engineering, Elsevier Academic Press, 2018
4. A. Selvarajan, S. Kar, T. Srinivas: Optical Fiber Communications: Principles and Systems, McGraw-Hill, 2006.
5. M.Ilyas, H.Mouftah, Optical communication Networks, CRC Press, 2003.
6. Teaching materials for lectures available on the e - learning system - Merlin (https://moodle.srce.hr)

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*
G.P. Agrawal: Fiber-Optic Communication Systems, John Wiley, 2010.	1	1
J.M. Lopez-Higuera (editor): Optical Fibre Sensing Technology, John Wiley & Sons, 2002.	1	1
R. Ramaswami, K.N. Sivarajan, G.H. Saski: Optical Networks: A Practical Perspective, 3rd ed., Elsevier, 2010.	1	1
J. Chesnoy: Undersea Fiber Communication Systems, Academic Press, 2002.	1	1
J.P.Dakin, Handbook of Optoelectronics, Taylor&Francis Group, 2006.	1	1
Teaching materials for lectures available on the e - learning system - Merlin (https://moodle.srce.hr)	-	-
Bažant, A. i dr.: Telekomunikacije - tehnologija i tržište, Zagreb, 2007.	1	1
Bažant, A. i dr.: Osnovne arhitekture mreža, Element, Zagreb, 2014.	1	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[45] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Marko Valčić, PhD	
Course title	**Guidance and control of vessels**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Acquiring knowledge and skills required for mathematical modelling and simulations in the field of guidance, navigation and motion control of waterborne crafts.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

By the end of this course, students will be able to:

1 Formulate a mathematical model of the kinematics and dynamics of a vessel with environmental loads.
2 Propose mathematical models for autopilots and dynamic positioning.
3 Create different vessel observers and analyse their quality.
4 Model vessel actuators, implement optimal thrust allocation with realistic constraints, and estimate thrust reduction.
5 Model and simulate systems for trajectory tracking and path following.
6 Critically evaluate and compare different strategies for the guidance and control of vessels.
7 Argue an opinion related to modern concepts of autonomous navigation and establish guidelines for future research.

1.4. Course content

Reference frames and kinematics of vessels. Vessel dynamics. Manoeuvring theory and standard manoeuvring tests. Models for ships, offshore structures and underwater vessels: autopilot models for heading and tracking control, dynamic positioning models, manoeuvring models. Environmental load models: wind, waves and ocean currents. Motion control: autopilots, dynamic positioning and position mooring systems, waypoint tracking and path-following control systems. Guidance systems: target and trajectory tracking, path following systems. Sensor and navigation systems: testing of signals and handling of redundant measurements, low-pass and notch filtering, state estimation, discrete-time Kalman filter, extended Kalman filter, intelligent identification and estimation, sensor fusion. Motion control systems: PID control, linear quadratic optimal control (LQR), model predictive control (MPC), nonlinear control. Propulsion systems: power systems, power and energy management, propulsion control, propellers and thrusters, control problem formulation, optimal thrust allocation, thrust loss effects. Adaptive and intelligent control of vessels. Weather optimal positioning and optimal weather route planning. Decision support systems for guidance and navigation of vessels. Autonomous vessels, subsystems and control: autonomous navigation and risk assessment. Intelligent collision avoidance for autonomous vessels.

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

1.7. Student's obligations

Course attendance (consultations), completing the project assignment, preparation and presentation of the seminar paper. The preparation of a project assignment and the presentation of a seminar paper may be substituted with the preparation and publication of a scientific paper in an appropriate journal or the preparation and presentation of a paper at an appropriate scientific conference.

1.8. Evaluation[46] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1	Experiment	
Written exam		Oral exam	1	Essay		Research	1
Project	2.6	Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The process of evaluating the acquired learning outcomes takes place as follows:

- 70 % of the acquired learning outcomes are evaluated (1-6) through mentorship and monitoring of student's activities related to independent student's work on the assigned project task, research, and preparation of final report (seminar or research paper) during course duration, where the student must realize a minimum of 50 % points.
- At the final part of the exam, 30 % of the acquired learning outcomes are evaluated (1-6), whereby the student must realize a minimum of 50 % of points to pass the final exam.
  Note: Publication of a scientific paper in an appropriate scientific journal or presentation of a paper at an appropriate scientific conference is equivalent to the final part of the exam.
- Final ECTS grade is defined on the basis of the achieved total % of knowledge, skills and competencies and numerical grade after the final / remedial exam is as follows:
  - grade *excellent* (5) corresponds to grade A in the ECTS scale and a success rate of 90 to 100 %,
  - a grade of *very good* (4) corresponds to a grade of B on the ECTS scale and a success rate of 75 to 89.9 %,
  - grade *good* (3) corresponds to grade C on the ECTS scale and a success rate of 60 to 74.9 %,
  - a grade of *sufficient* (2) corresponds to a grade of D on the ECTS scale and a success rate of 50 to 59.9 %,
  - the grade *insufficient* (1) corresponds to grade F in the ECTS scale and the success rate from 0 to 49.9 %.

Examples of evaluating learning outcomes in relation to set learning outcomes are:

- Published research paper of PhD student (main author) in an appropriate scientific journal.
- Prepared and accepted project assignment in the field of guidance, navigation and control of vessels. Based on the project task, a seminar paper is also prepared and presented. The practical part of the project assignment, i.e. the seminar paper, can be developed using programming environments/ languages like MATLAB & Simulink or Python.

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

Valčić, M., Tomas, V. (2020). *Guidance and control of vessels*. Lecture Notes, Faculty of Maritime Studies, University of Rijeka, Rijeka, Croatia.
Fossen, T.I. (2011). *Handbook of Marine Craft Hydrodynamics and Motion Control*. John Wiley & Sons Ltd,

[46] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

Chichester, UK.
Sørensen, A.J. (2018). *Marine Cybernetics: Towards Autonomous Marine Operations and Systems*. UK-2018-76, Department of Marine Technology, the Norwegian University of Science and Technology (NTNU), Trondheim, Norway. Available online: http://folk.ntnu.no/assor/Public/2018-08-20 marcyb.pdf
Valčić, M. (2020). *Optimization of thruster allocation for dynamically positioned marine vessels*. PhD Thesis, University of Rijeka, Faculty of Engineering, Rijeka, Croatia. Available online: https://www.bib.irb.hr/1053538/download/1053538.Valcic_PhD_Thesis_Final_022020.pdf
Valčić, M. (2015). *Intelligent estimation in dynamic positioning systems of marine vessels*. PhD Thesis, University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia. (In Croatian). Available online: https://repository.pfri.uniri.hr/

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

Fossen, T.I. (2021). *Handbook of Marine Craft Hydrodynamics and Motion Control*. 2nd Edition, John Wiley & Sons Ltd, Wiley-Blackwell, Chichester, UK.
Carlton, J. (2019). *Marine Propellers and Propulsion*. 4th Ed., Elsevier Ltd., Oxford, UK.
Wright, R.G. (2020). *Unmanned and Autonomous Ships: An Overview of MASS*. Routledge, Taylor & Francis Group, LLC, New York, NY, USA.
Dhanak, M.R., Xiros, N.I., Eds. (2016). *Springer Handbook of Ocean Engineering*. Springer, Heidelberg, Germany.
Perez, T. (2005). *Ship Motion Control: Course Keeping and Roll Stabilisation Using Rudder and Fins*. Springer-Verlag London Limited, Leipzig, Germany.
Triantafyllou, M.S., Hover, F.S. (2003). *Maneuvering and Control of Marine Vehicles*. Lecture notes, Department of Ocean Engineering, MIT, Cambridge, Massachusetts, USA. Available online: https://ocw.mit.edu/courses/mechanical-engineering/2-154-maneuvering-and-control-of-surface-and-underwater-vehicles-13-49-fall-2004/lecture-notes/1349_notes.pdf

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*
Valčić, M., Tomas, V. (2020). *Guidance and control of vessels*. Lecture Notes, Faculty of Maritime Studies, University of Rijeka, Rijeka, Croatia.	Available to enrolled students (pdf)	1-3
Fossen, T.I. (2011). *Handbook of Marine Craft Hydrodynamics and Motion Control*. John Wiley & Sons Ltd, Chichester, UK.	2	1-3
Sørensen, A.J. (2018). *Marine Cybernetics: Towards Autonomous Marine Operations and Systems*. UK-2018-76, Department of Marine Technology, the Norwegian University of Science and Technology (NTNU), Trondheim, Norway. Available online: http://folk.ntnu.no/assor/Public/2018-08-20 marcyb.pdf	Available online	1-3
Valčić, M. (2020). *Optimization of thruster allocation for dynamically positioned marine vessels*. PhD Thesis, University of Rijeka, Faculty of Engineering, Rijeka, Croatia. Available online: https://www.bib.irb.hr/1053538	Available online	1-3
Valčić, M. (2015). *Intelligent estimation in dynamic positioning systems of marine vessels*. PhD Thesis, University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia. (In Croatian). Available online: https://repository.pfri.uniri.hr/	Available online	1-3

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

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MARITIME LOGISTICS AND MANAGEMENT

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General information		
Course coordinator	Borna Debelić, PhD	
Course title	**Maritime domain allocation and coastal zone management**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The main objective is to familiarize students with actual scientific knowledge about the characteristics of coastal zone management and the issues of the allocation of the maritime domain in the context of recent research and with the connection to the practice. To provide an overview of current issues that arise in the practice of integrated coastal zone management and maritime domain management with the elaboration of selected case studies, in terms of theoretical concepts that modern science offers as a potential for overcoming the detected problems.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

It is expected that students after passing the exam for the course Maritime Domain Allocation and Coastal Zone Management can:

- Correctly interpret theoretical framework and the characteristics of allocation issues and the actions of the institutions;
- Describe different features and scope of economic governance and interpret the resource allocation problems and the underlying mechanisms;
- Describe and interpret the application of game theory to the allocative processes;
- Correctly interpret categories of goods and allocative specificities, as well as the issue of collective action and economic governance;
- Perform and analyse different possibilities of application of the theory of public and social choice on explanations of allocative function;
- Interpret fundamental economic determinants of maritime domain and interpret collective action characteristics of the maritime domain allocation problems;
- Correctly interpret maritime domain allocation mechanisms and the role of institutions in the allocation of the maritime domain;
- Describe economic significance of the maritime domain allocation and coastal zone management, and apply techniques of assessing and evaluating empirical conditions;
- Conduct and interpret research tasks in the field of coastal zone management.

1.4. Course content

The theoretical framework and the characteristics of allocation issues and the actions of the institutions. The theory of institutions in terms of allocative function. Features and scope of economic governance. The

allocation of resources and the underlying mechanisms. The application of game theory to the allocative processes. Possibilities of application of the theory of public and social choice on explanations of allocative function. Categories of goods and allocative specificities. The issue of collective action and economic governance. The fundamental economic determinants of maritime domain. Collective action characteristic of the allocative problems of the maritime domain. Allocation mechanisms of the maritime domain. The role of institutions in the allocation of the maritime domain. The economic significance of the allocation of the maritime domain and coastal zone management. Important international experiences in the field of coastal zone management and maritime domain management. Options for improving the allocation of the maritime domain and coastal zone management.

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

1. Actively participate in class;
2. Development of project assignment;
3. Implementation of evaluation research for the project task;
4. Preparing paper that presenting the research results of the project assignment;
5. Passing the written and oral final exam.

1.8. Evaluation[47] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1	Experiment	1
Written exam		Oral exam	1	Essay		Research	1.6
Project	1	Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The work of students in the course will be evaluated and assessed during classes. The total number of points a student can achieve is 100 (assessed activities are indicated in the table).

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

1. Debelić, B.: Maritime Common Good and Coastal Zone Management, Pomorstvo: Scientific Journal of Maritime Research, 32 (1), 2018, p. 151-161.
2. Debelić, B.: Rationalisation of maritime domain allocation mechanism of Republic of Croatia : doctoral thesis, Rijeka, 2013.
3. Ostrom, E.: Upravljanje zajedničkim dobrima: Evolucija institucija za kolektivno djelovanje, Naklada Jesenski i Turk, Zagreb, 2006.
4. Vojković, G.: Pomorsko dobro i koncesije. Hrvatski hidrografski institut, Split, 2003.
5. Bolanča, D. et al.: Pomorsko dobro, Inženjerski biro, Zagreb, 2005.

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

1. Mance, D., Vilke, S., Debelić, B.: Sustainable Governance of Coastal Areas and Tourism Impact on Waste Production: Panel Analysis of Croatian Municipalities, Sustainability, 12 (18), 2020., p. 7243.

[47] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

2. Debelić, B.: Agency Theory and a Concession Relation in Ports Open to Public Traffic in the Function of Empowerment of Entrepreneurial Initiatives, Pomorstvo: Scientific Journal of Maritime Research, 27 (1), 2013., p. 225-246.
3. Ostrom, E.: Beyond Markets and States: Polycentric Governance of Complex Economic Systems. American Economic Review, 100 (3), 2010., p. 641–672.
4. Petak, Z.: Politička ekonomija kolektivnog odlučivanja: doprinos Buchanana i Tullocka. Politička misao, 36 (3), 1999., p. 71–88.
5. Williamson, O. E.: The Economics of Governance. American Economic Review, 95 (2), 2005., p. 1–18.

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*
Debelić, B.: Racionalizacija mehanizma alokacije pomorskog dobra Republike Hrvatske: doktorska disertacija, Rijeka, 2013.	5	1-10
Ostrom, E.: Upravljanje zajedničkim dobrima: Evolucija institucija za kolektivno djelovanje, Naklada Jesenski i Turk, Zagreb, 2006.	5	1-10
Vojković, G.: Pomorsko dobro i koncesije. Hrvatski hidrografski institut., Split, 2003.	5	1-10
Bolanča, D. et al.: Pomorsko dobro, Inženjerski biro, Zagreb, 2005.	5	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

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General information		
Course coordinator	Alen Jugović, PhD	
Course title	**Economics of infrastructure projects in port systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The study of the theory and practice of managing infrastructure projects in our country and the world with special emphasis on the infrastructure of port projects financed by international institutions (WB, European Bank for Reconstruction and Development, EU funds, etc.), domestic institutions (from the budget, the Croatian National Bank and others) and private entities. At the same time, particular emphasis is placed on the impacts that such projects, but also the ports themselves, have.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam, it is expected that the students will be able to:

1) Establish a link between the financing of port infrastructure and the functionality of the port system in given the limitations of technical resources and port infrastructure;
2) Highlight and describe the types and models of financing port infrastructure;
3) Measure the effectiveness of a particular model of financing;
4) Identify the importance of budgetary funds in the total revenues of port authorities to prove whether he is related to the effectiveness of operations of port authorities;
5) Compare the models of governance with elimination of shortcomings to achieve maximum social and economic benefit for each function of the port authority as a seaport manager.

1.4. Course content

- The importance of port infrastructure for the port, the city, the region and the entire economy;
- Planning the development of port infrastructure: short, medium and long-term plans;
- Preparation of infrastructure projects – Market Analysis;
- Financing infrastructure: international, national and private sources of capital – specificity / advantages and disadvantages (Identification of required capital. The determination of liabilities to sources of capital. Budgeting as an instrument of project management);
- Examples of financing port infrastructure projects in Croatia in the ports of international importance and in the ports of county and local importance;
- Economic impacts of port investments: micro and macro effects.
- The role of management in the implementation of port investment.

1.5. Teaching methods		
	☒ lectures	☒ individual assignment
	☐ seminars and workshops	☐ multimedia and network

	☐ exercises ☐ long distance education ☒ fieldwork	☐ laboratories ☐ mentorship ☐ other _____
1.6. Comments		

1.7. Student's obligations

Attending lectures and field work. Examination through activities in class and the final oral exam.

1.8. Evaluation[48] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam	1	Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio		Article preparation	2				

1.9. Assessment and evaluation of student's work during classes and on final exam

The student is evaluated through classroom activities, research and dedicated article (essay) and final oral exam.

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

1.) Jugović, Alen: Upravljanje morskom lukom, Rijeka: Faculty of Maritime Studies; 2012.
2.) Wayne-K-Talley: Port Economics, Routledge, Taylor and Francis Group, London & New York, 2009.
3.) Theo Notteboom, Athanasios Pallis and Jean-Paul Rodrigue (2021) Port Economics, Management and Policy, New York: Routledge.

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

1.) Coto-Millán, Pablo, Pesquera, Miguel Angel, Castanedo, Juan: Essays on Port Economics, 2010, XVIII.
2.) Stampford, M: Maritime Economics – third edition, Routledge, Taylor and Francis Group, London & New York, 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*
Jugović, Alen: Upravljanje morskom lukom, Rijeka, Faculty of Maritime Studies, 2012.	50	20
Stampford, M: Maritime Economics – third edition, Routledge, Taylor and Francis Group, London & New York, 2009.	5	20

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[48] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

University of Rijeka
FACULTY OF MARITIME STUDIES

General information		
Course coordinator	Ana Perić Hadžić, PhD	
Course title	**Economics of public private partnerships**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The main goal of the course to acquaint PhD students with the latest knowledge and insights regarding the features of public-private partnerships as a model of financing the public sector which emerged as a new and specific way of economic development in the world. The partnership includes agreements between the government, private sector, non-governmental organizations and other actors of civil society and with him regarding the application of the institution of good governance that contain recognizable (transparent) processes in terms of sustainable development.

In addition to the primary objective, the other objectives of the course are to enable PhD students to understand and reflection on:

- economic-development solving of those problems in society that the public sector alone cannot (no financial possibilities), the private sector has no interest to self-invest (lack of return on invested funds), respecting the interests of the civil sector;
- theoretical-political links, motives and objectives, risks, and interest in connecting partners in public-private partnerships;
- modern trends in port sector development through the model of public-private partnerships such as concessions, greenfield investments and contracts on the operational project management;
- concrete examples emerged from recent research enable PhD students to draw conclusions on the advantages and disadvantages of the application of public private partnership in the world and especially in the Republic of Croatia.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:

1. Interpret new knowledge through research and demonstrate a systematic understanding of areas of the course, and apply research skills and methods related to research area of models connecting the public and private sectors.
2. Demonstrate the ability to understand, design, implement and customize serious research process, thus gaining knowledge about the specific consideration of economic development based on partnership of the public and private sector, which the student confirms by publishing their results in renowned publications.
3. Critically analyze, evaluate, assess and synthesize the existing and new ideas on ways of linking the

public and private sectors.
4. Discuss about their area of expertise with peers, the scientific community and the wider community.
5. In academic and professional contexts promote technological, social and cultural progress in the society of knowledge through the proposals of public-private partnerships beneficial to the whole society.

1.4. Course content

Important characteristics of the public and private sector partnership. Theoretical, economic and political links between PPPs. Areas of classic application of public-private partnership models. Advantages and disadvantages of financing through public private partnerships. Economic motives and participants in connecting public and private sectors. Models and forms of cooperation between public and private sector. The risks of linking public and private sectors. The role of the European Union and other international organizations in projects of public-private partnerships. Analysis and evaluation of the development of public-private partnerships in the world's seaports. World practice in the application of the public-private partnership in the systems of sea ports. Public-private partnership in the system of sea ports of the Republic of Croatian. The legal framework applying public-private partnership in the port system of the Republic Croatian. Port of Rijeka - example of (un)successful projects. Multicriteria decision making to help in decision-making on public private partnerships.

1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other simulators_____
1.6. Comments	It is expected that students who enrol in this course are experts in the area of port sector management.	

1.7. Student's obligations

Student's obligations, in addition to attendance, seminars and workshops are based on independent tasks; seminar paper or preparation of scientific paper for journal or conference related to research current topics in the field of public-private partnerships.

1.8. Evaluation[49] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experiment	
Written exam		Oral exam	1	Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio		Publication or presentation of research					

1.9. Assessment and evaluation of student's work during classes and on final exam

The learning outcomes are assessed and evaluated through the monitoring of students' work on the research, the obtained research results and the manner and quality of the publication or presentation of research.

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

1. Yescombe E.R.: Javno-privatno partnerstva, Načela politike i financiranje, MATE d.o.o., Zagreb, 2010.
2. Perić Hadžić, A., Jugović, A., Perić, M.: Criteria for the management partnership model in Croatian seaports, Economic Research-Ekonomska Istraživanja Vol. 28 , Iss. 1,2015, 226-242, DOI: 10.1080/1331677X.2015.1041775, 2015 Impact Factor: 0.466,

[49] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

http://dx.doi.org/10.1080/1331677X.2015.1041775
3. Perić Hadžić, A.: Javno-privatno partnerstvo u hrvatskim morskim lukama, Pomorstvo: Scientific Journal of Maritime Research, Vol.26 No.1 Lipanj 2012., str. 113-137.
4. Nikšić, M, Perić Hadžić, A.: Uloga Europske investicijske banke u javno-privatno partnerstvo, grupa autora, Javno-privatno partnerstvo; turizam, europska i svjetska iskustva, FINTRADE & TOURS d.o.o., Rijeka, 2007.
5. Čišić, D., Perić, A.: Primjena modela javno-privatnog partnerstva na razvoj luka, Pomorstvo, Pomorski fakultet u Rijeci, 2005., prethodno priopćenje, p. 101-113.

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

1. Developing Best Practice for Promoting Private Sector Investment in Infrastructure, Ports, Asian Development Bank, 2000., www.adb.org
2. On Public Financing and Charging Practices in the Community Sea Port Sector, Commission staff Working document, Commission of the European Communities, Brussels, 2001.
3. Haarmeyer D., Yorke, P.: Port Privatization: An International Perspective, Policy study No. 156, April, 1993.
4. Green Paper on Public – Private Partnership and Community Law on Public Contracts and Concessions, Commission of the European Communities, Brussels, 30.4.2004. COM (2004) 327 final
5. Juričić, D., Veljković, D.: Financiranje kapitalnih projekata lokalnog javnog sektora, Ekonomski fakultet Rijeka, Vitagraf d.o.o., Rijeka 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*
Yescombe E.R.: Javno-privatno partnerstva, Načela politike i financiranje, MATE d.o.o., Zagreb, 2010.	Available online	1-10
Perić Hadžić, A., Jugović, A., Perić, M.: Criteria for the management partnership model in Croatian seaports, Economic Research-Ekonomska Istraživanja Vol. 28, Iss. 1,2015, 226-242, DOI: 10.1080/1331677X.2015.1041775, 2015 Impact Factor: 0.466, http://dx.doi.org/10.1080/1331677X.2015.1041775	Available online	1-10
Perić Hadžić, A.: Javno-privatno partnerstvo u hrvatskim morskim lukama, Pomorstvo: Scientific Journal of Maritime Research, Vol.26 No.1 Lipanj 2012., str. 113-137.	Available online	1-10
Nikšić, M, Perić Hadžić, A.: Uloga Europske investicijske banke u javno-privatno partnerstvo, grupa autora, Javno-privatno partnerstvo; turizam, europska i svjetska iskustva, FINTRADE & TOURS d.o.o., Rijeka, 2007.	Available online	1-10
Čišić, D., Perić, A.: Primjena modela javno-privatnog partnerstva na razvoj luka, Pomorstvo, Pomorski fakultet u Rijeci, 2005., prethodno priopćenje, p. 101-113.	Available online	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

University of Rijeka
FACULTY OF MARITIME STUDIES

General information		
Course coordinator	Saša Aksentijević, PhD	
Course title	**Business continuity and resilience of port clusters**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The objective of this course is to equip doctoral students with the understanding and application of the latest knowledge in the area of corporate governance of information security in port clusters, business continuity, and disaster recovery, with a special emphasis on the specific requirements of various logistics stakeholders in maintaining operational resilience. The interrelationship between corporate governance of IT, integral and information security, and legal obligations regarding information security and data privacy protection will be analyzed, aiming to comprehensively inform participants about the topics of the lectures. Additionally, the course seeks to provide answers to specific questions from doctoral students related to integral and information security and highlights the importance of considering corporate information security in the context of the economic impact of logistics, taking into account the latest technological trends such as cloud computing, IoT, blockchain, and other disruptive technologies.

A special focus is placed on the security analysis of every step in the construction and use of the single window system for managing maritime administrative formalities, cargo, and customs procedures, emphasizing interoperability, the application of electronic signatures, and achieving contracted service levels at terminal operators (TOS), port community systems (PCS), and the national single window (NSW).

Through interactive teaching, doctoral students will explore key criteria for investing in information security solutions, the biggest challenges in IT security and the specifics of new technologies, methodologies for quantifying investment success, requirements for information security and business continuity in the context of the European maritime single window, and strategies and techniques for ensuring the resilience of port clusters despite cyber attacks, natural disasters, or economic downturns. Furthermore, through dynamic exchanges of theoretical and practical examples, students will receive a comprehensive overview of all domains of information security and business continuity, with a strong emphasis on the strategic orientation of corporate governance, tailored to market conditions.

1.2. Course enrolment requirements

According the Regulations.

1.3. Expected course learning outcomes

After successfully passing the exam, doctoral students will be able to:

1. Master the methods of the COBIT framework's impact on managing the IT function of logistics stakeholders – Students will understand how to implement control measures within the COBIT framework to address business risks and solve technical problems in corporate IT governance.

2. Analyze the impact of the ISO 27001:2022 standard on the confidentiality, integrity, and availability of information – Students will explore how a formal methodology for establishing an information security management system can affect the security aspects of logistics stakeholders' information systems.

3. Anticipate changes in the IT service delivery system through the application of ITIL 4 Edition – Through practical application of ITIL methodology, students will learn to predict and manage changes in IT services that result from the implementation of an information security management system.

4. Develop skills for risk assessment and treatment in accordance with the latest knowledge – Students will acquire the ability to quantitatively assess risks and justify the introduction of technological and organizational solutions into the IT systems of logistics stakeholders.

5. Understand specific risks and principles of managing cybersecurity in the context of port clusters – Students will thoroughly understand how to manage risks and respond to incidents, with a focus on the specific challenges of cybersecurity for port stakeholders.

6. Recognize the role of international regulations and standards in the cybersecurity of port infrastructures – Students will learn how international regulations and standards influence the management of cybersecurity and what are the best practices for protecting port operations.

Study the current state and the latest research in the field of cybersecurity of port clusters – Through analysis of the current state and new research, students will gain knowledge about cyber threats, attacks, and protection methods specific to port clusters, as well as the development of threats and solutions that address them in the future.

1.4. Course content

INFORMATION SECURITY MANAGEMENT IN PORT OPERATIONS – MANAGEMENT OVERVIEW

- Integral corporate security management
- Information security position within port stakeholders
- Information capital and knowledge management

FINANCIAL ASPECT OF INFORMATION SECURITY AND BUSINESS CONTINUITY

- Characteristics of investments in information security
- Description or running costs of information security
- Modern trends: outsourcing, cloud computing, everything as a service
- Usage of quantitative methods in decision making in information security investing

MANAGEMENT OF CYBERSECURITY IN PORT OPERATIONS

- Basic glossary of cybersecurity
- Information security management in port stakeholders
- Information security technologies
- Information security and privacy legal requirements
- Organization of information security in port stakeholders
- Basic information security measures

- Investments and running costs of information security
- Portfolio approach in information security
- Intellectual capital security

INTEGRATION OF INFORMATION SECURITY AND BUSINESS CONTINUITY IN PORT OPERATIONS

- Relations between corporate and information security
- Disaster recovery planning
- Creation and execution of business continuity plans
- Ensuring port cluster resilience

INFORMATION SECURITY IN BUILDING AND OPERATING SINGLE WINDOWS

- Use of electronic digital signature
- Single Sign On (SSO)
- Interoperability and single window information security
- Challenges in ensuring business continuity and disaster recovery of single window 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	not applicable	

1.7. Student's obligations

Research under mentorship and preparation of research results publication.

1.8. Evaluation[50] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	4.6
Project	1	Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Evaluation of learning outcomes is conducted through assigned research within the course topics in a part of the project carried out at the university within the theme of business continuity and resilience of the port cluster.

Examples of learning outcome assessments:

1. Creation of an Analytical Paper – Doctoral students are required to write an analytical paper in which they will thoroughly examine how the COBIT framework affects the management of the IT function of logistics stakeholders, using real examples or hypothetical case studies.
2. Creation of a Research Paper on the Application of the ISO 27001:2022 Standard – Doctoral students are required to write a research paper in which they will analyze the impact of ISO 27001:2022 on

[50] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

information security, showcasing examples from practice and theoretical foundations.

3. Creation of an Evaluation Report – Doctoral students are required to produce a report in which they will evaluate changes in the delivery of IT services as a result of the introduction of ITIL 4 Edition, including the benefits and potential challenges.
4. Creation of a Project Proposal – Doctoral students are required to create a project proposal that quantitatively assesses risks and justifies the introduction of new technological or organizational solutions, using risk assessment methods.
5. Creation of a Thematic Essay – Doctoral students are required to write an essay on the topic of specific risks and principles of managing cybersecurity in port clusters, integrating theory and practice to demonstrate a deep understanding of the subject.
6. Presentation of a Case Study – Doctoral students are required to prepare and present a case study that demonstrates how international regulations and standards impact cybersecurity in ports, analyzing specific challenges and solutions.

Creation of a Synthetic Paper on the Current State and Research – Doctoral students are required to write a synthetic paper that summarizes the current state and the latest research in the field of cybersecurity of port clusters, highlighting key findings and recommendations for further action.

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

1. Kessler, G. C., & Shepard, S. D., „Maritime Cybersecurity: A Guide for Leaders and Managers“, Elsevier, 2022.
2. Korhonen, Janne J., "Cybersecurity and the Maritime Transport Industry", Routledge, 2020.
3. UREDBA (EU) 2019/1239 EUROPSKOG PARLAMENTA I VIJEĆA od 20. lipnja 2019. o uspostavi europskog okružja jedinstvenog pomorskog sučelja i stavljanju izvan snage Direktive 2010/65/EU, L 198/64, 25.7.2019
4. Tehnička specifikacija PCS ICT sustava – Tehnička specifikacija zahtjeva informacijske sigurnosti, sukladnosti i intelektualnog vlasništva, naručitelj Lučka uprava Rijeka
5. Walker, J., “Maritime Cyber Risk Management: A Practical Guide for Shipowners. Routledge”, 2017.
6. U.S. Department of Homeland Security , "Port Cybersecurity: A Guide for Facility Security Officers", 2017.
7. Elaborat o jedinstvenom sučelju za formalnosti u pomorskom prometu i Kataloga isprava, dokumenata i podataka, Ministarstvo mora, prometa i infrastrukture, 2017.
8. Chaudry, V.P., "Maritime Cyber Safety and Security", Springer International Publishing, 2017
9. Perez, Michael J., "Cybersecurity for Industrial Control Systems: SCADA, DCS, PLC, HMI, and SIS", CRC Press, 2016.
10. The journal of maritime studies, year 22, number 2/2008, pages 245-258, “Influence of ISO 27001:2005 on Port of Rijeka security”

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

1. Aksentijević, S., Tijan, E., Nikolozo K., Perić-Hadžić A., “TOE framework in risk management during implementation of the Croatian national Port Community System”, Scientific Journal of Maritime Research 36 (2022), pages 175-186
2. Čapko, Z., Aksentijević, S., Tijan, “Economic and financial analysis of investments in information security“, E., MIPRO 2014., 26-30. svibanj 2014., 37-mi međunarodni skup, sekcija DE – Digitalna ekonomija
3. Aksentijević, S., Tijan, E., Hlača, “Investment Analysis of Information Security Management in Croatian Seaports” , MIPRO 2012., 21-25. svibanj 2012., 35-ti međunarodni skup, sekcija DE – Digitalna ekonomija
4. Aksentijević, S., Tijan, E., Hlača, B. , “Importance of organizational information security in port community systems”, MIPRO 2009, 25-29 svibanj 2009, 32-gi međunarodni skup, sekcija ISS

(Information Systems Security)
5. Tijan, E., Kos, S., Ogrizović, D.: Disaster recovery and business continuity in port community systems, Pomorstvo - Journal of Maritime Studies, 23 (2009) , 1; 243-260
6. Tijan, E.: Data Classification and Information Lifecycle Management in Port Community Systems, Pomorstvo - Journal of Maritime Studies, 2/2009 (2009) ; 557-568.
7. Maritime Mutual Risk Bulletin No. 29, "CYBER RISK MANAGEMENT: IMO GUIDELINES AND SMS INCORPORATION"

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

University of Rijeka
FACULTY OF MARITIME STUDIES

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General information		
Course coordinator	Edvard Tijan, PhD	
Course title	**Information management in seaport clusters**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

• Identify all relevant theoretical and practical features of seaports, seaport clusters and electronic business.
• Analyze the commercial and administrative processes taking place in the seaport clusters.
• Prove that the application of integral information systems for electronic business/electronic data exchange and messaging can rationalize the business of stakeholders involved in port operations as well as seaports as a whole.
• Review existing approaches to electronic business in seaports and propose a more appropriate solution – an integral model of electronic business / electronic data and messages exchange that maximizes the rationalization of business in seaport clusters.
PhD students will be offered answers to several questions on different levels:
• at a strategic level: How to improve the competitiveness of the seaport?
• at operational level: How to ensure harmonized port operations and high-quality port services?
• at a tactical level: How to optimize and efficiently use resources in the seaport cluster?

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:
Identify the stakeholders who work in the seaport clusters based on their roles and divide them into groups.
Graphically display business processes, subprocesses, and activities.
Investigate the mutual influence of the aforementioned stakeholders and evaluate their role.
Justify the rationality of the introduction of integral information systems in port operations.
Design, create and recommend the introduction of transformed business processes (reengineering).
Predict the bottlenecks that may occur during reengineering.
Suggest improvements in information and business systems of stakeholders in seaport clusters.
Improve information visibility and accuracy of information in seaport clusters.

1.4. Course content

• Flows of information in seaport clusters.
• Electronic business and electronic exchange of data and messages in seaport clusters.
• Main commercial and administrative processes taking place in seaport clusters.
• Data in administrative documents and forms exchanged in seaport clusters.
• Transformation of business processes in seaport clusters using electronic business.
• Rationalization and optimization of business through increased synergies among the stakeholders in the seaport cluster.
• The justification for introducing integrated systems for electronic data exchange and messages in seaport

clusters.

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

Research work, formulation of research results

1.8. Evaluation[51] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	4.6
Project	1	Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Assessment and evaluation of student's work is conducted through the research of specific topic.

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

1. Tijan, E, Agatić, A., Hlača, B.: Port Community System Implementation in Croatian Seaports, Promet-Traffic & Transportation. Vol 24, No 4 (2012); 305-315
2. Tijan, E., Agatić, A., Hlača, B.: Evolucija informacijsko-komunikacijskih tehnologija na kontejnerskim terminalima, Pomorstvo, 24/1 (2010)
3. Agatić, A., Čišić, D., Tijan, E.: Information Management in Seaport Clusters, Pomorstvo-Journal of maritime studies, 25 (2011), 2; 371-386
4. Čišić, D.; Perić Hadžić, A.; Tijan, E.: The economic impact of e-Business in seaport systems, MIPRO: 32nd International Convention on information and communication technology, electronics and microelectronics, Proceeding; Vol. V., Opatija, 2009.

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

1. Tijan, E., Kos, S., Ogrizović, D.: Disaster recovery and business continuity in port community systems, Pomorstvo - Journal of Maritime Studies, 23 (2009) , 1; 243-260
2. Tijan, E.: Data Classification and Information Lifecycle Management in Port Community Systems, Pomorstvo - Journal of Maritime Studies, 2/2009 (2009) ; 557-568.
3. CrimsonLogic Pte Ltd.: Study of System requirements specification for Port Community System, Release No 3.0, June 2007, 55-64
4. Jolić, N: Luke i ITS, Fakultet prometnih znanosti, Zagreb, 2008.
5. Perić Hadžić, A., Tijan, E., Jugović, A.: Regional Research-driven Marine Clusters. // Journal of China-USA Business Review. 10 (2011) , 11; 1115-1125

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*
All titles listed under 1.10 are freely available online		

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[51] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

Basic description		
Course coordinator	Livia Maglić, PhD Alen Jugović, PhD	
Course title	**Process management of smart and sustainable ports of nautical tourism**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Acquire knowledge and conduct scientific research in the field of process management of smart and sustainable ports of nautical tourism through modelling, redesign and collection of process data with the aim of improving and advancing business process performance.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:
Identify and differentiate the business processes of smart and sustainable nautical tourism ports
Apply management concepts and principles
Propose the redesign of business processes in nautical tourism ports with the aim of optimising the process
Evaluate the efficiency of processes in nautical tourism ports
Critically evaluate possible models of business process management
Create a business process management model using the specific
example of a nautical tourism port

1.4. Course content

Concepts, meaning, purpose and principles of business process management in nautical tourism ports. Strategy of business process management in nautical tourism ports. Business processes in smart and sustainable nautical tourism ports. Types and examples of business process management in smart and sustainable nautical tourism ports. Measuring and evaluating the success of business processes in smart and sustainable nautical tourism ports (measuring performance indicators). Modelling of business processes in smart and sustainable nautical tourism ports.

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

1.7. Student's obligations

Preparation of a seminar or a scientific paper on a given topic under the mentorship of the course leader.

1.8. Evaluation[52] of student's work

Course attendance	0,4	Activity/Participation	2	Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	3,6
Project		Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Learning outcomes are reviewed and assessed by monitoring the work of PhD students during research which ultimately results in the preparation of a seminar paper or the publication of a scientific paper.

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

1.) Maglić, L., Maglić, L., Grbčić, A. & Gulić, M. (2022) Marine Litter Composition in Port Areas on Mallorca Island. U: Mancini, S. & Vitiello, L. (ur.) Prime Archives in Marine Science. Hyderabad, India, Vide Leaf, str. 1-27. (https://www.bib.irb.hr/1232584).
2.) Maglić, L., Grbčić, A., Maglić, L. & Gundić, A. (2021) Application of Smart Technologies in Croatian Marinas. Transactions on maritime science, 10 (1), 1-11 doi:10.7225/toms.v10.n01.014..
3.) Ukić Boljat, H., Vilke, S., Grubišić, N. & Maglić, L. (2021) Application of multi-criteria analysis for the introduction of green port management practices: an evaluation of energy efficient mobility in nautical ports. Scientific journals of the Maritime University of Szczecin, 65 (137), 72-83 doi:10.17402/462.
4.) Maglić, L., Varaždinac, P. & Škiljan, I. (2019) Multi-Criterion Decision Model for Marina Location Selection in the County of Primorje and Gorski Kotar. Naše more : znanstveni časopis za more i pomorstvo, 66 (1), 28-36 doi:10.17818/NM/2019/1.4.
5.) Maglić, L., Grbčić, A., Maglić, L. & Blažina, A. (2022) Evaluation of ultrasonic berth sensors in the port environment: case study Port of Cristo. U: 2022 International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME). Male, Maldives, str. 1-5 doi:10.1109/ICECCME55909.2022.9988615.
6.) Kesić, B.; Jugović, A.: Menadžment pomorskoputničkih luka, Sveučilište u Rijeci Pomorski fakultet Rijeka & Liber d.o.o., Rijeka, 2006.
7.) Luković, Tihomir; Gračan, Daniela; Zec, Damir; Jugović, Alen; Petrinović, Ranka; Šerić, Neven; Milošević-Pujo, Branka; Asić, Antun; Horak, Siniša; Marušić, Zrinka et al., Nautički turizam Hrvatske, Split: Redak d.o.o., 2015.
8.) Jugović, Alen: The Impact of Maritime Passenger Traffic on the Development of Seaports and Their Surroundings // Tourism Management and Sustainable Development / Karanović, Goran ; Polychronidou, Persefoni ; Karasavvoglou, Anastasios ; Maskarin Ribarić, Helga (ur.). Opatija: Springer, Cham, 2021. str. 143-159 doi:10.1007/978-3-030-74632-2.
9.) Aksentijević, Dea; Mudronja, Gorana; Jugović, Alen: Nautical Tourism Ports in the Function of Sustainable Development of Croatian Islands // International Conference on Sustainable Transport | Book of Abstracts / / Vukelić, Goran ; Brčić, David (ur.). Rijeka: University of Rijeka, Faculty of Maritime Studies, 2022.
10.) Jugović, Alen; Sirotić, Miljen; Peronja, Ivan: Sustainable Development of Port Cities from the Perspective of Transition Management // Transactions on maritime science, 10 (2021), 2; 466-476 doi:10.7225/toms.v10.n02.w01.

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

1.) Maglić, L., Maglić, L., Grbčić, A. & Gulić, M. (2022) Composition of Floating Marine Litter in Port Areas of the Island of Mallorca. Journal of Marine Science and Engineering, 10 (8), 1-14 doi:10.3390/jmse10081079.
2.) Mudronja, Gorana; Aksentijević, Dea; Jugović, Alen: An Overview of Innovations and Technology for Sustainable Development of Seaports // Proceedings of 9th International Conference on Maritime Transport / Martínez de

[52] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

Osés, Francesc Xavier ; La Castells i Sanabra, Marcel (ur.). Barcelona, Španjolska: Universidad Politecnica de Catalunya, 2022. str. 1-15 doi:10.5821/mt.10928.

3.) Šantić, L., Maglić, L. & Vilke, S. (2012) Ocjena postojećeg stanja i razvojni planovi luka nautičkog turizma Primorsko-goranske županije. Suvremeni promet : časopis za pitanja teorije i prakse prometa, 32, 395-399. (https://www.bib.irb.hr/599392).

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. Maglić, L., Maglić, L., Grbčić, A. & Gulić, M. (2022) Marine Litter Composition in Port Areas on Mallorca Island. U: Mancini, S. & Vitiello, L. (ur.) Prime Archives in Marine Science. Hyderabad, India, Vide Leaf, str. 1-27. (https://www.bib.irb.hr/1232584).	Available online	20
2. Maglić, L., Grbčić, A., Maglić, L. & Gundić, A. (2021) Application of Smart Technologies in Croatian Marinas. Transactions on maritime science, 10 (1), 1-11 doi:10.7225/toms.v10.n01.014..	Available online	20
3. Ukić Boljat, H., Vilke, S., Grubišić, N. & Maglić, L. (2021) Application of multi-criteria analysis for the introduction of green port management practices: an evaluation of energy efficient mobility in nautical ports. Scientific journals of the Maritime University of Szczecin, 65 (137), 72-83 doi:10.17402/462.	Available online	20
4. Maglić, L., Varaždinac, P. & Škiljan, I. (2019) Multi-Criterion Decision Model for Marina Location Selection in the County of Primorje and Gorski Kotar. Naše more : znanstveni časopis za more i pomorstvo, 66 (1), 28-36 doi:10.17818/NM/2019/1.4.	Available online	20
5. Maglić, L., Grbčić, A., Maglić, L. & Blažina, A. (2022) Evaluation of ultrasonic berth sensors in the port environment: case study Port of Cristo. U: 2022 International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME). Male, Maldives, str. 1-5 doi:10.1109/ICECCME55909.2022.9988615.	Available online	20
6. Kesić, B.; Jugović, A.: Menadžment pomorskoputničkih luka, Sveučilište u Rijeci Pomorski fakultet Rijeka & Liber d.o.o., Rijeka, 2006.	30	20
7. Luković, Tihomir; Gračan, Daniela; Zec, Damir; Jugović, Alen; Petrinović, Ranka; Šerić, Neven; Milošević-Pujo, Branka; Asić, Antun; Horak, Siniša; Marušić, Zrinka et al., Nautički turizam Hrvatske, Split: Redak d.o.o., 2015.	5	20
8. Jugović, Alen: The Impact of Maritime Passenger Traffic on the Development of Seaports and Their Surroundings // Tourism Management and Sustainable Development / Karanović, Goran ; Polychronidou, Persefoni ; Karasavvoglou, Anastasios ; Maskarin Ribarić, Helga (ur.). Opatija: Springer, Cham, 2021. str. 143-159 doi:10.1007/978-3-030-74632-2.	Available online	20
9. Aksentijević, Dea; Mudronja, Gorana; Jugović, Alen: Nautical Tourism Ports in the Function of Sustainable Development of Croatian Islands // International Conference on Sustainable Transport | Book of Abstracts / / Vukelić, Goran ; Brčić, David (ur.). Rijeka: University of Rijeka, Faculty of Maritime Studies, 2022.	Available online	20
10. Jugović, Alen; Sirotić, Miljen; Peronja, Ivan: Sustainable Development of Port Cities from the Perspective of Transition Management // Transactions on maritime science, 10 (2021), 2;	Available online	20

466-476 doi:10.7225/toms.v10.n02.w01.		

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Biserka Rukavina, PhD Nikola Mandić, PhD	
Course title	**Legal framework for maritime domain and sea port management**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of this course is to enable students to acquire knowledge of the legal aspect of maritime domain and seaport management. Furthermore, the aim is to encourage students to study and research the maritime and administrative legal regulations on maritime domain and seaports. By acquiring new knowledge, students should be able to apply the theoretical characteristics of concessions and concessionary approval to concrete cases, recognize the deficiencies of positive legal regulations and actively contribute to the effective implementation of these institutes.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Upon completion of the course, students will be able to:
1. Define and interpret basic legal principles and norms relating to maritime domain and seaports.
2. Explain the procedure for determining the borders of the maritime domain.
3. Explain the procedure for granting concessions of maritime domain.
3. Recognize and explain the differences between concessions and concessionary approval.
5. Apply theoretical characteristics of concessions and concessionary approval to concrete cases.
6. Analyze the deficiencies of positive legal regulations and explain possible future solutions.

1.4. Course content

1. The legal status of maritime domain and sea ports in the Republic of Croatia.
2. Legal framework for concessions in the Republic of Croatia.
3. Concession grant procedure.
4. Concessionary approval grant procedure.
5. Maritime domain and sea ports – future 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. Seminar paper. Oral exam.

1.8. Evaluation[53] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experiment	
Written exam		Oral exam	3.6	Essay		Research	
Project		Continuous assessmet		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Evaluation of learning outcomes is carried out through preparation of seminar paper and oral exam.

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

1. Maritime Domain and the Sea Ports Act, Official Gazette of the Republic of Croatia, No. 158/03., with amendments.
2. The Concession Act, Official Gazette of the Republic of Croatia, No. 69/17., with amendments.
3. Bolanča, Dragan, Pomorsko dobro i koncesije, Pomorsko dobro – problemi i perspektive, Inženjerski biro d.d. Zagreb, 2005.
4. Seršić, Vanja, Koncesije na pomorskom dobru, Novi informator, Zagreb, 2011.

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

1. Bolanča, Dragan, Pomorsko dobro u svjetlu novog Zakona o pomorskom dobru i morskim lukama iz 2003. , Poredbeno pomorsko pravo, god. 43., br. 158., 2004.
2. Kundih, Branko, Pomorsko dobro sutra - *de lege ferenda*", Nekretnine u vlasništvu Republike Hrvatske i opća dobra, Inženjerski biro d.d., Zagreb, 2007.
3. Rak, Loris, Rukavina, Biserka, Jelčić, Olga, Uvođenje općeg stvarnopravnog režima na objektima lučke suprastrukture izgrađenim na temelju ugovora o koncesiji, Poredbeno pomorsko pravo, Jadranski zavod HAZU, Zagreb, br. 169., 2015.
4. Seršić, Vanja, Institut koncesija prema novom Zakonu o koncesijama", I dio Informator, br. 5734, 18.2.2009. i II dio Informator, br. 5735, 21.2.2009.

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*
Maritime Domain and the Sea Ports Act, Official Gazette of the Republic of Croatia, No. 158/03., with amendments.	Unlimited. Text available in Official Gazette.	1-10
The Concession Act, Official Gazette of the Republic of Croatia, No. 69/17., with amendments.	Unlimited. Text available in Official Gazette.	1-10
Bolanča, Dragan, Pomorsko dobro i koncesije, Pomorsko dobro – problemi i perspektive, Inženjerski biro d.d. Zagreb, 2005.	2	1-10
Seršić, Vanja, Koncesije na pomorskom dobru, Novi informator, Zagreb, 2011.	5	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[53] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Mladen Jardas, PhD Gorana Mudronja, PhD	
Course title	**Logistics and Development of Port Cities**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of the course is to explore the role of logistics in port cities and its impact on urban economic development. Students will gain advanced knowledge of the integration of logistics systems, environmentally sustainable practices, and digitalization in the context of urban development in port cities. Additionally, the course will analyze the impact of logistics on economic growth and the optimization of traffic flows in urban areas.

1.2. Course enrolment requirements

-

1.3. Expected course learning outcomes

After completing and passing the course, students will be able to:

1. Evaluate the role of logistics in port cities and its impact on economic development.
2. Assess sustainable logistics strategies and their economic contribution to urban areas.
3. Analyze the role of digitalization and smart technologies in optimizing port city logistics.
4. Propose innovative approaches to improving urban logistics in the context of economic and environmental sustainability.
5. Examine best practices in managing logistics in port cities.

1.4. Course content

Port Cities as Logistics and Economic Hubs
- The significance of port cities in global supply chains
- Multimodal transport and logistics strategies

Sustainable Development and Environmental Aspects of Port City Logistics
- Green logistics and pollution reduction strategies
- Environmentally friendly logistics infrastructure

Urban Logistics and Integration of Delivery Systems
- Delivery optimization and traffic congestion reduction
- Smart logistics solutions in port urban areas

Digitalization and Technological Innovations in Port City Logistics
- IoT, blockchain, and artificial intelligence in logistics
- Digital platforms for smart logistics management

Economic Development of Port Cities and Logistics Systems
- Development of logistics solutions as drivers of economic activity
- Investments and financing of logistics projects in port cities

Case Studies and Practical Analysis
- Examples of successful logistics solutions in port cities
- Analysis of challenges and opportunities in urban logistics development

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

1.7. Student's obligations

Student responsibilities include attending classes, completing an individual assignment in the form of a seminar paper or preparing a publication in a scientific journal or a presentation at a scientific conference, depending on their field of interest, as well as passing the exam.

1.8. Evaluation[54] of student's work

Course attendance	0,4	Activity/Participation		Seminar paper	2	Experimental work	
Written exam		Oral exam	1	Essay		Research	2,6
Project		Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Learning outcomes are assessed and evaluated through monitoring the work of doctoral students during research, analyzing the results obtained, the method and quality of preparation, publication, or presentation of the research, and an oral exam.

Examples of evaluating learning outcomes during classes and on the final exam:

1. How does logistics contribute to the economic development of port cities and what are the key challenges in this process?
2. What are the main sustainable logistics strategies in urban environments and how do they contribute to the development of port cities?
3. How can digitalization and smart technologies improve the efficiency of logistics processes in port cities?
4. Design and justify an innovative model of urban logistics that would simultaneously improve economic efficiency and reduce the environmental footprint of port cities.
5. Choose one example of good practice in logistics management of a port city and analyze its key elements and impact on the local economy.

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

1. Notteboom, T., Pallis, A. & Rodrigue, J.-P. (2022). Port Economics, Management and Policy. Routledge.

[54] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

2. Jacobs, F.R. & Chase, R.B. (2018), Upravljanje operacijama i lancem opskrbe, Mate, Zagreb

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

1. Rodrigue, J.-P. (2020). The Geography of Transport Systems. Routledge.
2. Mudronja, G.; Jugović, A.; Škalamera-Alilović, D. (2020.) Seaports and Economic Growth: Panel Data Analysis of EU Port Regions, Journal of marine science and engineering, 8 (2020), 12; 1017
3. Mudronja, G.; Jugović, A.; Škalamera-Alilović, D. (2019.): Research and Development and Economic Growth: EU Port Regions, Zbornik radova Ekonomskog fakulteta u Rijeci : časopis za ekonomsku teoriju i praksu, Vol. 37, No. 2, str. 587-602., ISSN 1331-8004
4. Mudronja, G.; Aksentijević, D. (2024.). Framework for Planning the Implementation of Innovations in Seaport Operations: Case Study of the Seaport of Rijeka u u K. Skala i V. Mornar (ur.) MIPRO 2024 47th ICT and Electronics Convention Proceedings, (str. 1117-1122), Opatija, Hrvatska: Croatian Society for Information, Communication and Electronic Technology – MIPRO.
5. Mudronja, G.; Aksentijevć, D.; Jugović, A. (2022.). An overview of innovations and technology for sustainable development of seaports u F. X. Martinez de Oses, M. Castellis-Sanabra (ur.). Proceedings of 9th International Conference on Maritime Transport (str. 1-15). Barcelona, Španjolska: Universidad Politecnica de Catalunya
6. Mudronja, G. (2020.). Inovacije i tehnološki napredak u poslovanju morskih luka i njihov utjecaj na gospodarstvo. u K. Skala (ur.) MIPRO 2020 43rd International Convention Proceedings, (str. 1737-1742), Opatija, Hrvatska: Croatian Society for
7. Jardas, M.; Perić Hadžić, A.; Ogrizović, D. Application of the MAMCA Method in the Evaluation of Delivery Flows within City Centers: A Case Study of Rijeka. Urban Sci. 2024, 8, 149. https://doi.org/10.3390/urbansci8030149
8. Jardas, M.; Perić Hadžić, A.; Tijan, E. Defining and Measuring the Relevance of Criteria for the Evaluation of the Inflow of Goods in City Centers. Logistics 2021, 5, 44. https://doi.org/10.3390/logistics5030044
9. Jardas, M., Krljan, T., Perić Hadžić, A. i Grubišić, N. (2020). Distribution center logistics optimization model – City of Rijeka case study. Pomorstvo, 34 (1), 185-194. https://doi.org/10.31217/p.34.1.20

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*
Notteboom, T., Pallis, A. & Rodrigue, J.-P. (2022). Port Economics, Management and Policy. Routledge. Available online: https://porteconomicsmanagement.org/	5	
Jacobs, F.R. & Chase, R.B. (2018), Upravljanje operacijama i lancem opskrbe, Mate, Zagreb	7	

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

TRANSPORT SYSTEM

General information		
Course coordinator	Tanja Poletan Jugović, PhD	
Course title	**Planning of transport flows and transport route valorisation**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

- Analysis of THE rules and factors that determine the formation, spatial distribution, consolidation of cargo flows and transport route valorisation on the transport market;
- Exploring the basic rules and specifics of the analysis and evaluation of transport supply, demand and the environment (as the main factors of competitiveness and transport route valorisation on the transport services market);
- Developing conclusions on the general assumptions for maritime and land transport route valorisation and for cargo flows attracting (for concrete examples of transport routes);
- Studying the analitics and specificity of tracking cargo flows on the world, regional, national level (according to different criteria) as a function of planning cargo flows and defining activities for their intensification;
- Detection of current challenges in planning transport flows and valorization of the transport route in the context of sustainability;
- Studying the methodology and multicriterial analysis model of cargo flow planning and transport route valorisation.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:

1. Analyse and interpret (in theoretical and practical sense) geo-traffic, socio-economic factors and patterns of formation, spatial distribution and consolidation of cargo flows on the transport route;
2. Systematize and argue the general and specific factors of competitiveness of the route (corridor) on the transport market (in theory and in practical terms to a specific example of the route);
3. Argue the importance of the relevant phenomena for the evaluation (competitiveness) of the transport route (corridor) on the transport market;
4. Analyse, plan and optimize the relevant indicators for cargo flows on the transport route (corridor);
5. Plan and optimize the factors of route (corridor) valorisation on the transport market.

1.4. Course content

- The basic principles and factors of formation, distribution and consolidation of cargo flows.
- Indicators of the structure and dynamics of cargo flows – geo-traffic analysis of international cargo flows, Croatia in international trade flows.
- Valuation of traffic direction in the market of transport services – aspect offers (competitiveness of

transport services), the aspect of demand (comprehensiveness of requirements, needs and preferences of service users), the aspect of the environment (the presence of competition from alternative transport routes).

- Basic and specific determinates of passenger and cargo flow planning.
- Current challenges in the planning of transport flows and transport route valorization in the context of sustainability
- Multi-criteria simulation models and optimization of transport route valorisation (the specific example).

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 (lectures or consultations)
- Research and study work (seminar) or publication of a scientific paper related to the conducted research
- Presentation of research or presentation of scientific paper related to the conducted research

1.8. Evaluation[55] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experiment	
Written exam		Oral exam	1.6	Essay		Research	2
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

- course attendance (lectures or consultations) - learning outcomes 1-5; 0,4 ECTS = 10 height of assessment points
- research and study work - seminar/scientific paper - learning outcomes 4-5; 2 ECTS = 35 height of assessment points
- presentation of research - seminar/scientific paper - learning outcomes 4-5; 1 ECTS = 35 height of assessment points
- Oral exam - learning outcomes 1-5; 1,6 ECTS; 20 of height of assessment points

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

- teaching materials and published scientific papers of lecturer (course coordinator)
- Poletan, T., Robni tokovi, Faculty of Maritime Studies, University in Rijeka, 2014.
- Jean – Paul Rodrigue, The Geography of Transport Systems, - Fifth edition, New York: Routlege, 2020. (selected chapters)

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

- Scientific paper in scientific journals (Journal of Transportation Geography, Transportation Research, Pomorstvo – Scientific Journal of Maritime Research), projects and other researches related to the course
- Actual statistical sources and databases: Eurostat, Shipping Statistics and Market Review, ISL (Institute

[55] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

of Shipping Economics and Logistics), Bremen; Shipping Statistics and Market Review, ISL (Institute of Shipping Economics and Logistics), Bremen, … (the latest numbers with actual data) for the purpose of obtaining current data related to the problem of researchScientific papers published in scientific journals *(Journal of Transportation Geography, Transportation Research, Pomorstvo – Scientific Journal of Maritime Research),* projects and other related research

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 materials and published research papers of lecturer (course coordinator)	Available online	2
Poletan, T., Robni tokovi, Faculty of Maritime Studies, University in Rijeka, 2014.	5	2
Jean – Paul Rodrigue, The Geography of Transport Systems, - Fifth edition, New York: Routlege, 2020. (selected chapters)	Available online + 2	2

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

University of Rijeka
FACULTY OF MARITIME STUDIES

General information		
Course coordinator	Krešimir Buntak, PhD	
Course title	**Digital transformation of business and SMART management**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The course aims to understand digital transition and transformation as a key environment and strategy for governance and modern businesses. Accordingly, in addition to the new technologies and concepts of Industry 4.0, knowledge of the concept of sustainable and corporate social responsibility (CSR) is also of great importance. Based on that, a new concept of SMART management is being developed, which students will be familiar with and analyse in the context of the business environment and the area of interest.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:

1. Interpret and describe the underlying settings of the digital transformation;
2. Analyse and categorise key domains of digital transformation and Industry 4.0 in particular in the context of governance;
3. Understand and valorise the term and concept of sustainable development, the main components of sustainable development, as well as the core SDGs presented by Agenda 2030;
4. Understand the term and concept of corporate social responsibility (CSR), the main principles of corporate social responsibility (CSR), and link the concept of corporate social responsibility (CSR) and the concept of sustainable development;
5. Understand the term, concept, basic principles and components of SMART management;
6. Critically assess, explore and evaluate the use of SMART management in organisations of different sizes and areas of activity.

1.4. Course content

1 Digital transformation domain:
- 1.1 Domains of digital transformation: Clients, competition, data, innovation, value;
- 1.2 Drivers of digital transformation;
- 1.3 Competence as a prerequisite for digital transformation;
- 1.4 Digital Transformation Tools;
- 1.5 Industry 4.0 and Industrial Technologies 4.0.

2 Sustainability, sustainable business and corporate social responsibility:
- 2.1 Definition and development of sustainable development;
- 2.2 Components of sustainable development;

2.3 Agenda 2030 and the Sustainable Development Goals (SDGs);
2.4 Corporate social responsibility;
2.5 Principles and core concepts of CSR;
2.6 CSR as part of the strategic management;
2.7 Sustainable development and CSR in the EU and Croatia.
3 SMART management:
3.1 Basic settings, principles, functions and management roles;
3.2 Development of management concepts and theory from classical theory to SMART management theory;
3.3 SMART management;
3.4 Key elements of SMART management;
3.5 Impact of SMART management on the competitiveness of modern business.

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 classes, conducting independent research and writing a scientific article.

1.8. Evaluation[56] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam	1.6	Essay		Research	2.0
Project		Continuous assessment		Report		Practical work	
Portfolio		Article preparation and writing	2				

1.9. Assessment and evaluation of student's work during classes and on final exam

Teaching activity	Student activity	Learning Outcome	Methods of assessment
Lectures	Listening to the lectures and participating in the debate	1-6	Attendance of teaching Teaching activity Oral exam
Self-standing tasks	Conduct of research and writing of Article	3-6	Selection of research problems Conduct of selected research Article writing

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

1. Own lectures.
2. Bartodziej, C.J., 2017. The concept industry 4.0. In The concept industry 4.0 (pp. 27-50). Springer Gabler, Wiesbaden.
3. Blewitt, J: Razumijevanje održivog razvoja, Naklada Jesenski i Turk, Zagreb 2017.
4. Matešić, M., Pavlović, D., Bartoluci, D., Društveno odgovorno poslovanje, VPŠ Libertas, Zagreb, 2015

[56] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

5. Rodgers, L. David. 2019. Vodič kroz digitalnu transformaciju. Finessa. Beograd.
6. Sikavica, P., Bahtijarević Šiber, F., Pološki Vokić, N., Suvremeni menadžment, Školska knjiga, Zagreb, 2008
7. Ustundag, A. and Cevikcan, E., 2017. Industry 4.0: managing the digital transformation. Springer.

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

1. Sikavica, P., Bahtijarević Šiber, F., Pološki Vokić, N., Temelji menadžmenta, Školska knjiga, Zagreb, 2008
2. Buntak, K., Kovačić, M. & Martinčević, I. (2020) TECHNICAL AND TECHNOLOGICAL COMPETENCE AS FOUNDATION FOR DIGITAL TRANSFORMATION. In: Drljača, M. (ed.) 21st International Symposium on Quality QUALITY – YESTERDAY, TODAY, TOMORROW.
3. Buntak, K., Kovačić, M. & Martinčević, I. (2020) Impact of digital transformation on knowledge management in organization. Advances in Business Related Scientific Research Journal (ABSRJ), 11 (1), 36-47.
4. Buntak, K., Kovačić, M. & Mutavdžija, M. (2019) Internet of things and smart warehouses as the future of logistics. Tehnički glasnik - Technical journal, 13 (3), 248-253 doi:10.31803/tg-20190215200430.
5. Buntak, K., Kovačić, M. & Martinčević, I. (2019) Knowledge Management In Digital Era. U: Fošner, A. (ur.) Book of proceedings: ADVANCES in Business- Related Scientific Research Conference (2019 ; Ljubljana).
6. Crowther, D., Aras G. Corporate Social Responsibility, Ventus Publishing, 2008.
7. The 2030 Agenda for Sustainable Development A/RES/70/1 ISO 26000:2010
8. ISO 26000:2010

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*
Own lectures	Available online	1-10
Bartodziej, C.J., 2017. The concept industry 4.0. In *The concept industry 4.0* (pp. 27-50). Springer Gabler, Wiesbaden.	Available online	1-10
Blewitt, J: Razumijevanje održivog razvoja, Naklada Jesenski i Turk, Zagreb 2017.	Available online	1-10
Matešić, M., Pavlović, D., Bartoluci, D., Društveno odgovorno poslovanje, VPŠ Libertas, Zagreb, 2015	Available online	1-10
Rodgers, L. David. 2019. Vodić kroz digitalnu transformaciju. Finessa. Beograd.	Available online	1-10
Sikavica, P., Bahtijarević Šiber, F., Pološki Vokić, N., Suvremeni menadžment, Školska knjiga, Zagreb, 2008	Available online	1-10
Ustundag, A. and Cevikcan, E., 2017. *Industry 4.0: managing the digital transformation*. Springer.	Available online	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Ines Kolanović, PhD	
Course title	**Methodology of service quality measurement in maritime affairs**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of this course is to enable students to understand the basic determinants of service quality and the process of evaluating service quality in maritime affairs in order to formulate quality solutions and guidelines for their improvement by applying appropriate scientific methods.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:

1. Recognize and discuss service quality determinants in maritime affairs;
2. Explore and interpret standards in the function of service quality;
3. Explain and propose the concept of service quality in maritime affairs;
4. Collect and valorise data important for service quality measurement in maritime affairs;
5. Design an optimal model for service quality measurement in maritime affairs;
6. Argue and evaluate the methodological approach for service quality measurement in maritime affairs;
7. Critically identify activities to improve service quality in maritime affairs.

1.4. Course content

Theoretical determinants and assumptions of establishing the concept of service quality. Dimensions and quality attributes of service in maritime affairs. Standards and guidelines for quality assurance. Standardization in the function of service quality. Measuring service quality from the aspect of customer expectations and perceptions. Models for measuring service quality. Quality index. Service quality management. Methodological approach to measuring the service quality in maritime affairs.

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 (lectures or consultative classes), research and publication of research results in the form of

scientific work.

1.8. Evaluation[57] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	5.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

In order to evaluate the learning outcomes, a discussion will be held with the PhD student to assess the understanding of the content in accordance with the course objectives.
Learning outcomes are assessed by evaluating the quality of the research from a theoretical and applied aspect and based on the quality of the written scientific paper.

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

1. Amitava Mitra, Fundamentals of quality control and improvement, 5th Edition, Wiley, New Jersey, 2021.
2. Chauhan, V., Gupta, A., Parida M., Demystifying service quality of Multimodal Transportation Hub (MMTH) through measuring users' satisfaction of public transport, Transport Policy, Volume 102, pp. 47-60, 2021.
3. Gupta, A., Singh, R.K. and Mangla, S.K., Evaluation of logistics providers for sustainable service quality: Analytics based decision making framework. *Ann Oper Res*, 2021.
4. Noor Azwa Noralama, Mohamad Rosni Othmanb, Jagan Jeevanc, Mohd Saifullzwaan Saadond, Seaport quality: a definition of the contemporary seaport management, Journal of Critical Reviews, Vol 7, Issue 8, pp- 1137-1147., 2020.
5. Pantouvakis, A. and Karakasnaki, M., Examining the impact of market orientation on service quality in shipping companies: the role of risk propensity, *International Journal of Quality and Service Sciences*, Vol. 13 No. 1, pp. 106-122., 2021.

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

1. Lazibat, T.: Upravljanje kvalitetom, Znanstvena knjiga d.o.o., Zagreb, 2009.
2. Hemalatha, S. Lingaraju Dumpala, Balakrishna, B., Relative Importance Analysis of Factors Influencing Sea Port Service Quality, Recent Trends in Mechanical Engineering pp 641-649, Conference paper, Select Proceedings of ICIME 2020.
3. Hemalatha, S. Lingaraju Dumpala, Balakrishna, B., Service quality evaluation and ranking of container terminal operators through hybrid multi-criteria decision making methods, The Asian Journal of Shipping and Logistics, Volume 34, Issue 2, pp. 137-144., 2018.
4. Kanji, K.; Asher, M.: 100 Methods for total Quality management, Sage publications, London, 1996.
5. ISO 9001:2015
6. Sayareh, J., Iranshahi, S., Golfakhrabadi, N., Service quality evaluation and ranking of container terminal operators. Asian J. Shipp. Logist. **32**(4), pp. 203–212, 2016.

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*
Amitava Mitra, Fundamentals of quality control and improvement, 5th Edition, Wiley, New Jersey, 2021.	Available online	1
Chauhan, V., Gupta, A., Parida M., Demystifying service quality of Multimodal Transportation Hub (MMTH) through measuring users'	Available online	1

[57] **NOTE**: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

satisfaction of public transport, Transport Policy, Volume 102, pp. 47-60, 2021.		
Gupta, A., Singh, R.K. and Mangla, S.K., Evaluation of logistics providers for sustainable service quality: Analytics based decision making framework. Ann Oper Res, 2021.	Available online	1
Noor Azwa Noralama, Mohamad Rosni Othmanb, Jagan Jeevanc, Mohd SaifulIzwaan Saadond, Seaport quality: a definition of the contemporary seaport management, Journal of Critical Reviews, Vol 7, Issue 8, pp-1137-1147., 2020.	Available online	1
Pantouvakis, A. and Karakasnaki, M., Examining the impact of market orientation on service quality in shipping companies: the role of risk propensity, International Journal of Quality and Service Sciences, Vol. 13 No. 1, pp. 106-122., 2021.	Available online	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Neven Grubišić, PhD	
Course title	**Modelling tactical logistical problems on container terminals**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

To familiarize students with the types and methods of operational decision making on container terminals and internal transport

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:

1. Link the main operational decision-making problems on container terminals;
2. Examine existing mathematical models and determine the value of decision variables;
3. Revise existing models depending on the technical and technological characteristics and criteria of decision-making;
4. Formulate individual problem depending on the selected criteria for optimization;
5. Evaluate and justify the results;
6. Demonstrate the application of software tools for optimization and modelling.

1.4. Course content

Tactical-logistical problems in sea-side transshipment system on container terminals: Berth allocation problem, Crane allocation problem, Quay Crane scheduling problem. Optimization criteria. Operational decision-making problems on CT storage area: Job scheduling of RTG and RMG cranes, Post-stacking problems, Reshuffling. Transport network problems in inland transport. Determining the shortest path, maximum flow, and resource allocation optimization. Use of optimization software tools LINGO, AIMMS. Modification of existing models depending on criteria for optimization. Post-opt analysis and interpretation of results.

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

1.6. Comments	Computer tools for optimization and modeling are used in the teaching process.

1.7. Student's obligations

After conducting scientific research, students are to design a programming task (practical optimization model) using software-computing tools.

1.8. Evaluation[58] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	3
Written exam		Oral exam	0.6	Essay		Research	2
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Evaluation of outcomes is carried out through activities in the classroom (method of computer modeling of given problems), the quality of research and practical work – a programming task that the student must make and present at the exam.
Examples of evaluating the individual learning outcome:

1. Explain the conditioning of solutions results of individual tactical logistical problems in sea-side transshipment process on the operation of the ship and the planning of ship arrivals.
2. Create an existing mathematical model and determine the value of the main variables.
3. For the selected model redefine inputs and change the criteria of decision-making.
4. Create a programme basis for custom problem according to the own choice.
5. Perform a post-optimum analysis and explain the obtained solution.
6. Demonstrate the use of software tools and explain their limitations.

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

1. Grubišić, N., Krljan, T., Maglić, L.: The Optimization Process for Seaside Operations at Medium-Sized Container Terminals with a Multi-Quay Layout. Journal of Marine Science and Engineering, 8(11), 891, 2020.
2. Grubišić, N., Dundović, Č., Žuškin, S.: A split task solution for quay crane scheduling problem in mid-size container terminals. Tehnički vjesnik - Technical Gazette, 23(6): 1723-1730, 2016.

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

1. Grubišić, N.: Optimizacija raspodjele vezova i obalnih dizalica na lučkim kontejnerskim terminalima. Doktorski rad. Sveučilište u Rijeci, Pomorski fakultet, Rijeka, 2013.
2. Grubišić, N., Hess, S., Hess, M.: A Solution of Berth Allocation Problem in Inland Waterway Ports. Tehnički vjesnik - Technical Gazette, Vol 21, No 5. pp 1135-1141, 2014.
3. Bohrer, P.: Crane Scheduling in Container Terminals, VDM Verlag Dr. Müller, Saarbrücken, 2010.
4. Gen M., Cheng, R., Lin L.: Network Models and Optimizaiton, Springer-Verlag, London, 2008.
5. Mattfeld, D.C.: The Management of Transshipment Terminals, Springer, New York, 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*
Grubišić, N., Krljan, T., Maglić, L.: The Optimization Process for Seaside Operations at Medium-Sized Container Terminals with a Multi-Quay Layout. Journal of Marine Science and Engineering, 8, 891, 2020.	Available online	1-10
Grubišić, N., Dundović, Č., Žuškin, S.: A split task solution for quay crane scheduling problem in mid-size container terminals. Tehnički vjesnik - Technical Gazette, Vol 23, No 6. pp 1723-1730, 2016.	Available online	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted, and appropriate measures are adopted accordingly.

[58] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Siniša Vilke, PhD	
Course title	**Sustainability in urban transport**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of the course is to acquire knowledge about the development of urban transport as an integral part of green logistics and sustainability policy. To this end, PhD students will explore the possibilities of improving public urban and individual transport according to modern requirements and criteria of sustainable transport and environmental management. PhD students will be introduced to the sustainable development of transport systems in urban areas.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:

1. Interpret the link between public urban transport planning and transport sustainability.
2. Analyze transport policy measures for sustainable transport in urban areas.
3. Explain the elements of the transport system in urban areas.
4. Explain the relationship between spatial transport planning and urban transport.
5. Detect and analyze measures to improve transport in urban areas to reduce negative environmental impacts.
6. Analyze and investigate the implementation of various forms of transport in the urban transport system.

1.4. Course content

Basic components and development of urban transport. The impact of transport on the development of urban areas. Basic components and importance of green logistics. Urban transport, energy, and environmental pollution. Urban expansion, remote business, and transportation. Innovative technologies in urban transport. Traffic sustainability and environmental management. Sustainable traffic planning in the context of sustainable development. Technological features of urban transport infrastructure. Features of traffic demand with travel modes. Application of geographic information system (GIS) in urban areas. Objectives of green logistics in urban areas. Impact of information and communication technology traffic sustainability. Objectives of transport sustainability policy.

1.5. Teaching methods

☒ lectures	☒ individual assignment
☒ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratories
☐ long distance education	☒ mentorship

	☐ fieldwork	☐ other _____
1.6. Comments		

1.7. Student's obligations

Class attendance, seminar paper, scientific research will lead to the preparation of the article and the final oral exam.

1.8. Evaluation[59] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam	1	Essay		Research	3.6
Project		Continuous assessment		Report		Practical work	
Portfolio		Preparation of the article	1				

1.9. Assessment and evaluation of student's work during classes and on final exam

Outcome evaluation is carried out through activities in lectures, research, and the final oral exam.

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

1. Genevieve, G., Hanson, S.: The Geography of Urban Transportation, Fourth Edition, The Guilford Press, New York, 2017.
2. Vuchic, V., R.: Urban Transit: Operations, Planning and Economics, John Wiley & Sons, Inc., Hoboken, New Jersey, 2005.

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

1. Vuchic, V., R.: Urban Transit Systems and Technology, John Wiley & Sons, Inc., Hoboken, New Jersey, 2007.
2. Black, A.: Urban Mass Transportation Planning, McGraw-Hill College, New York, 1995.

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*
Genevieve, G., Hanson, S.: The Geography of Urban Transportation, Fourth Edition, The Guilford Press, New York, 2017.	1	1-10
Vuchic, V., R.: Urban Transit: Operations, Planning and Economics, John Wiley & Sons, Inc., Hoboken, New Jersey, 2005.	1	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[59] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Livia Maglić, PhD	
Course title	**Optimization of storage yard operation in container terminals**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of this course is for PhD students to become familiar with real operations and logistics problems in the storage yard at a container terminal and to learn how to resolve them by various computational methods and tools. Upon completion of this course, the PhD student will be able to identify key problems in the storage systems, analyze and identify inefficient storage operations, and evaluate and apply optimization methods to resolve them.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:
Explain and analyze the storage subsystem.
Interpret storage operations at a container terminal.
Explain and parse NP-hard optimization problems in the storage subsystem.
Explain and compare container relocation problem, pre-marshalling problem and re-marshalling problem.
Classify and explain the problem of allocating container handling equipment.
Identify and analyze the vehicle routing problem in the storage yard subsystem.
Develop a critical opinion on the researched problem
Propose an approach and method for solving the research problem in the field of storage processes.
Create an optimization model using various computational methods and tools.
Evaluate the proposed optimization model.

1.4. Course content

Storage yard subsystem at container terminals. Container storage yard operations. Definitions and classifications of NP-hard problems in the container storage yard. Determinants and categorization of problems at the container storage area. The vehicle routing problem in the storage subsystem. Container handling equipment allocation problem. The optimization methods and tools for resolving problems at storage yards. The methods for computer-based experiment and model validation.

1.5. Teaching methods

☒ lectures	☒ individual assignment
☐ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratories
☐ long distance education	☒ mentorship
☐ fieldwork	☐ other _____

1.6. Comments	

1.7. Student's obligations

Preparation of a scientific paper on a given topic under the mentorship of the course coordinator.

1.8. Evaluation[60] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam	2	Essay		Research	3.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Learning outcomes are assessed and evaluated through monitoring of the research conducted by the PhD student, which ultimately results in the preparation of a scientific paper.

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

Maglić, L. Optimization of container relocation operations in port container terminals, University of Rijeka, Faculty of Maritime Studies, 2016.
Bose, J.W. Handbook of terminal planning, Springer Cham, 2011.
Constantine D. M. Port planning, National Technical University of Athens Zografos, Greece

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

Carić, T. Optimizacija prometnih procesa, University of Zagreb, Faculty of Transport and Traffic Sciences, 2014.

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*
Maglić, L. Optimization of container relocation operations in port container terminals.	Available online/ 1 in library	
Bose, J. Handbook of terminal planning, Springer Cham, 2011.	1	
Constantine D. M. Port planning	Available online	

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[60] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

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General information		
Course coordinator	Neven Grubišić, PhD Luka Novačko, PhD	
Course title	**Traffic simulation and transport modelling**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

To familiarize students with the types and methods of transport modelling and traffic simulation tools at the macroscopic, mesoscopic, microscopic level.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:

1. Apply the appropriate level of transport modelling and choose the right simulation tool depending on the problem definition and objective of the research.
2. Create transport network supply and compose demand distribution matrix between traffic zones.
3. Select and configure assignment attributes and develop the assignment procedures according to research data, using the simulation tools.
4. Design microsimulation model of private and public transport on real example.
5. Refine simulation models according to calibration and validation parameters.
6. Define optional scenarios of traffic states based on different traffic policies and actions.
7. Estimate simulation results according to different scenarios and effects of diverse management options on the traffic condition.

1.4. Course content

Classification, purpose and application of transport models and traffic simulation tools. Strategy of traffic survey and data collection. Conceptual design of transport network. Demand matrix, generalized cost function, skim matrix, VD and impedance functions. Four-step model of trip generation, trip distribution, mode-choice, and assignment. Growth factor models and synthetic models (gravity model). Discrete choice models – Multinomial Logit model. Traffic assignment methods – route choice. AON assignment, equilibrium assignment, stochastic assignment, dynamic assignment. Public-transport assignment. Mesoscopic simulation tools. Hybrid simulations. Microsimulation tools – modelling signalized and unsignalized intersections. Freight movement modelling. Calibration and model validation. Basic and future scenario development, definition of alternative policies and actions. Graphical attributes and presentation of simulation results and reports.

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		

After conducting a case study, students are required to create a programming task – experimental transport model using appropriate computer simulation tool,.

1.8. Evaluation[61] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	3
Written exam		Oral exam	0.6	Essay		Research	2
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Evaluation of outcomes is carried out through activities in the classroom (method of computer simulation and modelling), the quality of research and experimental work – a programming task that the student must make using the appropriate simulation tool, and the presentation on the exam. Examples:

1. Identify and formulate the problem and objective of the research and suggest the scope and the level of transport modelling and choose the appropriate computer software tool.
2. Create and import the main elements of transport supply network, zones, centroids, and set-up of traffic demand matrix between the zones.
3. Draw up the basic trip assignment procedure and calculate the skim matrices using the simulation tool.
4. Develop microsimulation model of real intersection.
5. Calibrate and validate the model sample according to traffic survey data.
6. Depending on type of the problem, define different policies and actions to improve the transport system and develop alternative scenarios depending on application of selected actions using the simulation software.
7. Compare the simulation results for different scenarios and discuss the effects of different policies and actions on the transport system performance.

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

1. PTV Visum Manual, PTV Planung Transport Verkehr AG, Karlsruhe, 2021.
2. PTV Vissim Manual, PTV Planung Transport Verkehr AG, Karlsruhe, 2021.

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

Teodorović, D., Janić, M.: Transportation Engineering – Theory, Practice, and Modeling. Elsevier, 2017.
JASPERS Appraisal Guidance (Transport): The use of Transport Models in Transport Planning and Project Appraisal, 2014.
Hensher, D.A., Button, K.J.: Handbook of Transport Modelling. Emerald Publishing, 2nd edition, 2007.
Grubišić, N., Krljan, T., Maglić, L., Vilke, S.: The Microsimulation Model for Assessing the Impact of Inbound Traffic Flows for Container Terminals Located near City Centers. Sustainability, 12, 22, 9478, 2020.
Babojelić, K., Novačko, L.: Modelling of Driver and Pedestrian Behaviour – A Historical Review. Promet - Traffic & Transportation, Vol 32 Issue 5; p.: 727-745, 2020.

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*
PTV Visum Manual, PTV Planung Transport Verkehr AG, 2021.	pdf	1-10
PTV Vissim Manual, PTV Planung Transport Verkehr AG, 2021.	pdf	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted, and appropriate measures are adopted accordingly.

[61] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Ljudevit Krpan, PhD	
Course title	**Land use transport planning**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of the course is to acquire the necessary knowledge of the basic elements of spatial and traffic planning. Furthermore, the aim is for students to independently assess and identify the objective spatial planning and accommodation options of the transport infrastructure (linear and planar).
Acquired knowledge will enable students to rationally evaluate project ideas related to traffic system planning as well as the possibility of a critical review of the proposed design solutions.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:

1. Rank levels of physical planning documents;
2. Estimate objective spatial possibilities for planning and development of transport infrastructure in physical planning documents;
3. Propose optimal transport solutions (in accordance of traffic needs and space requirements) for every level of physical planning documents;
4. Develop optimal Land Use Transport solutions;
5. Valorise land use transport solutions and validate optimal land use transport solutions;
6. Critically evaluate intermediate influence of physical and transport solutions, especially in urban soundings.

1.4. Course content

1. Introduction to the course: goals and obligations of the course, work programme and taking exams;
2. Basic of spatial planning;
3. Spatial Plans;
4. Urban Plans;
5. Urban planning documents from transport systems and transport infrastructure view;
6. Correlation of spatial content and transport;
7. Basic of Land Use Transport Planning;
8. Land Use Transport Models: Spatial differentiations and System of Development Centres in Physical Plans;
9. Land Use Transport Models: Defining transport zones;
10. Land Use Transport Models: Defining systems of poles and connections system (functional-nodal

method) and transport routes.		
1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☐ exercises ☒ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Comments	In the course of the lecture, students will visit the Institute for Physical Planning of the Primorsko-goranska County and get a concrete insight into the models of spatial-traffic planning implemented for the needs of the Primorsko-goranska County Spatial Plan.	

1.7. Student's obligations

Attending classes, written exam, report preparation.

1.8. Evaluation[62] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam	3	Essay		Research	
Project		Continuous assessment		Report	2.6	Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The activities of the students will be evaluated through involvement in the teaching process, answering questions and preparation of papers (scientific article), within which they will address some of the topics from the scope of the course. The exam will be oral and the exam questions will include a test of knowledge about each of the set learning outcomes. The final grade will be defined based on the arithmetic mean of the sum of grades of each of the listed activities in point 1.8: Evaluation of the student's work.

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

Krpan, Lj.: Modeli prostorno-prometnog planiranja, Sveučilište Sjever, Varaždin, 2015. (selected chapters)
Own lectures.

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

1. Rodrigue, J-P., et. all: The Geography of Transport Systems, Taylor@Francis Group, New York, 2006.
2. Maletin, M.: Planiranje i projektovanje saobračajnica u gradovima, Orion art, Beograd, 2005.
3. Štimac, M.: Prostorno planiranje u praksi, Glosa, Rijeka, 2010.

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*
Krpan, Lj.: Modeli prostorno-prometnog planiranja, Sveučilište Sjever, Varaždin, 2015. (selected chapters)	3	3
Own lectures	Available online	3

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[62] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

University of Rijeka
FACULTY OF MARITIME STUDIES

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MARINE AND COASTAL PROTECTION

General information		
Course coordinator	*Professor emeritus* Damir Zec, PhD Matej David, PhD	
Course title	**Ballast water management and risk assessment**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Familiarize the student with the principles, methods, and limitations of ballast water management on ships and terminals, focusing on management policy and risk assessment methods.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:
- Discuss the basic principles of preventing the transport of invasive species by ballast waters;
- Develop a research programme to determine the ballast water terminal load;
- Design a baseline study program for given ports;
- Make a risk assessment for a port or ship.

1.4. Course content

Ships and ballast waters. Profile and transport of ballast water and capacities of different ship types. Influences and safety aspects of ballast water.
Negative impacts of ballast water on the environment, economy and human health. Processes of transfer of organisms via ballast water and various negative influences; case studies with significant adverse effects.
International Convention for the Management of Ballast Water and Sediments. The requirements of the Convention and the associated guidelines, in particular in the risk management section.
Technical requirements. National and regional requirements and approaches to ballast water management, in particular regarding risk assessment.
Methods and approaches to ballast water management. Methods of exchange of ballast water and methods of treatment of ballast waters, including possibilities and limitations.
Methods and approaches to risk assessment for ballast water management purposes. Risk assessment as required for implementation of the International Convention on the Management of Ballast Water and Sediment.
Inspection of the BWM Convention implementation. Inspection procedures and methods provided for in the Convention and guidelines, focusing on theoretical settings and the practical application of ballast water sampling procedures.
Decision-making systems for ballast water management. Methods and application of decision-making systems and early warning systems.

1.5. Teaching methods

☒ lectures	☒ individual assignment
☐ seminars and workshops	☐ multimedia and network
☐ exercises	☐ laboratories
☒ long distance education	☐ mentorship

	☐ fieldwork	☐ other _____
1.6. Comments		

1.7. Student's obligations

The student must develop a risk assessment program for a selected case (a couple of ports, a line, or similar).

1.8. Evaluation[63] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	
Project	3	Continuous assessment		Report		Practical work	2.6
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The evaluation of learning outcomes is based on the verification of the accuracy of the programme set during the teaching process, in particular:
- The research programme to investigate if the ballast water load is appropriate for the chosen port conditions.
- The development programme of the baseline study is appropriate to the conditions set in the selected port.
- The risk study, including all sources, is appropriate to the conditions set.

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

1. Global Maritime Transport and Ballast Water Management, editors David, M., Golash, S., Invading Nature-Springer Series in Invasion Ecology, Springer 2024, doi.org/10.1007/978-94-017-9367-4
2. IMO, International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004, 13 February 2004, IMO, London, 2004., incl. Guidelines G1-G15

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

1. David, M., Gollasch, S., Cabrini, M., Perkovič, M., Bošnjak, D., Virgilio, D. (2007). Results from the first ballast water sampling study in the Mediterranean Sea - the Port of Koper study. Marine Pollution Bulletin 54, 53-65.
2. M. David, M. Perkovič, V. Suban, S. Gollasch, A Generic Ballast Water Discharge Assessment Model as a Decision Supporting Tool in Ballast Water Management, Dec. Supp. Syst. 53 (2012) 175-185, DOI: 10.1016/j.dss.2012.01.002.
3. David, M., Gollasch, S., Leppäkoski, E., 2013. Risk assessment for exemptions from ballast water management – The Baltic Sea case study. Marine Pollution Bulletin 75, 205–217, DOI: 10.1016/j.marpolbul.2013.07.031.
4. David, M., Gollasch, S., Pavliha, M. (2013). Global ballast water management and the same location concept – a clear term or a clear issue? Ecological Applications 23 (2), 331–338.
5. David M (2013) Ballast water sampling for compliance monitoring - Ratification of the BWM

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*
Global Maritime Transport and Ballast Water Management, editors David, M., Golash, S., Invading Nature-Springer Series in Invasion Ecology, Springer 2024, doi.org/10.1007/978-94-017-9367-4	1	1-10
IMO, International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004, IMO, 13 February 2004, IMO, London, 2004., incl. Guidelines G1-G15	Available online	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[63] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	*Professor emeritus* Damir Zec, PhD Radoslav Radonja, PhD	
Course title	**Sustainable fleet management**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The course aims to familiarise students with a systematic approach to sustainability in shipping, principles of sustainable ship management or shipping, optimisation methods in shipping management, available technological solutions and development trends, and the effects of new technologies (especially AI) on maritime development.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

By completing the course, students will be able to:

1. Interpret guidelines and requirements imposed by sustainable development and sustainable maritime affairs at the global/local level,
2. Develop suitability criteria for a ship or a fleet taking into account environmental, technological, economic and social point of view,
3. Compare and critically assess different suitability criteria,
4. Create a program to optimise ship movements in the sea (water), conversion and transmission of energy,
5. Select a goal function and criteria to optimise ship management,
6. Assess the trends of sustainable development of ships and their impact on the economy, environment and social processes,
7. Critically judge the likelihood of emerging disruptive technologies in maritime affairs (autonomous ships, new propulsion and transport technologies), with particular emphasis on the sustainability of professional competencies and capacities.

1.4. Course content

- Sustainable development and sustainable maritime affairs: trends, legislation (global/regional/local), the necessity of active participation,
- Sustainability criteria (environmental, technological, economic, social) and their limitations,
- Principles and methods of optimising ship movement in the sea/water (construction, underwater coatings, resistance reduction, etc.), conversion and transmission of energy (fuel consumption, heat recovery systems, alternative energy sources, alternative fuels, ...),
- Principles and methods of optimising ship operations (ship/fleet/human management, transport management, optimisation of navigation according to weather conditions, optimisation of ship speed, optimisation of production and supply of electricity, ...),

- Strategies for ecological and technological development of ships and their economic and social impact,
- Autonomous vessels (safety, ecological, technological, economic and social aspects),
- The education system and sustainability of professional competencies and capacities for sustainable seafaring and sustainable ship/ship management

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☐ exercises ☒ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other _____
1.6. Comments	Teaching may be performed by long-distance learning or through consultations, if necessary.	

1.7. Student's obligations

Active participation in the course and individual assignments

1.8. Evaluation[64] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experiment	
Written exam		Oral exam		Essay		Research	3.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

- Research activity: creation of optimisation model for the shipowner in national maritime navigation;
- Problem-solving tasks: comparative analysis of the effectiveness of alternative levels of technologies and impulse systems;
- Research activity: assessment of the impact of new technologies (estimation of disruptive potential).

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

1. The Fourth IMO GHG Study, MEPC 75/7/15, 2020
2. DNV Maritime Forecast to 2050 - 4th Edition, DNV, 2020
3. Assessment of selected alternative fuels and technologies, DNV, 2019
4. M. Zhang, M. Janic, L.A. Tavasszy, A Freight Transport Optimization Model for Integrated Network, Service, and Policy Design, Elsevier, 2015
5. Fleet Management and Logistics, edited by Teodor G. Crainic, Gilbert Laporte, Springer, 1998
6. Inge Norstad, Kjetil Fagerholt, Gilbert Laporte, Tramp ship routing and scheduling with speed optimisation, Transportation Research Part C: Emerging Technologies, 2011
7. Diez, M., Peri, D., Robust optimisation for ship conceptual design, Ocean Engineering, 2010
8. Online Optimization of Large Scale Systems, Grötschel, M., Krumke. S. O., Rambau, J., Springer, 2001

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

1. Bielli, M., Bielli. A., Rossi. R., Trends in Models and Algorithms for Fleet Management, Procedia - Social and Behavioral Sciences, 2011
2. Papanikolaou, A., Holistic ship design optimisation, Computer-Aided Design, 2010

[64] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

3. Peri, D., Michele Rossetti, M., Campana, E. F., Design Optimisation of Ship Hulls via CFD Techniques, Journal of Ship Research, 2001
4. Kim, S., Lee. K., An optimisation-based decision support system for ship scheduling, Computers & Industrial Engineering, 1997

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

Title	*Number of copies*	*Number of students*
All titles	Available online	

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Lovro Maglić, PhD Marko Perković, PhD	
Course title	**Sustainable navigation management**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The main course objective is to familiarize students with a sustainable approach to planning and process of ships' navigation, coastal and auxiliary systems that affect the organization of navigation, the principles of sustainable navigation management, optimization methods, technological and organizational solutions and new technologies in navigation management.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Students will be able to:

- Analyze national, European, and international regulations related to protection of the marine environment from the impact of ships during navigation;
- Analyze national, European, and international regulations related to enhancement of ship's safety and security during navigation;
- Interpret the principles, guidelines and requirements for the voyage planning and process of sustainable maritime navigation;
- Analyze and critically evaluate the measures of marine traffic monitoring systems on the safety of navigation and environmental pollution from ships;
- Analyze the system of monitoring, reporting, and verification of carbon dioxide emissions from ships and its impact on ships' navigation;
- Model maritime traffic from the aspect of navigational safety and the marine environment protection;
- Analyze the impact of various systems for the organization of maritime routes on marine environment protection;
- Develop criteria for the acceptability of the ship's voyage plan from the ecological, technological and economic aspects;
- Assess the development and the impact of new technologies in the field of monitoring ships during navigation with the aim of improving safety, security, and environmental protection (satellite systems, unmanned aerial vehicles, underwater ROVs, advanced sensors, etc.).

1.4. Course content

- Principles of sustainable development of maritime transport;
- National, European, and international regulations related to the protection of the marine environment

from ships during navigation;
- Restrictions and eligibility criteria from the safety, security and environmental protection aspect;
- Principles of reducing the impact on the environment during ship navigation (emissions of gases, noise, vibrations, harmful substances, etc.);
- Principles and methods of reducing the impact on the environment and increasing safety and security by monitoring and managing traffic routes;
- Optimization of navigation by implementation of national or regional regulations;
- Education and competencies system for the needs of sustainable navigation management;
- Development of culture and improvement of awareness on marine environment protection and safety of navigation;
- Development of innovative technologies for monitoring shipping routes.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☐ exercises ☒ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other _____
1.6. Comments	If necessary, the lessons can be consultative or performed as long-distance education.	

1.7. Student's obligations

The obligations of students are based on the research into course objectives and the preparation of a seminar paper on the set research task.

1.8. Evaluation[65] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experiment	
Written exam		Oral exam		Essay		Research	3.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

- Research – assessment of the impact of new technologies in the control of harmful gas emissions on the shipping route;
- Research – assessment of the impact of new technologies in the examination of a suitable place for determining the boundaries of the port anchorage;
- Research – development of an environmental pollution model by optimizing the planned ship's route;
- Research – development of a model estimating the probability of a maritime accident by introducing restrictive measures of the VTS on a certain shipping route.

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

- UN A/RES/70/1 Transforming our world: the 2030 Agenda for Sustainable Development
- The Fourth IMO GHG Study, MEPC 75/7/15, 2020
- Sustainable Shipping, A Cross-Disciplinary View, Psaraftis, Harilaos N., (Ed), Springer, 2019.
- Oil Pollution in the Mediterranean Sea: Part II - National Case Studies, Angela Carpenter and Andrey - G.Kostianoy (Ed.), Springer, 2018.
- REGULATION (EU) 2015/757 E - on the monitoring, reporting and verification of carbon dioxide

[65] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

emissions from maritime transport.
- Panagakos G., et al., Monitoring the Carbon Footprint of Dry Bulk Shipping in the EU: An Early Assessment of the MRV Regulation, Sustainability, 2019, 11(18).
- Porathe T., A Navigating Navigator Onboard or a Monitoring Operator Ashore? Towards Safe, Effective, and Sustainable Maritime Transportation: Findings from Five Recent EU Projects, Transportation Research Procedia, Vol. 14, 2016.
- Parrot L., et al., A decision support system to assist the sustainable management of navigation activities in the St. Lawrence River Estuary, Canada, Environmental Modelling & Software, Vol. 26 (12), 2011.
- Chintoan-Uta, M.; Ramos Silva, J., Global maritime domain awareness: a sustainable development perspective, WMU Journal of Maritime Affairs, 16, 2017.

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

N/A

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*
Sustainable Shipping, A Cross-Disciplinary View, Psaraftis, Harilaos N., (Ed), Springer, 2019.	1	1-10
Other titles	Available online	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

University of Rijeka
FACULTY OF MARITIME STUDIES

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General information		
Course coordinator	Aleksandar Cuculić, PhD	
Course title	**Emission limitation – electrical propulsion systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of the course is to provide students with the necessary knowledge in the field of electric propulsion systems and related technologies, which enable the realization of modern ships with reduced or completely reduced emissions of carbon dioxide and other products harmful to the environment and health. All the dominant factors from the point of view of the ship and the necessary supporting infrastructure on shore, which are necessary for the development of environmentally friendly and sustainable ships, are analyzed, taking into account the type, purpose and specifics of the operation. The safety aspects of the application of these technologies on board are also considered.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:

1. Understand the basic concepts and know the components of electric marine propulsion and related technologies.
2. Describe the methods of electricity storage and explain the potential applications of energy storage devices in the ship's electrical system.
3. Identify the types and know the basic characteristics of electrochemical batteries.
4. Explain the problems of using hydrogen and hydrogen cells on board.
5. Define indicators of energy efficiency of electric propulsion systems.
6. Critically evaluate the influence of certain factors of the electric propulsion system on increasing energy efficiency and reducing emissions.
7. Assess the requirements to be met by the supporting shore infrastructure.
8. Apply the acquired knowledge to evaluate and select the appropriate electric propulsion system concept according to the type and purpose of the vessel in order to reduce harmful emissions and increase sustainability.

1.4. Course content

Theoretical determinants and concepts of electric marine propulsion. Types, characteristics and theoretical basis of electrochemical battery, fuel cell and energy storage technologies. Indicators of energy efficiency of ships. Power management to increase the environmental efficiency of the ship and maximize the efficiency of available electricity from batteries and other sources. Project definition of a ship with electric propulsion with the aim of reducing the impact on the marine environment.

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 (lectures or consultations); conducting research and writing a seminar paper; oral exam.

1.8. Evaluation[66] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experiment	
Written exam		Oral exam	1	Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The students are evaluated through class attendance, research and the final oral exam.

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

1. European Maritime Safety Agency: Study on electrical energy storage for ships - battery systems for maritime applications – technology, sustainability and safety, EMSA 2020.
2. MUKUND, R. PATEL. Shipboard propulsion, power electronics, and ocean energy. ROUTLEDGE, 2017.
3. Teaching materials and published papers of lecturer.

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

1. Borstlap, René, Hans Ten Katen, and Klaas Dokkum. Ships' Electrical Systems. Dokmar, 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*
European Maritime Safety Agency: Study on electrical energy storage for ships - battery systems for maritime applications – technology, sustainability and safety, EMSA 2020.	Available online	1
MUKUND, R. PATEL. Shipboard propulsion, power electronics, and ocean energy. ROUTLEDGE, 2017.	1	1
Teaching materials and published papers of lecturers	Available online	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[66] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Biserka Rukavina, PhD	
Course title	**Legal aspects of marine environment protection**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The education and advancement of researchers capable of undertaking research in the field of marine environment protection, in particular to conduct research on the promotion of maritime safety standards, to actively contribute to the effectiveness of marine environment management and being trained to respect international obligations and transfer of knowledge.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Expected learning outcomes are the ability to research and analyze in the field of marine environment protection, especially to conduct research to promote maritime safety standards, actively contribute to the effectiveness of marine environmental management and be able to comply with international obligations and transfer knowledge in legal aspects of marine environmental protection.

1.4. Course content

The definition of the marine environment. Safety of Maritime Navigation (International Maritime Organization, the European Maritime Safety Agency, the organization of administrative inspection and technical professional activities in the Republic of Croatia, maritime navigation). Maritime domain and ports. Ship (concept and types, elements of individualization of ships, registration of ships, ship safety, calibration of ships, books and documents). Floating units. Boat and yacht. The role of the human factor (stakeholders on land, master and crew). International, regional and national sources of law on protection of marine environment. Implementation and control of international standards of environmental protection. The requirements for maritime industry, government and non-governmental organizations, and public awareness development.

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

70% in teaching and 30% on the final exam (according to the Regulations on Studies of the University of Rijeka

and the Regulation on studying at the Faculty of Maritime Studies in Rijeka). Monitoring the work of students through attendance, class participation, seminar paper and continuous assessment. The final exam assesses the theoretical knowledge in the field of legal aspects of marine environmental protection.

1.8. Evaluation[67] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1	Experiment	
Written exam		Oral exam	1.8	Essay		Research	
Project		Continuous assessment	2.8	Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Specify the objectives of marine environment protection.
Describe the principles of biodiversity protection.
Explain the coastal protection instruments.
Specify the importance of the ecosystem approach to governance.
Describe the process of establishing protected marine areas.

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

- Luttenberger, Axel, Osnove međunarodnog prava mora, Rijeka, 2006.

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

- Runko Luttenberger, Lidija, Luttenberger, Axel Environmental impact assessment of nautical ports projects, 19th International Conference on Transport Science ICTS 2020, Congress Proceedings, Fakulteta za pomorstvo in promet, Portorož, pp. 200-205
- Luttenberger, Axel, Governance and Marine Spatial Planning, Mediterranean Issue, Book 2, Reflection on the Mediterranean, Institute of Social Sciences Ivo Pilar, VERN Group, Croatia Academy of Science and Art, uro-Meditteranean Academic Network, 2019, pp. 231-237
- Luttenberger, Axel, Legal Framework for Marine Environmental Governance, 8th International Maritime Science Conference, Faculty of Maritime Studies in Kotor University of Montenegro and Faculty of Maritime Studies in Split University of Split, Book of Proceedings, Kotor, 2019, pp.481-487
- Luttenberger, Axel, Challenges in regulating marine litter in a semi-enclosed sea, 2nd International Scientific Conference of Maritime Law, Modern Challenges of Marine Navigation, Faculty of Law University of Split, Split, 2018, pp.151-161
- Runko Luttenberger, Lidija, Luttenberger, Axel, The role of insurance and tourism industries in achieving climate resilience, Tourism & Hospitality Industry 2018, Congress Proceedings, Faculty of Tourism and Hospitality Management, Opatija, 2018, pp. 383-393
- Luttenberger, Axel, Runko Luttenberger, Lidija, Stakeholders in abating marine litter in the Adriatic, 18thInternational Conference on Traffic Science, Slovenian Society of Traffic Science, University of Ljubljana, Faculty of Maritime Studies, University of Split, Faculty of Maritime Studies, Portorož, 2018, pp.220-225
- Luttenberger, Axel, Regulating marine litter in circular economy, 1st International Scientific Conference of Maritime Law, Modern Challenges of Marine Navigation, Faculty of Law University of Split, Split, 2017, pp.235-251
- Luttenberger, Axel, Runko Luttenberger Lidija, Challenges in regulating environmental crimes, 7th International Maritime Science Conference - IMSC 2017, Faculty of Maritime Studies, Split, 2017, pp.213-220
- Luttenberger, Axel, Runko Luttenberger, Lidija, Sustainable procurement and environmental life-cycle

[67] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

costing in maritime transport, World Maritime University Journal of Maritime Affairs, Malmo, 2016, pp 1-13, doi:10.1007/s13437-016-0116-6

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*
Luttenberger, Axel, Osnove međunarodnog prava mora, Rijeka, 2006	5	5

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Žarko Koboević, PhD Jelena Čulin, PhD	
Course title	**Pollution prevention by solid and liquid substances**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The objectives of the course are to study the pollution of the sea and coastal areas with solid and liquid substances from vessels.
Familiarization of PhD students with international and national legal regulations related to such pollution.
Study of pollution sources and hazardous practices and shipboard practices in the handling of solid and liquid substances. Introducing the equipment and devices on ships for the prevention of marine pollution as well as their practical application but also the examples improper use.
The course aim insists on the presentation of practical procedures for the purpose of managing solid and liquid substances on ships, either as cargo or as waste.
PhD students will develop an awareness of the procedures and practices for disposing of solid and liquid substances from ships in an environmentally friendly manner.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

It is expected that doctoral students after attending lectures, writing a seminar paper, publishing a scientific paper after research on the assigned topic and passing the exam will be able to do the following:
- Identify harmful substances that the ship releases or may release into the environment and describe and define the level of harmfulness of the released substances,
- Describe and compare the requirements of international and national regulations for the prevention of marine pollution from ships,
- Understand the principles of operation of various devices and equipment for the prevention of marine pollution with solid and liquid substances from vessels,
- Apply and adapt the acquired knowledge to create plans or procedures for the handling of devices for the disposal of solid and liquid waste in an environmentally friendly manner on board vessels,
- Independently assess the level of harmfulness of an individual ship or ship system, and identify and categorize according to the priorities of action with regard to the risks or consequences of marine pollution.
- Design and anticipate possible scenarios of harmful events of pollution with solid and liquid substances from vessels and propose or create preventive measures for them that will reduce or eliminate harmful consequences for the environment.
- Conduct and interpret research tasks in the field of protection of marine pollution by solid and liquid substances.

1.4. Course content

Generally about solid and liquid harmful substances discharged into the sea. Harmful effect of solids and liquids on the marine environment. Harmful impact of cargo systems, ballast systems, engine room systems and accomodation systems on the marine environment.
International and national legal regulations for the prevention of pollution by solid and liquid substances from vessels.
Machinery and devices on board vessels for processing solid and liquid substances as waste for discharge from ship or disposal on land in an environmentally friendly manner.
Bilge separators, solid waste and oil sludge incinerators, compactors, presses and crushers. Black and gray wastewater treatment plants, advanced sanitary water treatment plants. Processing and disposal of bio-waste and ash.
Procedures for handling solid and liquid substances on board vessels in order to prevent pollution from vessels.
Improper procedures or operational practices in handling solid and liquid waste on ships.

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

1.6. Comments	

1.7. Student's obligations

Attendance and activity in classes, seminar paper and implementation of research from a current topic in the prevention of pollution from vessels and preparation for publication of scientific paper in a scientific journal on the researched topic. Exam.

1.8. Evaluation[68] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1	Experiment	
Written exam		Oral exam	0.6	Essay		Research	4
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

- independent student work based on theoretical knowledge through the preparation of a seminar paper
- applicative contribution based on conducted research and preparation for publication of scientific paper
- knowledge at oral exam

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

1. *Barcelona Convention* for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, 1995., (Official Gazette – International agreements, no. 17/98)
2. Svein Kristiansen, Safety Management and Risk Analysis, Elsevier Butterwort-Heinmann, Norfolk, 2005.
3. Klaas van Dokkum: Ship Knowledge, Covering Ship Design, Construction and Operation, Dokmar, 2006
4. Maritime Code (Official Gazette, no. 181/04, 76/07)
5. MARPOL Convention, (Official Gazette – International agreements, no. 1/92, 4/05)

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

[68] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

1. Ž. Koboević: Model onečišćenja mora crnim otpadnim vodama s plovila, doktorska disertacija, Rijeka, Pomorski fakultet u Rijeci, 2015.
2. Ćorić D.: Onečišćenje mora s brodova - Međunarodna i nacionalna pravna regulativa, Pravni fakultet Sveučilišta u Rijeci, Rijeka 2009.
3. Koboević, Žarko; Mišković, Darijo; Capor Hrošik, Romana; Koboević, Nikša: Analysis of Sea Pollution by Sewage from Vessels // Sustainability – (Special Issue Maritime Transportation: Risks, Health and Environmental Protections), volume 14(1)263 (2022) Doi:10.3390/su14010263
4. Koboević Ž., Komadina P., Kurtela Ž.: Protection of the Seas from Pollution by Vessel's Sewage with Reference to Legal Regulations, Promet – Traffic & Transportation, Vol. 23, Zagreb 2011. pp. 377-387
5. Koboević Ž.; Krmek, I.:Napredni sustavi za tretiranje fekalnih voda na kruzerima *// Knowledge International Journal, vol.43(3)* / Skopje, 2020. str. 533-539
6. Koboević, Ž; Jovančević, M; Jurjević, M; Car, M.:Integrated Systems for Processing All Types of Waste on Ships *// Book of Proceedings 8th International Maritime Science Conference, April11th-12th 2019. Budva Montenegro* / Kotor: Birokonto, Herceg Novi, 2019. str. 283-294
7. Mišković, D; Kurtela, Ž; Koboević, Ž.: Procjena rizika od izlijevanja nafte u more s tankera *// Suvremeni promet : časopis za pitanja teorije i prakse prometa,* 37 (2017), 1-2; 48-53
8. EMSA/OP/05/05/, Final Report – Study on ships producing reduced quantities of ships generated waste – present situation and future opportunities to encourage the development of cleaner ships, HPTI – Hamburg Port Training Institute GmbH, 2005, available from: (http://emsa.europa.eu/about/download/1160/714/23.html)
9. EC Directive, (2007), Commission Directive 2007/71/EC of 13th December 2007 amending Annex II of Directive 2000/59/EC of the European Parliament and the Council on port reception facilities for ship-generated waste and cargo residues, dostupno na: http://eurex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007L0071:EN:NOT
10. Strategija pomorskog razvitka i integralne pomorske politike Republike Hrvatske za razdoblje od 2014. do 2020. godine, Ministarstvo pomorstva, prometa i infrastrukture; Zagreb srpanj 2014., dostupno na: http://www.mppi.hr/UserDocsImages/POMORSKA%20STARTEGIJA%20VRH%202207201%20web%2026-7_14.pdf

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

Title	*Number of copies*	*Number of students*
Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, 1995., (Official Gazette – International agreements, no. 17/98)	Available online	1
Svein Kristiansen, Safety Management and Risk Analysis, Elsevier Butterwort-Heinmann, Norfolk, 2005.	1	1
Klaas van Dokkum: Ship Knowledge, Covering Ship Design, Constuction and Operation, Dokmar, 2006	1	1
Maritime Code (Official Gazette, no. 181/04, 76/07)	Available online	1
MARPOL Convention, (Official Gazette – International agreements, no. 1/92, 4/05)	Available online	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

University of Rijeka
FACULTY OF MARITIME STUDIES

General information		
Course coordinator	Mirano Hess, PhD Mirjana Kovačić, PhD	
Course title	**Coastal zone management and sustainable development**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

1. The theory and practice research of coastal zone management in the world and in Croatia
2. Analyze the role of public administration in the development of the coastal area and the social and private sector whose activities are related to the management and use of the coastal area
3. Analyze the interdependence of development planning/management and sustainable development, on selected case studies
4. Research and analyze of coastal zone management models
5. Analyze the methodology of coastal zone valorization

Specific objective:
Analyze the fundamental issues and problems of growth and development and the problems of sustainability in order to understand the processes taking place in the coastal area and plan balanced development

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

1. Explain the theoretical and legislative determinants of coastal zone management
2. Understand the role of public administration in the development of the coastal area as well as other stakeholders involved in the management and use of the coastal area.
3. Explain the interdependence of coastal zone planning / management and sustainable development.
4. Understand and critically explain different models of coastal zone management
5. Understand, explain and apply coastal valorization methods and development scenario methods
6. Explain and apply multicriteria analysis methods in coastal zone evaluation
7. Identify and critically assess fundamental issues and problems of growth and development and the problems of sustainability and a holistic approach to development

1.4. Course content

1. INTRODUCTION: previous research, The role of the coastal area in the economic development of the country
2. THEORETICAL APPROACH TO COASTAL AREA MANAGEMENT AND PLANNING: coastal zone management mechanisms and instruments, coordination and role of public administration and citizens in coastal zone development, sustainable coastal zone development

3. INTEGRATED COASTAL GOVERNANCE: institutional framework, methodology, EU, regions and regional development, world 4. COASTAL AREA MANAGEMENT IN CROATIA: organization and structure of public administration, Institutional and intellectual capacities, maritime domain management, institute of concessions, legislative framework, planning as part of coastal zone management 5. BEACH MANAGEMENT: theoretical approach of beaches' classification, valorization methods, world and Croatian experiences, management models

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

Problem research and analysis, critical review, under mentorship, with the aim of presenting the results in the form of a scientific work.

1.8. Evaluation[69] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	5.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Demonstration of understanding the items listed in the course content through discussion with the student. Assessment of the quality of the performed scientific research, and assessment of the value of the obtained results from the theoretical and practical aspect.

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

1. Durap A., Balas C. E.: Towards sustainable coastal management: a hybrid model for vulnerability and risk assessment, Journal of Coastal Conservation, 2024. https://doi.org/10.1007/s11852-024-01065-y
2. Putra A., Hermon D.: Sustainable Development-based Coastal Management Policy Development: A Literature Review, Journal of Sustainability Science and Management, 2023, DOI: 10.46754/jssm.2023.01.015
3. Alencar N. M. P. de, Tissier M. Le, Paterson S. K., Newton A.: Circles of Coastal Sustainability: A Framework for Coastal Management, Sustainability, MDPI, 2022., doi:10.3390/su12124886
4. Fabiano M., Marin V., Paoli C., Vassallo P., 2019. Methods for the Sustainability Evaluation of Coastal Zone, Journal of Mediterranean Ecology vol. 10, p. 5-11. Available at: http://www.jmecology.com/wp-content/uploads/2014/03/5-12-Fabiano.pdf
5. Kitsiou D., Coccossis H., Karydis M., 2012. Multidimensional evaluation and ranking of coastal areas using GIS and Multiple criteria choice methods, An International Journal for Scientific Reaserch: The Science of the Total Environment, Volume 284, p. 1-17. Available at: https://doi.org/10.1016/S0048-9697(01)00851-8
6. Kovačić, M. Komadina, P: Upravljanje obalnim područjem i održivi razvoj, Pomorski fakultet Sveučilišta

[69] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

u Rijeci, 2011.

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

1. Aher S. J.: Sustainable development: nternational Journal for Legal Research & Analysis, 2022.
2. Ozili P. K.: Sustainability and Sustainable Development Research around the World, Managing Global Transitions, 2022., DOI: 10.26493/1854-6935.20.259-293
3. Jiang L. , Yang T., Wang X., Yu J., Liu J., Zhang K.: Research on integrated coastal zone management from past to the future: a bibliometric analysis, Frontiers in Marine Science, 2023., https://doi.org/10.3389/fmars.2023.1201811
4. Kies F., Monge-Ganuzas M., Los Ríos-Escalante P. R. D., Elegbede I. O.: Integrated Coastal Zone Management (ICZM) Framework and Ecosystem Approach: eutrophication phenomenon at the Mediterranean Sea, Bulletin de la Société des Sciences de Liège, 2020
5. Kovačić, M., Mrvica, A., Šimić Hlača, M.: Analytical Research Regarding the Methodological Suitability of the Multi-Criteria Analysis for the Scientific Evaluation of the Coastal Area// Journal Transactions on Maritime Science Vol. 9 (2020), No. 2; 316-323 doi:10.7225/toms.v09.n02.013.
6. Kovačić, M., Luković, T., Saftić, D.: Geographic Information System in Coastal Area Management, 30th International Conference on Organizational Science Development. „Future Organization" 30 (2011); Portorož, 615-624.
7. Kovačić, M., Jurić, M. Lekić, R.: Responsibility of Public Administration in the Protection of Coastal Area during the Adoption Process to EU – Case Study of Croatia, 32nd International Conference on Organizational Science Development. „Smart Organization. High Potential. Lean Organization. Internet of Things." 32 (2013); Portorož, p. 432-441.
8. Gundić, A., Jašić, D., Kovačić, M.: Problems of Equal Development of the Coastal Region - Šibenik - Knin County, 4th Conference of the Adriatic Forum, Geopolitical Issuea of the Adriatic – Yesterday, Today, Tomorow, 16th – 18th September 2011, Zadar, Croatia.

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*
Durap A., Balas C. E.: Towards sustainable coastal management: a hybrid model for vulnerability and risk assessment, Journal of Coastal Conservation, 2024. https://doi.org/10.1007/s11852-024-01065-y	1	1
Putra A., Hermon D.: Sustainable Development-based Coastal Management Policy Development: A Literature Review, Journal of Sustainability Science and Management, 2023, DOI: 10.46754/jssm.2023.01.015	1	1
Alencar N. M. P. de, Tissier M. Le, Paterson S. K., Newton A.: Circles of Coastal Sustainability: A Framework for Coastal Management, Sustainability, MDPI, 2022., doi:10.3390/su12124886	1	1
Fabiano M., Marin V., Paoli C., Vassallo P., 2019. Methods for the Sustainability Evaluation of Coastal Zone, Journal of Mediterranean Ecology vol. 10, p. 5-11. Available at: http://www.jmecology.com/wp-content/uploads/2014/03/5-12-Fabiano.pdf	1	1
Kitsiou D., Coccossis H., Karydis M., 2012. Multidimensional evaluation and ranking of coastal areas using GIS and Multiple criteria choice methods, An International Journal for Scientific Reaserch: The Science of the Total Environment, Volume 284, p. 1-17. Available at: https://doi.org/10.1016/S0048-9697(01)00851-8	1	1
Kovačić, M. Komadina, P: Upravljanje obalnim područjem i održivi razvoj, Pomorski fakultet Sveučilišta u Rijeci, 2011.	1	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Biserka Rukavina, PhD Mirjana Kovačić, PhDs	
Course title	**Marine spatial planning and protection of the marine environment**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

1. The theory and practice research of marine spatial planning in the world and in Croatia
2. Analyse and interpret the importance of the existence of an appropriate legal framework for the management of the coastal area
3. Analyse the basic principles of marine spatial planning and the importance of implementation in the function of evaluating and protecting the marine area
4. Analyse the interdependence of development planning/management and marine spatial planning, on selected case studies
5. Research and analyse marine spatial planning models in the function of evaluating and protecting the marine environment
6. Analyse the methodology and tools (GIS) necessary for shaping and mapping the marine space

Special objective:

7. Analyse the fundamental legal issues and problems of the establishment of marine spatial planning, as well as sustainability problems in order to understand the processes that take place in the marine environment

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:

1. Explain the theoretical and legislative determinants of marine spatial planning
2. Understand the role of public administration in the establishment of marine spatial planning as well as other stakeholders participating in the management and use of the marine environment
3. Explain the interdependence of planning/management and marine spatial planning
4. Understand and critically explain different models and approaches to marine spatial planning
5. Understand, explain and apply valorisation methods and tools (GIS) necessary for the design and mapping of marine space
6. Explain and apply the methods of multi-criteria analysis in the protection of the marine environment
7. Understand the fundamental legal and other issues and problems of the valorisation and protection of the marine environment

1.4. Course content

1. INTRODUCTION: previous research, the role of marine spatial planning in the economic development of the

country
2. THEORETICAL APPROACH to MARINE SPATIAL PLANNING: legal framework, management of the distribution of human activities in space and time in order to achieve ecological, economic and social goals and outcomes
3. MARINE ENVIRONMENT MANAGEMENT: theoretical/holistic approach to management, world and Croatian experiences of marine spatial planning/management models
4. MARINE SPATIAL PLANNING and INTEGRATED COASTAL AREA MANAGEMENT: institutional framework, mechanisms and instruments for the protection of the marine environment, the role of public administration and citizens in the valorisation of the marine environment
5. EVALUATION OF MARINE ENVIRONMENT/ MARINE SPATIAL PLANNING: spatial planning in the function of MSP, development scenarios
6. METHODOLOGICAL APPROACH TO MSP: spatial analysis and resource categorization, activity mapping, modelling using GIS tools
7. MULTI-CRITERIA ANALYSIS: Application of VKA methods in marine area zoning, practical examples of problem solving

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

Problem research and analysis, critical review, under mentorship, with the aim of presenting the results in the form of a scientific work.

1.8. Evaluation[70] of student's work

Course attendance	0.5	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	5.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Demonstration of understanding the items listed in the course content through discussion with the student, 1 ECTS credit.
Assessment of the quality of the scientific research, and assessment of the value of the obtained results from the theoretical and practical aspect, 5 ECTS credits.

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

1. Ansong, J., H. Calado, H., Gilliland, P.M.: A multifaceted approach to building capacity for marine/maritime spatial planning based on European experience, Marine Policy, 2019, 103422, ISSN 0308-597X, (https://www.sciencedirect.com/science/article/pii/S0308597X18304056)
2. Direktiva 2008/56/EZ o uspostavi okvira za djelovanje Zajednice u području politike morskog okoliša, SL L 164, 25.6.2008.
3. Direktiva 2014/89/EU Europskog parlamenta i Vijeća od 23. srpnja 2014. o uspostavi okvira za prostorno planiranje morskog područja, SL L 257, 28.8.2014.

[70] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

4. Fabiano M., Marin V., Paoli C., Vassallo P., 2009. Methods for the Sustainability Evaluation of Coastal Zone, Journal of Mediterranean Ecology vol. 10, p. 5-11. Available at: http://www.jmecology.com/wp-content/uploads/2014/03/5-12-Fabiano.pdf
5. Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization and the Directorate-General for Maritime Affairs and Fisheries of the European Commission, MSPglobal: International guide on marine/maritime spatial planning. 2021. https://unesdoc.unesco.org/ark:/48223/pf0000379196.
6. Kovačić, M., Rukavina, B., Perinić, L.: Marine spatial planning in Croatia – legal and technical aspects, Pomorstvo, 36 (2022), 1; 14-21.
7. Kovačić, M., Zekić, A., Rukavina, B. (2016). Maritime Spatial Planning in Croatia–Necessity or Opportunity for Balanced Development. Pomorstvo, 30 (1), 82-87.
8. Kovačić, M. Komadina, P: Upravljanje obalnim područjem i održivi razvoj, Pomorski fakultet Sveučilišta u Rijeci, 2011.

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

1. Crossland, Christopher J., Baird, D., Ducrotoy, J.P., Lindeboom, H.: The Coastal Zone — a Domain of Global Interactions, In book: Coastal Fluxes in the Anthropocene, 2005.
2. Kovačić, M., Mrvica, A., Šimić Hlača, M.: Analytical Research Regarding the Methodological Suitability of the Multi-Criteria Analysis for the Scientific Evaluation of the Coastal Area// Journal Transactions on Maritime Science Vol. 9 (2020), No. 2; 316-323 doi:10.7225/toms.v09.n02.013.
3. Kovačić, M., Luković, T., Saftić, D.: Geographic Information System in Coastal Area Management, 30th International Conference on Organizational Science Development. „Future Organization" 30 (2011); Portorož, 615-624.
4. Kovačić, M., Jurić, M. Lekić, R.: Responsibility of Public Administration in the Protection of Coastal Area during the Adoption Process to EU – Case Study of Croatia, 32nd International Conference on Organizational Science Development. „Smart Organization. High Potential. Lean Organization. Internet of Things." 32 (2013); Portorož, p. 432-441.
5. Gundić, A., Jašić, D., Kovačić, M.: Problems of Equal Development of the Coastal Region - Šibenik - Knin County, 4th Conference of the Adriatic Forum, Geopolitical Issuea of the Adriatic – Yesterday, Today, Tomorow, 16th – 18th September 2011, Zadar, Croatia.
6. Zaucha, J., Gee, K. 2020. Maritime Spatial Planning: Past, Present, Future (Cham, Switzerland: Palgrave Macmillan, 2018), 477 pp., Ocean Yearbook Online, 34(1), 614-618. https://doi.org/10.1163/22116001-03401037

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. Ansong, J., H. Calado, H., Gilliland, P.M.: A multifaceted approach to building capacity for marine/maritime spatial planning based on European experience, Marine Policy, 2019, 103422, ISSN 0308-597X, Available online: (https://www.sciencedirect.com/science/article/pii/S0308597X18304056)	Available online	1-5
2. Direktiva 2008/56/EZ o uspostavi okvira za djelovanje Zajednice u području politike morskog okoliša, SL L 164, 25.6.2008. Available online: https://eur-lex.europa.eu/legal-content/HR/ALL/?uri=CELEX:32008L0056	Available online	1-5
3. Direktiva 2014/89/EU Europskog parlamenta i Vijeća od 23. srpnja 2014. o uspostavi okvira za prostorno planiranje morskog područja, SL L 257, 28.8.2014. Available online: https://eur-lex.europa.eu/legal-content/HR/TXT/?uri=CELEX%3A32014L0089	Available online	1-5
4. Fabiano M., Marin V., Paoli C., Vassallo P., 2009. Methods for the Sustainability Evaluation of Coastal Zone, Journal of Mediterranean Ecology vol. 10, p. 5-11. Available online: http://www.jmecology.com/wp-content/uploads/2014/03/5-12-Fabiano.pdf	Available online	1-5

5. Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization and the Directorate-General for Maritime Affairs and Fisheries of the European Commission, MSPglobal: International guide on marine/maritime spatial planning. 2021. Available online: https://unesdoc.unesco.org/ark:/48223/pf0000379196	Available online	1-5
6. Kovačić, M., Rukavina, B., Perinić, L.: Marine spatial planning in Croatia – legal and technical aspects, Pomorstvo, 36 (2022), 1; 14-21. Available online: https://hrcak.srce.hr/279298	Available online	1-5
7. Kovačić, M., Zekić, A., Rukavina, B. (2016). Maritime Spatial Planning in Croatia–Necessity or Opportunity for Balanced Development. Pomorstvo, 30 (1), 82-87. Available online: https://hrcak.srce.hr/clanak/236743	Available online	1-5
8. Kovačić, M. Komadina, P: Upravljanje obalnim područjem i održivi razvoj, Pomorski fakultet Sveučilišta u Rijeci, 2011.	1	1-5

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	*Professor emeritus* Frano Barbir, PhD	
Course title	Hydrogen Technologies in Shipping	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The objectives of the course are:
To introduce the student to the necessity of decarbonization of the energy sector, with a special emphasis on transport, which includes maritime transport. In doing so, it is important to know the IMO regulations regarding emissions of harmful gases.
To introduce the student to hydrogen fuel, produced from renewable energy sources, as one of the possible solutions of decarbonization, with the state of technologies of production, storage and application of hydrogen and possible directions of development, with problems that may arise in the application of hydrogen as a fuel in maritime transport, in comparison with other alternative fuels and their advantages and disadvantages.
To provide the student with the knowledge that he/she can independently analyze and compare different decarbonization options from a technical, environmental and economic aspect.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

After passing the exam students will be able to:
1. Understand necessity and urgency for decarbonization of the energy sector, particularly in transport, and understand the role of hydrogen produced from renewable energy sources.
2. Understand the challenges of hydrogen use in shipping and be aware of advantages and especially disadvantages in comparison with other alternatives.
3. Applied acquired knowledge in evaluation and selection of adequate technical solutions in corresponding to the ship type and use.
4. Determine the needs that must be satisfied by the onshore infrastructure.
5. Independently analyze and compare different decarbonization solutions from technical, environmental and economic aspect.
6. Critically evaluate and be able to communicate with fellow experts, the scientific community and the wider community on the field of hydrogen technologies and their application in maritime sector

1.4. Course content

- Necessity for decarbonization of the energy sector, particularly the transport
- IMO emission restrictions
- Hydrogen and its properties
- Role of hydrogen in decarbonization of energy sector

- Technologies for generation of hydrogen from renewable energy sources
- Fuel cells and electric drive
- Hydrogen storage, safety aspects
- Fuels produced from hydrogen (methanol, ammonia) and their use in shipping
- Practical examples

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 (consultations) attendance, literature review, individual research, gathering and analysing data, synthesis of the results and writing of a seminar paper.

1.8. Evaluation[71] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	3	Experiment	
Written exam		Oral exam		Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Active participation in class, presenting the obtained and relevant research results, and finally, writing a seminar paper to serve as basis for defining the grade.

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

K.S.V. Santhanam, R.J. Press, M.J. Miri, A.V. Bailey, G.A. Takacs, Introduction to Hydrogen Technology, 2nd ed., Wiley, 2017
G. Pawelec and M. Muron, Techno-economic assessment of low-carbon hydrogen technologies for the decarbonization of shipping, Technical Paper, Hydrogen Europe, June 2021.
A. Slaughter, S. Ray, T. Shattuck, International Maritime Organization (IMO) 2020 Strategies in a non-compliant world, Deloitte. Co., 2019

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

F.Barbir, PEM Fuel Cells: Theory and Practice, 2nd ed., Elsevier/Academic Press, 2013
L.S. Hammer, Maritime Forecast to 2050, Energy Transition Outlook 2021, DNV, October 2021
How hydrogen could help decarbonize the maritime sector, Policy Paper, Hydrogen Europe, June 2021.
International Journal of Hydrogen Energy,
Magazine H2View

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*
K.S.V. Santhanam, R.J. Press, M.J. Miri, A.V. Bailey, G.A. Takacs, Introduction to Hydrogen Technology, 2nd ed., Wiley, 2017	1	5

[71] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

G. Pawelec and M. Muron, Techno-economic assessment of low-carbon hydrogen technologies for the decarbonization of shipping, Technical Paper, Hydrogen Europe, June 2021.	Available online	5
A. Slaughter, S. Ray, T. Shattuck, International Maritime Organization (IMO) 2020: Strategies in a non-compliant world, Deloitte. Co., 2019	Available online	5

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

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NAVAL SYSTEMS

General information		
Course coordinator	*Professor emeritus* Serđo Kos, PhD Luka Mihanović, PhD	
Course title	**Geopolitics and geostrategy**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of the course is the presentation of geostrategy as a part of geopolitics which deals with the research of geographic factors with impact on the political and military planning of action of a specific state in the realization of national interests. Geopolitics studies geographical and political characteristics of a certain region (influence of geography on politics). Geostrategy studies military planning aspects aiming at achieving the defined national goals (application of military power on specifically critical area on Earth, directed towards the creation of political presence in international system).
Students will learn about the term of geostrategy and its connection with geopolitics. Also, geostrategy will be presented through its evolutional phases – development of land power (Clausewitz and Jomini), maritime power (Mahan, Corbett, Mackinder), aerial power (Dhouet, Mitchell, Seversky), nuclear power (Brodie, Kahn) and space power (Oberg, Dolman, Klein). Among them, the main focus will be placed on maritime power and its relevance today and in the future.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

The following are the expected learning outcomes on the basis of which the students, after completing and passing the course will be able to:

1. Explain structural elements of geopolitics and geostrategy and their relationship,
2. Analyse and evaluate relevant factors that influence the formulation of the geostrategy,
3. Explain stages of geostrategy from the beginning of the 19th century until today,
4. Explain theories of maritime power, nuclear power and space power,
5. Analyse and evaluate maritime power and correlate it with the geostrategy,
6. Analyse and evaluate geostrategic characteristics of maritime space,
7. Analyse and evaluate geopolitical and geostrategic components of the sea,
8. Analyse and evaluate maritimization and militarization at sea,
9. Analyse and evaluate the impact of maritime power on warfare,
10. Analyse and evaluate elements of terrestrial power.

1.4. Course content

Definition of geopolitics and geostrategy. Relation between geostrategy and geopolitics. The impact of factors on forming geostrategy. Geographical factor. Historical factor. Demographical factor. Strategical culture. Other factors.

Development phases of geo-strategy from the beginning of the 19th century to the present. Theories of land power of the 19th century. Theories of naval power 1890-1919. Theories of aerial power 1918-1945. Theories of nuclear power 1945-1960. Theories of space power 1999-present.
Naval power. Connection of naval power and geostrategy. Construction of naval power. Naval power strategy. Geostrategic characteristics of maritime areas. Geopolitical and geostrategic components of the sea. Maritimisation during the world history. Militarisation at sea.
Impact of naval power on maritime warfare. Elements and classification of land power. Theory of naval power. Mahan's theory of naval power. Corbett and naval power. Mackinder and geostrategy. Other theoreticians of the naval power. Case studies. Geostrategic significance of the Mediterranean. Geostrategic significance of the Indian ocean. Geostrategy of the USA (expedition warfare).

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

Research aimed at presenting the results in the form of scientific work.

1.8. Evaluation[72] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio		Project assignment	3				

1.9. Assessment and evaluation of student's work during classes and on final exam

Demonstration of understanding the items listed in the course content through discussion with the student, 1 ECTS credit.
Assessment of the quality of the scientific research, and assessment of the value of the obtained results from the theoretical and practical aspect, 5 ECTS credits.

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

1. Collins, J. M.: Military Geography, Washington: National Defence University Press, 1998.
2. Cvrtila, V.: Politička geografija i geopolitika, skripta, Zagreb: Fakultet političkih znanosti, 2004.
3. Jablonsky, D.: Roots of Strategy – Book 4 (Mahan, Corbett, Dhouet, Mitchell), Mechanicsburg-Pennsylvania: Stackpoole Books, 1999.

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

1. Bouchard, C.; Crumplin, W.: Neglected no longer: the Indian Ocean at the forefront of world geopolitics and global geostrategy, Journal of the Indian Ocean Region, 6,1, 2010., pp. 26-51.
2. Diaconu, Florin: A Renewed Geopolitical and Geostrategic Role for the Mediterranean Sea, Strategic Impact, no.3, 2008.
3. Dodds, K.: Geopolitics: A Very Short Introduction, New York: Oxford University Press, 2007.
4. Hattendorf, J. B.: Naval Strategy and Policy in the Mediterranean: Past, Present and Future, London: Frank Cass Publishers, 2000.
5. Murray, W.; Knox, M; Bernstein, A.: The Making of Strategy: Rulers, States, and War, Cambridge:

[72] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

Cambridge University 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*
Collins, J. M.: Military Geography, Washington: National Defence University Press, 1998.	1	1-10
Cvrtila, V.: Politička geografija i geopolitika, skripta, Zagreb: Fakultet političkih znanosti, 2004.	1	1-10
Jablonsky, D.: Roots of Strategy – Book 4 (Mahan, Corbett, Dhouet, Mitchell), Mechanicsburg-Pennsylvania: Stackpoole Books, 1999.	1	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

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General information		
Course coordinator	Luka Mihanović, PhD	
Course title	**Navy combat systems**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	1	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (P+V+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Introduce students to navy combat systems, their constructional and technological solutions. Adopt knowledge on artillery and rocket armed systems of navies, mine warfare and submarine warfare of armed navies with special focus on their use. Conduct a comprehensive analysis of today's navy weapon systems and tendencies of their future development and appliance expending on global safety movements. Explore platforms (holders) of navy weapon systems with an emphasis on warships. Analyse networking and interdependence of weapon systems with other ship systems and systems on mainland. Master knowledge on efficiency and tactics of applying navy weapon systems on different platforms and in different conditions of combat acts.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Upon successful completion of the course, students will be able to:
1. Understand the basics of ballistics and shooting theory.
2. Analyse the different types of naval cannons and their tactical use.
3. Analyse the most significant naval artillery systems of the world navies.
4. Understand the basics of rocket weaponing and their tactical use.
5. Explain the basic principles of air defence and missile defence of naval forces.
6. Understand the basics of mine weapons and their tactical use.
7. Understand principles anti-mine defence.
8. Understand the basics of torpedo weaponing and their tactical use.
9. Know the principles of use of navy combat carriers.
10. Explain development tendencies of the ships combat systems.

1.4. Course content

1. Classification of holders of navy weapon systems.
2. Systems of warship weaponing, the division of weapon systems.
3. Ballistics foundations and shooting theories, shooting goals n sea, land and in air.
4. Ship's canon weaponing.
5. Ship's rocket weaponing.
6. Anti-aircraft defence of the ship.
7. Underwater weaponing.
8. Mine weapons.

9. Torpedo weaponing.
10. Electronic combat systems.
11. Integrated systems for ship managing and devices for fire managing.
12. Special ship weaponing systems.
13. The most important weaponing systems of navy's of the world.
14. Development tendencies the ships combat 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

Attending class, participating in seminars, independent assignments and research.

1.8. Evaluation[73] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1	Experiment	
Written exam	1	Oral exam	1	Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Assessment is performed through participation in seminars, seminar paper, research in the field and attendance.

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

1. Brlić, M.: Razarači i fregate za 21. stoljeće, Zagreb, 2002.
2. Kristić, V.; Polić, I.: Naoružanje i opremanje ratnog broda, FSB, Zagreb
3. Seretinek, Ž.: Tendencija razvoja suvremenih brodskih sustava, HRM, 2006.
4. Seretinek, Ž.: Osnove balistike i teorije gađanja, HVU, Zagreb, 2011.
5. Mihanović L., Seretinek, Ž.: Topničko streljivo HRM, HVU, Zagreb, 2017.

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

1. https://www.janes.com/naval-weapons
2. Newspapers: Hrvatski vojnik; Armada, Defence news, Navy, …
3. Materials issued by professors Croatian Military Academy.
4. Different materials issued by the world's largest manufacturers of ship weapons and equipment.

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*
All titles	1	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[73] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

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General information		
Course coordinator	Stjepan Domjančić, PhD	
Course title	**Maritime dimension of international security**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of the course is to get acquainted with the maritime dimension of international security, which is one of the most dynamic sectors in the field of security. Maritime security affects development efforts, insurance, international law and global shipping. Students will be introduced to the dominant approaches to international security with special emphasis on the place and role of the maritime dimension in these approaches. Students will be provided with a historical overview of changes in access to maritime security and its impact on global security trends. The maritime dimension of peacekeeping operations, i.e. other peace support and crisis response operations, will be presented and explained.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Upon successful completion of the course, students will be able to:
1. Explain the basic concepts of modern security studies and maritime aspects of these studies.
2. Analyse and evaluate dominant approaches to international security.
3. Explain the stages of development of the maritime dimension of international security.
4. Analyse and evaluate changes in approaches to international security and contemporary risks and threats to international security related to the maritime dimension.
5. Analyse and evaluate the development of the naval component of modern armed forces.
6. Analyse and evaluate political, social and technical-technological trends that influence the shaping of the maritime dimension of international security.
7. Analyse and evaluate the dominant global actors of the maritime dimension of international security.
8. Explain the role of naval forces in conducting international operations.
9. Analyse and evaluate recent peacekeeping operations, peace support operations, crisis response operations, humanitarian interventions, etc. in relation to their maritime dimension.
10. Identify trends in the development of the maritime dimension of international security.

1.4. Course content

- Contemporary security studies and approaches to international security – realism and neorealism, liberalism, constructivism, post-modernism. The place and role of the maritime dimension.
- Stages of development of the maritime dimension of security – the era of colonial expansion, world wars, the Cold War period, the post-Cold War period, the maritime dimension in the 21st century.
- International security – situation, trends, actors. The significance of the maritime dimension in contemporary security trends.
- Naval component in the development plans of modern armed forces and strategic commitments.
- Political and social factors that influence the formation of the maritime orientation of individual countries. Security aspects of maritime orientation.

- The impact of technical and technological achievements on naval warfare.
- Maritime dimension of peacekeeping operations, crisis response operations, peace support operations. Case studies.

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

1.7. Student's obligations

Attending classes, participating in seminars, independent assignments and research.

1.8. Evaluation[74] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	1	Experiment	
Written exam	1	Oral exam	1	Essay		Research	2.6
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Participation in seminars, seminar paper, research in the field and attendance.

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

Bueger, C., Edmunds, T.: Beyond seablindness: a new agenda for maritime security studies. International Affairs 93, 2017.
Collins, A. (ur.): Suvremene sigurnosne studije. Zagreb: Politička kultura, 2010.
Buzan, B., Waever O., De Wilde, J.: Security: A new framework for analysis. Boulder: Lynne Rienner, 1998.
Marlow, P. B.: Maritime security: an update of key issues. Maritime Policy & Management 48(1). 2021.

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

Buzan, B.: People, States and Fear: An Agenda for International Security Studies in the Post-Cold War Era. Boulder: Lynne Rienner, 1991.
Hough, P.: Understanding Global Security. London i New York: Routledge, 2008.
Kolodziej, E. A.: Sigurnost i međunarodni odnosi. Zagreb: Politička kultura, 2012.
Merlingen, M., Ostrauskaite, R. (ur.): European Security and Defence Policy. London i New York: Routledge, 2008.

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*
Bueger, C., Edmunds, T.: Beyond seablindness:a new agenda for maritime security studies. International Affairs 93(6), 2017.	1	1
Collins, A. (ur.): Suvremene sigurnosne studije. Zagreb: Politička kultura, 2010.	1	1
Buzan, B., Waever O., De Wilde, J.: Security: A new framework for analysis. Boulder: Lynne Rienner, 1998.	1	1
Marlow, P. B.: Maritime security: an update of key issues. Maritime Policy & Management 48(1). 2021.	1	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[74] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Robert Fabac, PhD	
Course title	**Strategic planning and leadership**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

The main objectives of the course concern the achievement of learning outcomes from several related areas, important for the highest level of leadership and management in large organizations, especially in military systems. These areas are: strategic management, public sector management, defence planning, modern leadership, approaches to understanding leadership, decision making and decision support, interactive decision-making (game theory) and digital transformation.

1.2. Course enrolment requirements

None

1.3. Expected course learning outcomes

Upon successful completion of the course, participants will be able to:
• analyze the concept of competitive advantage as well as the ways of its realization;
• compare modern planning techniques and define an integrated support system for defence planning;
• define the organizational design model of an efficient / effective organization;
• identify and select appropriate decision support tools;
• make models of interactive decision making by applying game theory;
• describe a system for measuring organizational performance and supporting the implementation of the strategy;
• analyze different approaches to leadership in practice;
• analyze and argue strategies and implementation (action) plans.

1.4. Course content

- Strategy and strategic management. Mission and vision of the organization. Setting organizational goals. Strategic planning. Strategic management process model.
- Strategic management in the public sector. Military strategy. National Security Strategy. The impact of innovation and new technologies on military organization.
- Resource-based view. Core competencies. Resource management. Organization capabilities. Capabilities in the domain of defence. Strategic management in a changing environment. SWOT analysis. Creating a strategy. Strategy implementation.
- Strategic planning support systems. Balanced scorecard (BSC). BSC implementation. Planning, Programming, and Budgeting System (PPBS). The SPPP system. Approaches to defence planning.
- Organizational interactions - models of game theory. Planning in interactive situations. Competitive

advantage.

- Organizational design. Organizational structure. Galbraith's model. Business processes. Projects organized. Organizational changes. Digitization and digital transformation. Digital transformation strategy. Implementation of new technologies. Artificial Intelligence.
- Decision making in the organization. The decision-making process. The problem of multicriteria evaluation. Uncertainty and risk. Group decision-making techniques. Decision support tools.
- Interactive decision-making - game theory. Competitive scenarios. Cooperative scenarios. Interaction modelling and simulations.
- Decision making in the defence system. Response to asymmetric threats. Decision making in crises. Information technology in decision-making. Business intelligence.
- Behavioural approach in organizational theory. Communication and decision-making. Guidance. Behavioural leadership theory. Situational approach to leadership. Transactional and transformational leadership. Scenario techniques for managers and leaders. Strategic communication management.

1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☐ exercises ☒ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other _____
1.6. Comments	In case of an impediment in conducting live classes, distance education will be applied.	

1.7. Student's obligations

Active participation in teaching processes.

1.8. Evaluation[75] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper	2	Experiment	
Written exam	1	Oral exam	1.6	Essay		Research	1
Project		Continuous assessment		Report		Practical work	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The stated learning outcomes will be verified through seminar work and conducted research, which is also a prerequisite for taking the exam. In the written part of the exam, there will be a shorter check using appropriate quantitative tasks. In the oral part of the exam, emphasis will be placed on topics of particular interest to the PhD student, but attention will also be paid to other content.

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

- Bryson, J. M. (2011), Strategic planning for public and non-profit organizations: A guide to strengthening and sustaining organizational achievement (4th ed.), Jossey-Bass, San Francisco, CA
- Northouse, P. G. (2019), Leadership: Theory and Practice. SAGE Publications. Los Angeles
- Hitt, M. A., Ireland, R.D., Hoskisson, R.E. (2014), Strategic Management: Competitiveness and Globalization- Concepts and Cases, 11th Ed., Cengage Learning
- Ministry of Defence UK (2021), Digital Strategy for Defence Delivering the Digital Backbone and unleashing the power of Defence's data, April 2021, available at https://www.techuk.org/resource/digital-strategy-for-defence-delivering-the-digital-backbone-and-

[75] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

unleashing-the-power-of-defence-s-data.html

- Fabac, R. (2020), Organizacijska teorija - s naglaskom na teoriju igara, Naklada Slap, Jastrebarsko

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

- Morgan, F.E., Boudreaux, B., Lohn, A.J., Ashby, M., Curriden, C., Klima, K., Grossman, D. (2020), Military Applications of Artificial Intelligence - Ethical Concerns in an Uncertain World, RAND Corporation
- DOD/GAO working group (1984), Planning, programming, and budgeting system (PPBS), available at https://www.gao.gov/assets/oacg-84-5.pdf
- Buble, M. (Ur.) (2005), Strateški menadžment, Sinergija, Zagreb

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*
Bryson, J. M. (2011), Strategic planning for public and non-profit organizations: A guide to strengthening and sustaining organizational achievement (4th ed.), Jossey-Bass, San Francisco, CA	Available online	1-10
Northouse, P. G. (2019), Leadership: Theory and Practice. SAGE Publications. Los Angeles	Available online	1-10
Hitt, M. A., Ireland, R.D., Hoskisson, R.E. (2014), Strategic Management: Competitiveness and Globalization- Concepts and Cases, 11th Ed., Cengage Learning	Available online	1-10
Ministry of Defence UK (2021), Digital Strategy for Defence Delivering the Digital Backbone and unleashing the power of Defence's data, April 2021, available at https://www.techuk.org/resource/digital-strategy-for-defence-delivering-the-digital-backbone-and-unleashing-the-power-of-defence-s-data.html	Available online	1-10
Fabac, R. (2020), Organizacijska teorija - s naglaskom na teoriju igara, Naklada Slap, Jastrebarsko	Available online	1-10

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

General information		
Course coordinator	Dario Ogrizović, PhD Dražen Žgaljić, PhD	
Course title	**Critical Infrastructure Security**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

Introduction to physical and cyber security protection of critical infrastructure which is essential for maintaining vital societal functions. Damage to, destruction of or disruption of critical infrastructure due to natural disasters, terrorism, criminal activity or malicious conduct can have an immediate, dramatic and significant negative impact on the security of a country or the European Union and the well-being of its citizens.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After finishing the course, the students will be able:

1. Analyze and define the theoretical foundations of CI.
2. Conduct a risk, threat, and vulnerability assessment.
3. Identify possible physical and cyber threats to CI.
4. Investigate and evaluate different approaches to CI protection.
5. Evaluate the interconnection and dependency of critical systems.
6. Distinguish and systematize automated industrial control systems for CI.

1.4. Course content

Theoretical foundations of CI. Key resources and assets. Threat factors and agents in CI. Risk, threat and vulnerability assessment. Risk mitigation and CI resilience. Cascading effects of CI interdependencies. Coordination of CI protection. Incident management. Physical, human and cyber systems. Cybersecurity. Law and regulations. Industrial hardware and software management systems. Maritime CI. New types of CI and future threats and risks.

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

1.7. Student's obligations

Course attendance (consultations), preparing and presenting a seminar paper and project.

1.8. Evaluation[76] of student's work

Course attendance	0,4	Activity/Participation		Seminar paper	1	Experimental work	
Written exam		Oral exam		Essay		Research	2
Project	2,6	Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The learning outcomes are validated and evaluated by monitoring the students' work on the research, the obtained research results and the manner and quality of research and presentation of a seminar paper and project.

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

1. Hayden, E. (2020). Critical Infrastructure Risk Assessment: The Definitive Threat Identification and Threat Reduction Handbook. Rothstein Publishing.

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

1. Brooks, C. J., & Craig, P. A., Jr. (2022). Practical industrial cybersecurity: ICS, Industry 4.0, and IIoT. Wiley.

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*
Hayden, E. (2020). Critical Infrastructure Risk Assessment: The Definitive Threat Identification and Threat Reduction Handbook. Rothstein Publishing.	3	2

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

[76] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

General information		
Course coordinator	Tomislav Sunko, PhD	
Course title	**The Role of the Coast Guard in Enhancing Maritime Safety and Security Efficiency**	
Study programme	Doctoral (PhD) programme *Maritime Studies*	
Course status	Elective	
Year	I.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	12

1. COURSE DESCRIPTION

1.1. Course objectives

This course aims to enable PhD candidates to independently analyse, investigate, and critically evaluate the functions of coast guard services across diverse maritime safety and security environments, including peacetime operations, wartime engagements, and combat missions. Additionally, through systematic research of scholarly and regulatory sources, students will develop competencies in assessing existing frameworks, exercising critical judgement, and formulating novel approaches to improving maritime safety and security as pertaining to coast guard activities.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

It is expected that, after completion of the course, PhD students will be able to:

1. Analyse and research the functional and organisational forms of coast guard models worldwide;
2. Evaluate existing research on coast guard organisational models internationally;
3. Interpret coast guard organisations and operations from legislative, theoretical, and practical perspectives;
4. Analyse the doctrinal principles underlying coast guard roles in peacetime, wartime, and combat-related tasks;
5. Critically assess the functional correlation between coast guard services and the organisational-operational structures within the system of surveillance and protection of the rights and interests of coastal states;
6. Research, critically appraise, and propose surveillance innovations aimed at enhancing maritime safety and security and the operational efficiency of coast guards;
7. Assess future development trends in coast guard organisation based on scientific and legislative literature.

1.4. Course content

- Organisational, geographical, and structural models of coast guard organisation worldwide;
- The impact of coast guard services on contemporary maritime safety and security;
- Comparative analysis of coast guard services globally;
- Legal, statutory, and sub-statutory regulations governing coast guard operations;
- The roles of coast guards in peacetime, wartime, and combat-related tasks;

- Operational efficiency of coast guards in addressing contemporary maritime challenges;
- Protection of sovereign rights and interests, and the enforcement of jurisdiction in internal waters, territorial seas, exclusive economic zones (EEZs), and continental shelves;
- Technological and strategic innovations in maritime safety and security aimed at enhancing the operational efficiency of coast guards;
- The international dimension of national coast guard participation in multipurpose maritime cooperative operations and support missions coordinated by EU agencies (EFCA, EMSA, and Frontex);
- Integrated management of external maritime borders with a view to improving maritime safety and security in general;
- Research on coast guard development trends: a comparative approach.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assigment ☒ multimedia and network ☐ laboratories ☒ mentorship ☐ other _____
1.6. Comments	In case of an impediment in conducting live classes, distance education will be applied.	

1.7. Student's obligations

Class attendance and active participation in course activities (including individual consultations).
Research, analysis and comparison of findings of scientific studies, legislative acts, and innovations in the context of coast guard studies and maritime safety and security.
Based on relevant literature, develop a theoretical framework for a research paper and a corresponding research proposal, incorporating the intended scientific contribution within the field of the course.

1.8. Evaluation[77] of student's work

Course attendance	0.4	Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	3.6
Project		Sustained knowledge check		Report		Practice	
Portfolio			2				

1.9. Assessment and evaluation of student's work during classes and on final exam

Student performance is evaluated through continuous monitoring of their work on the research proposal, the development of a theoretical framework, and the methodological appropriateness of their research design.

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

1. Boşilcă, R.-L., Ferreira, S., & Ryan, B. J. (Eds.) (2022). *Routledge handbook of maritime security*. Routledge.
2. Krause, J., & Bruns, S. (Eds.) (2020). *Routledge handbook of naval strategy and security*. Routledge.
3. McCabe, R., Sanders, D., & Speller, I. (Eds.) (2021). *Europe, small navies and maritime security: Balancing traditional roles and emergent threats in the 21st century*. Routledge.
4. Mujuthaba, A. M. (2022). *What is a coast guard? Developing a nomenclature model for coast guard* (master's thesis, Naval Postgraduate School). https://apps.dtic.mil/sti/pdfs/AD1185049.pdf
5. Prabhakaran, P. (2009). *Coast guards of the world and emerging maritime threats*. Ocean Policy Research Foundation. https://www.spf.org/_opri_media/publication/pdf/200903_ISSN1880-0017.pdf

[77] NOTE: Each method of evaluation should be accompanied by a corresponding share of ECTS credits of individual activities, so that the total ECTS credits correspond to the ECTS value of the course. Empty fields should be used for additional activities.

6. Sunko, T. (2024). *Optimizacija prostornog razmještaja resursa obalne straže u poluzatvorenim morima u funkciji nacionalne sigurnosti*. Doktorski rad. Sveučilište u Rijeci: Pomorski fakultet. https://urn.nsk.hr/urn:nbn:hr:187:493640

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

1. Amižić Jelovčić, P., Primorac, Ž., & Mandić, N. (2017). *Obalna straža Republike Hrvatske – pravni okvir*. Pravni fakultet Sveučilišta u Splitu.
2. Apriliyanti, K., Agussalim, D., & Eddyono, S. W. (2024). Indonesia-Australian Coast Guard cooperation: an integrative partnership in controlling cross-border crime. *Journal of Interdisciplinary LegalIssues, 1*(2), 109–145.
3. Bolanča, D., & Amižić Jelovčić, P. (2018). Pravni okvir borbe protiv pomorskog terorizma s posebnim osvrtom na Obalnu stražu Republike Hrvatske. *Poredbeno pomorsko pravo, 57*(172), 355–406. https://doi.org/10.21857/yrvgqtkrn9
4. Canadian Naval Review. (n.d.). https://www.navalreview.ca/archive/
5. Choi, T. (2020). Sea Control by Other Means: Norwegian Coast Guard Operations Under International Maritime Law. *Ocean Development & International Law*, *51*(1), 35–46. https://doi.org/10.1080/00908320.2019.1636501
6. Gray, C. S. (2001). The Coast Guard and Navy. *Naval War College Review, 54*(3), 112–138. https://digital-commons.usnwc.edu/nwc-review/vol54/iss3/9
7. Guilfoyle, D., & Chan, E. S. Y. (2022). Lawships or warships? Coast guards as agents of (in)stability in the Pacific and South and East China Sea. *Marine Policy*, *140*, Article 105048. https://doi.org/10.1016/j.marpol.2022.105048
8. Guo J, Fu S and Shi Y (2025) New developments in the administrative law enforcement of CCG: from the perspective of the implementation of CGP. *Front. Mar. Sci. 12:1682235*. https://doi.org/10.3389/fmars.2025.1682235
9. Gustafsson, Å. (2019). Maritime security and the role of coast guards: The case of Finland and the Åland islands' demilitarisation. *Baltic Journal of Law & Politics, 12*(1), 1–34. https://doi.org/10.2478/bjlp-2019-0001
10. Hrvatski vojnik. (n.d.). https://hrvatski-vojnik.hr/
11. Jinhu W., Yichao W., & Xin S. (2025). Forcible measures for maritime law enforcement by the coast guard. *Front. Mar. Sci. 12:1654808*. https://doi.org/10.3389/fmars.2025.1654808
12. Kubiak, K. (2019). Kystvakten – Norwegian Coast Guard. *Studia Maritima, 32*, 207–230. http://dx.doi.org/10.18276/sm.2019.32-09
13. Lee, K. B. (2018). The Korea Coast Guard's Use of Force Against Chinese Fishing Vessels: A Note. *Ocean Development & International Law*, *49*(3), 226–235. https://doi.org/10.1080/00908320.2018.1443416
14. Nimac, K. (2014). Ustrojstvo i organizacija obalnih straža u svijetu s posebnim osvrtom na Obalnu stražu Sjedinjenih Američkih Država. *Elektronički zbornik radova Veleučilišta u Šibeniku, 8*(1–2), 155–167. https://hrcak.srce.hr/124979
15. Proceedings of the Marine Safety and Security Council: The Coast Guard Journal of Safety and Security at Sea. (n.d.). https://www.dco.uscg.mil/Featured-Content/Proceedings-Magazine/Proceedings-Archives-Delete/Proceedings-Archives/
16. Sunko, T., Kos, S., Balić Dorić, I. & Sršen, A. (2025). Comparative Analysis of the Dominant Models of Coastal Guard Structures in Europe with Access to Semi-Enclosed Seas. *Pomorstvo, 39* (1), 45-54. https://doi.org/10.31217/p.39.1.4
17. Sunko, T., Mladineo, M., Medvidović, Z. & Dedo, M. (2025). Evaluation of Maritime Safety Policy Using Data Envelopment Analysis and PROMETHEE Method. *Applied sciences, 15* (24), 13256. https://doi.org/10.3390/app152413256
18. Waerp, E. (2025). Nordic Exceptionalism? How Scandinavian Border and Coast Guards Rationalize Their Participation in Frontex Operations. *Nordic Journal of Migration Research*, *15*(3), 1–17.

https://www.jstor.org/stable/48816308
19. Yang, P. (2025). Where Should China Coast Guard Go? Developments and Future of China Coast Guard Reform. *Asia-Pacific Journal of Ocean Law and Policy*, *10*(1), 49-73. https://doi.org/10.1163/24519391-bja10075
20. Zhang, S. A. (2025). Law enforcement or use of force: The legal nature of activities conducted by CCG and JCG in the disputed waters. *Mar. Policy 171,* 106440. https://doi.org/10.1016/j.marpol.2024.106440

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*
Boşilcă, R.-L., Ferreira, S., & Ryan, B. J. (Eds.) (2022). *Routledge handbook of maritime security*. Routledge.	1	1
Krause, J., & Bruns, S. (Eds.) (2020). *Routledge handbook of naval strategy and security*. Routledge.	1	1
Sunko, T. (2024). *Optimizacija prostornog razmještaja resursa obalne straže u poluzatvorenim morima u funkciji nacionalne sigurnosti*. Doktorski rad. Sveučilište u Rijeci: Pomorski fakultet.	1	1
McCabe, R., Sanders, D., & Speller, I. (Eds.) (2021). *Europe, small navies and maritime security: Balancing traditional roles and emergent threats in the 21st century*. Routledge.	1	1
Mujuthaba, A. M. (2022). *What is a coast guard? Developing a nomenclature model for coast guard* (master's thesis, Naval Postgraduate School).	Available online	1
Other titles	Available online	1

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

Quality assurance is monitored in accordance with the ISO 9001 system and the European standards and guidelines for quality assurance, which are implemented at the Faculty of Maritime Studies in Rijeka. Yearly analysis of quantitative student examination data is conducted and appropriate measures are adopted accordingly.

University of Rijeka
FACULTY OF MARITIME STUDIES

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LIST OF COURSE COORDINATORS

Name	Institution	Contact/e-mail address
Saša Aksentijević, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia Aksentijevic Forensics and Consulting, Rijeka, Croatia	sasa.aksentijevic@pfri.uniri.hr sasa.aksentijevic@ict-forensics-consulting.com
Professor emeritus Frano Barbir, PhD	University of Splitu, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, Croatia	fbarbir@fesb.hr
Mate Barić, PhD	University of Zadar, Maritime Department, Zadar, Croatia	mbaric@unizd.hr
Robert Baždarić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	robert.bazdaric@pfri.uniri.hr
Dean Bernečić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	dean.bernecic@pfri.uniri.hr
Mirjana Borucinsky, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	mirjana.borucinsky@pfri.uniri.hr
David Brčić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	david.brcic@pfri.uniri.hr
Krešimir Buntak, PhD	University North, University Center Koprivnica, Koprivnica, Croatia	krbuntak@unin.hr
Aleksandar Cuculić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	aleksandar.cuculic@pfri.uniri.hr
Jelena Čulin, PhD	University of Zadar, Maritime Department, Zadar, Croatia	jculin@unizd.hr
Jasmin Ćelić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	jasmin.celic@pfri.uniri.hr
Matej David, PhD	Dr. Matej David Consult, Izola, Slovenia	matej.david@siol.net
Borna Debelić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	borna.debelic@pfri.uniri.hr
Stjepan Domjančić, PhD	Dr. Franjo Tuđman Croatian Military Academy, Zagreb, Croatia	stjepan.domjancic@suradnik.unizg.hr
Biserka Draščić Ban, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	biserka.drascic@pfri.uniri.hr
Robert Fabac, PhD	University of Zagreb, Faculty of Organization and Informatics, Zagreb, Croatia	rfabac@foi.hr
Vlado Frančić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	vlado.francic@pfri.uniri.hr
Ivica Glavan, PhD	University of Zadar, Maritime Department, Zadar, Croatia	iglavan@unizd.hr
Neven Grubišić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	neven.grubisic@pfri.uniri.hr
Marko Gulić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	marko.gulic@pfri.uniri.hr
Nermin Hasanspahić, PhD	University of Dubrovnik, Faculty of Maritime Studies, Dubrovnik, Croatia	nermin.hasanspahic@unidu.hr
Mirano Hess, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	mirano.hess@pfri.uniri.hr
Svjetlana Hess, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	svjetlana.hess@pfri.uniri.hr
Renato Ivče, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	renato.ivce@pfri.uniri.hr

Mladen Jardas, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	mladen.jardas@pfri.uniri.hr
Alen Jugović, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	alen.jugovic@pfri.uniri.hr
Irena Jurdana, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	irena.jurdana@pfri.uniri.hr
Mate Jurjević, PhD	University of Dubrovnik, Faculty of Maritime Studies, Dubrovnik, Croatia	mjurjevic@unidu.hr
Josip Kasum, PhD	University of Split, University Department of Forensic Sciences, Split, Croatia	josip.kasum@unist.hr
Žarko Koboević, PhD	University of Dubrovnik Faculty of Maritime Studies, Dubrovnik, Croatia	zarko.koboevic@unidu.hr
Ines Kolanović, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	ines.kolanovic@pfri.uniri.hr
Professor emeritus Pavao Komadina, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	pavao.komadina@pfri.uniri.hr
Professor emeritus Serđo Kos, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	serdjo.kos@pfri.uniri.hr
Mirjana Kovačić, PhD	Primorje-Gorski kotar County, Regional Development Agency, Rijeka, Croatia	mirjana.kovacic@prigoda.hr
Predrag Kralj, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	predrag.kralj@pfri.uniri.hr
Ljudevit Krpan, PhD	Primorje-Gorski kotar County, Administrative Department for Regional Development, Infrastructure and Project Management, Rijeka, Croatia	ljkrpan@unin.hr ljudevit.krpan@pgz.hr
Nikola Lopac, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	nikola.lopac@pfri.uniri.hr
Livia Maglić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	livia.maglic@pfri.uniri.hr
Lovro Maglić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	lovro.maglic@pfst.hr
Nikola Mandić, PhD	University of Split, Faculty of Maritime Studies, Split, Croatia	nmandic@pfri.uniri.hr
Luka Mihanović, PhD	Dr. Franjo Tuđman Croatian Military Academy, Zagreb, Croatia	luka.mihanovic@morh.hr
Đani Mohović, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	dani.mohovic@pfri.uniri.hr
Robert Mohović, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	robert.mohovic@pfri.uniri.hr
Gorana Mudronja, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	gorana.mudronja@pfri.uniri.hr
Luka Novačko, PhD	University of Zagreb, Faculty of Transport and Traffic Sciences, Zagreb, Croatia	luka.novacko@fpz.unizg.hr
Dario Ogrizović, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	dario@pfri.uniri.hr
Ivan Panić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	ivan.panic@pfri.uniri.hr
Darko Pastorčić, PhD	University of Zadar, Maritime Department, Zadar, Croatia	Darko.Pastorcic@zd.t-com.hr
Vladimir Pelić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	vladimir.pelic@pfri.uniri.hr

Josip Orović, PhD	University of Zadar, Maritime Department, Zadar, Croatia	jorovic@unizd.hr
Ana Perić Hadžić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	ana.peric@pfri.uniri.hr
Marko Perkovič, PhD	University of Ljubljana, Faculty of Maritime Studies and Transport, Portorose, Slovenia	marko.perkovic@fpp.uni-lj.si
Tanja Poletan Jugović, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	tanja.poletan@pfri.uniri.hr
Igor Poljak, PhD	University of Zadar, Maritime Department, Zadar, Croatia	ipoljak1@unizd.hr
Radoslav Radonja, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	radoslav.radonja@pfri.uniri.hr
Igor Rudan, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	igor.rudan@pfri.uniri.hr
Biserka Rukavina, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	biserka.rukavina@pfri.uniri.hr
Tomislav Senčić, PhD	University of Rijeka, Faculty of Engineering, Rijeka, Croatia	tomislav.sencic@riteh.hr
Boris Sviličić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	boris.svilicic@pfri.uniri.hr
Tomislav Sunko, PhD	Dr. Franjo Tuđman Croatian Military Academy, Zagreb, Croatia	tsunko@morh.hr
Đani Šabalja, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	dani.sabalja@pfri.uniri.hr
Davor Šakan, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	davor.sakan@pfri.uniri.hr
Edvard Tijan, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	edvard.tijan@pfri.uniri.hr
Sandra Tominac Coslovich, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	sandra.tominac@pfri.uniri.hr
Fran Torbarina, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	fran.torbarina@pfri.uniri.hr
Anton Turk, PhD	University of Rijeka, Faculty of Engineering, Rijeka, Croatia	anton.turk@riteh.hr
Marko Valčić, PhD	University of Zadar, Maritime Department, Zadar, Croatia	mvalcic@unizd.hr
Sanjin Valčić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	sanjin.valcic@pfri.uniri.hr
Siniša Vilke, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	sinisa.vilke@pfri.uniri.hr
Goran Vizentin, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	goran.vizentin@pfri.uniri.hr
Goran Vukelić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	goran.vukelic@pfri.uniri.hr
Professor emeritus Damir Zec, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	zec@pfri.uniri.hr
Dražen Žgaljić, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	drazen.zgaljic@pfri.uniri.hr
Srđan Žuškin, PhD	University of Rijeka, Faculty of Maritime Studies, Rijeka, Croatia	srdan.zuskin@pfri.uniri.hr