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Course description

Generic information			
Head of Course	Biserka Draščić Ban, PhD		
Course	Applied Mathematics		
Study Programme	Marine Engineering and Maritime Transport Technology		
Type of Course	mandatory		
Year of Study	1.		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	6	
	Number of Hours (L+E+S)	30+30+0 (2+2+0)	

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

Introduction to the elements of numerical mathematics and the basic concepts of probability theory.

1.2. Prerequisites for Course Registration

none

1.3. Expected Learning Outcomes

1. Describe the space of elementary events
2. Explain and apply probability to specific problems in practice
3. Recognize and apply the Total probability and Bayesian formula
4. Describe random variables
5. Use and calculate numerical characteristics of random variables
6. State and apply the Poisson and Moivre - Laplace theorems in specific situations
7. Calculate the errors in the approximate calculation
8. Describe and apply interpolation polynomials, numerical methods for solving equations, and numerical integration

1.4. Course Outline

The space of elementary events. Probability. Total probability and Bayesian formulas. Random variables. Numerical characteristics of random variables. Binomial, Poisson, uniform, normal distribution. Poisson's and Moivre-Laplace theorems. Error analysis. Interpolation. Numerical solution of equations. Numerical integration

1.5. Modes of Instruction	☒ Lectures ☐ Seminars and workshops ☒ Exercises ☐ E-learning ☐ Field work	☐ Practical work ☐ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments		

1.7. Student Obligations

Regular attendance at classes and homework.

1.8. Assessment[1] of Learning Outcomes

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Course attendance	2	Class participation		Seminar paper		Experiment	
Written exam		Oral exam	1,5	Essay		Research	
Project		Continuous Assessment	2,5	Presentation		Practical work	
Portfolio							

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

Assessment of learning outcomes outcomes is done according to the Ordinance on Studies of the University of Rijeka and the Ordinance on Studying at the Faculty of Maritime Studies in Rijeka as follows:

- through continuous testing of knowledge during classes, 70% of acquired learning outcomes are evaluated through the 1st written exam - learning outcomes 1-6 (30%), the 2nd written exam - learning outcomes 6-8 (30%), and through regular class attendance (10 %)
- At the final part of the exam, 30% of the acquired learning outcomes are evaluated (1-8), where the student must realize a minimum of 50% of points to pass the final exam.

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

WRITTEN EXAM:

1. There are 1000 dice in the box, all of which are correct, except for one, which has a six on all sides. Fortunately, one dice was drawn and thrown four times. All four times it dropped to number 6. What is the probability that it is a faulty dice?

2. The random variable X has a normal distribution with expectation EX = 3 and is valid P (X <5) = 0: 6915. Calculate the probability of event P (-1 <X <6) .l

3. Determine the zero point of the function f (x) = x2-2 / x with an accuracy of 0.005.

4. The function is given in the table:

x	0	1	2	3
f(x)	0,1232	0,3687	0,4587	0,6899

Using Simpson's formula with 2n = 6, determine the integral of the function f (x) on the segment [0,3].

ORAL EXAM:
1. The Total probability theorem
2. Approximation of the Binomial Distribution by the Normal Distribution
3. Iterative method for solving equations

1.10. Main Reading

1. . Poganj: Teorija vjerojatnosti. Metodička zbirka riješenih ispitnih zadataka, Pomorski fakultet u Rijeci, 1997.
2. B. Draščić, T. Poganj, Primijenjena matematika, Pomorski fakultet u Rijeci, Sveučilište u Rijeci, Rijeka, 2010. (e-izdanje)

1.11. Recommended Reading

1. N.V.Kopchenova, I.A.Maron: Computational mathematics, MIR Publishers, Moscow, 1972.
2. P. Vranjković: Zbirka zadataka iz vjerojatnosti i statistike, Školska knjiga, Zagreb, 1992.
3. W. Feller: An Introduction to Probability Theory and its Applications, I,II, J. Wiley & Sons, New York, 1950, 196

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
T. Poganj: Teorija vjerojatnosti. Metodička zbirka riješenih ispitnih zadataka, Pomorski fakultet u Rijeci, 1997.	35	

B. Draščić, T. Poganj, Primijenjena matematika, Pomorski fakultet u Rijeci, Sveučilište u Rijeci, Rijeka, 2010.	As needed	

1.13. Quality Assurance

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3.2. Course description

Generic information			
Head of Course	Ines Kolanović, PhD		
Course	Research work methodology		
Study Programme	Marine Engineering and Maritime Transport Technology		
Type of Course	Mandatory		
Year of Study	1.		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		4 ECTS
	Number of Hours (L+E+S)		30 + 0 + 15

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The goal of this course is that after completing the course, students will be able to write student and scientific papers using the technology and methodology of scientific and professional research.

1.2. Prerequisites for Course Registration

1.3. Expected Learning Outcomes

It is expected that the student will be able to:

1. Interpret the terms: science, technology and methodology of scientific research
2. Present the classification of science in the Republic of Croatia
3. Identify and distinguish the basic characteristics of certain types of scientific, scientific and professional works
4. Identify and use the rules of scientific research methodology in writing student papers
5. Identify and use the rules of scientific research technology in writing student papers

1.4. Course Outline

About science, scientific activity and research: theory of science, characteristics of modern science, Croatian Qualifications Framework, classification of science in the Republic of Croatia, scientific institutions. Scientific, scientific and professional works: classification of written works, concept, types and characteristics of scientific, scientific and professional works. Characteristics of works in the higher education system at graduate and postgraduate studies. Concept and characteristics of scientific methods. Methodology of scientific research. Technology of scientific research: identifying a scientific problem, setting a hypothesis, selecting and analyzing a topic (title), developing a research plan, compiling a working bibliography, collecting and studying literature and scientific information, solving the problem, formulating research results, applying research results. Writing a text and technical processing of a scientific and professional work: documentary basis of the manuscript, citing literature, referencing in the text, displaying illustrations.

1.5. Modes of Instruction	☒ Lectures ☒ Seminars and workshops ☐ Exercises ☐ E-learning ☐ Field work	☒ Practical work ☐ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments		

1.7. Student Obligations

Students are required to: attend classes, pass 1 preliminary exam (continuous knowledge assessment), write a seminar paper, and pass a final exam. Students must be present in class for at least 70% of the total number of hours of lectures and seminars.

1.8. Assessment[1] of Learning Outcomes

Course attendance	1,5	Class participation		Seminar paper	1	Experiment	
Written exam	0,75	Oral exam		Essay		Research	
Project		Continuous Assessment	0,75	Presentation		Practical work	
Portfolio							

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

Procedure:

- The final grade in the course is the sum of the points earned by the student during the course (70% of the grade) and the points earned on the final exam (30% of the grade), in accordance with the Regulations on Studies of the University of Rijeka and the Regulations on Studying at the Faculty of Maritime Studies in Rijeka.
- Continuous knowledge assessment:
  Midterm Exam – 30%; Learning outcomes: 1 to 5
  Research assignment (seminar paper) – 40%; Learning outcomes: 4 and 5
  - Final exam – 30%; Learning outcomes: 1 to 5

A minimum of 50% of the points must be achieved on midterm exam.
A minimum of 50% of the points must be achieved on the research assignment (seminar paper)
A minimum of 50% of the points must be achieved on the final exam.

Examples of learning outcomes evaluation:

1. Define the terms science, technique, technology and methodology of scientific research work. (LO1)
2. Explain the classification of scientific fields. (LO2)
3. Using a specific example, highlight the basic characteristics of scientific works. (LO3)
4. State the characteristics of the methodology of scientific research when writing seminar papers at the graduate level. (LO4)
5. Analyze the rules of scientific research technology and their application in writing seminar papers at the graduate level. (LO5)

1.10. Main Reading

1. Kolanović, Ines: Teaching material on the e-learning platform (Merlin)
2. Instructions for writing a thesis,
3. Zelenika, Ratko: Metodologija i tehnologija izrade znanstvenog i stručnog djela, Pisana djela na stručnim i sveučilišnim studijima, knjiga peta, Ekonomski fakultet u Rijeci, Rijeka, 2011.

1.11. Recommended Reading

1. Zelenika, Ratko: Metodologija i tehnologija izrade znanstvenog i stručnog djela, Znanost-poluga održive egzistencije čovječanstva, knjiga treća, Ekonomski fakultet u Rijeci, Rijeka, 2011.
2. Žugaj, Miroslav; Dumičić, Ksenija; Dušak, Vesna: Temelji znanstvenoistraživačkog rada, Metodologija i metodika, Fakultet organizacije i informatike, Varaždin, 2006.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Teaching material on platform Merlin	unlimited	15
Metodologija i tehnologija izrade znanstvenog i stručnog djela, Pisana djela na stručnim i sveučilišnim studijima, knjiga peta	6	15

1.13. Quality Assurance

The quality of studies is continuously monitored in accordance with the requirements of the ISO 9001 standard and in accordance with European standards and guidelines for quality assurance implemented at the Faculty of Maritime Studies in Rijeka. At the end of the semester, teachers and associates are evaluated by students, in accordance with the Manual for the Quality of Studies at the University of Rijeka.

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3.2. Course description

Generic information			
Head of Course	Fran Torbarina, PhD		
Course	Applied thermodynamics and engineering thermodynamics		
Study Programme	Marine Engineering and Transport Technology		
Type of Course	Obligatory		
Year of Study	I		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		6
	Number of Hours (L+E+S)		45 + 15

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The objectives of the course are to introduce the students to efficient methods of running and managing thermal systems and energy on board, the basics of ship heat exchanger design and calculations, as well as other thermal engineering problems which arise during the operation of thermal systems on board.

1.2. Prerequisites for Course Registration

Without prerequisites.

1.3. Expected Learning Outcomes

After attending and passing the course, students will be able to:

1. Explain the heat transfer mechanisms, apply the conservation laws of mass and energy and state the most common types of heat exchangers.
2. Explain the characteristics of fluid flow and energy conversion in nozzles. Specify the types of nozzles and design various nozzles. State the most common nozzle applications on ships.
3. Define thermodynamical state of humid air, analyze common humid air processes using the *hx* diagram and compare them in terms of energy consumption.
4. Specify and explain various methods for improving the energy efficiency of Clausius-Rankine process.
5. Calculate thermal stress in pipes, and explain the basic principles of thermal stress occurrence and material behavior at high temperatures.
6. Specify and explain various methods for improving the energy efficiency of Joule-Brayton process.

1.4. Course Outline

Introduction; physical properties and units, mass and energy conservation, steady state heat conduction, transient heat conduction, convective heat transfer, radiative heat transfer, heat balances, fluid flow in nozzles, de Laval nozzle, critical cross section of nozzles, nozzle design, energy conversion in nozzles, ejectors and injectors, application of the laws of conservation of mass and energy on fluid flow in steam and gas turbines, humid air, the *hx* diagram for humid air, humid air state changes, processes with humid air, marine energy and process systems – application, characteristics and designs; thermal processes, energy losses, energy efficiency, heat pumps, thermo-mechanics, thermal stresses, material behavior at high temperatures.

1.5. Modes of Instruction	☒ Lectures ☐ Seminars and workshops ☒ Exercises ☐ E-learning ☐ Field work	☐ Practical work ☐ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments	-	

1.7. Student Obligations

A student that attends less than 70% of the total lectures and exercises classes cannot take the final exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper		Experiment	
Written exam		Oral exam	2	Essay		Research	
Project		Continuous Assessment	2	Presentation		Practical work	
Portfolio							

[1] NOTE: Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The procedure of evaluating the accomplished learning outcomes is carried out according to the Ordinance on Studies of the University of Rijeka and the Ordinance on Studying at the Faculty of Maritime Studies in Rijeka as follows:

- 60% of the accomplished learning outcomes is evaluated through continuous testing of knowledge during classes
- 40% of the accomplished learning outcomes is evaluated at the final exam. To pass the final exam, a student must realize a minimum of 50% of the final exam points.

Examples of evaluating learning outcomes in regards to the set learning outcomes:

1. Design and calculate main engine heavy oil heater for given parameters.
2. Determine the magnitudes of the critical state of the nozzle in which the superheated steam of the given state expand. Determine the shape of the whole nozzle with specific cross-sections and construct a diagram of the change in cross-section, velocity and volume along the nozzle.
3. For the given parameters, define the ratio of mixing fresh and circulating air in the air chamber, in order to achieve the so-called a relaxed state of air. Calculate the required amount of heat to be supplied to the air chamber to reheat the resulting mixture.
4. Explain the Rankine Counterpressure process and the model of cogeneration of mechanical power and heat flow.
5. Analyze the behavior of individual materials under elevated temperatures and define thermal stresses.
6. Analyze the improvement in the efficiency of the Joule-Brayton process by increasing the combusting temperature.

1.10. Main Reading

1. Teaching materials for the e-course are available on the e-learning platform - Merlin.
2. B. Halasz, Uvod u termodinamiku, Fakultet strojarstva i brodogradnje Sveučilišta u Zagrebu, 2015
3. F. Bošnjaković, Nauka o toplini I Dio, Tehnička knjiga Zagreb, 1978.
4. F. Bošnjaković, Nauka o toplini II Dio, Tehnička knjiga Zagreb, 1976.

1.11. Recommended Reading

1. F. Torbarina, K. Lenić, A. Trp, M. Kirinčić, *Parametric analysis of system performance and cost of heating systems with heat pump and latent thermal energy storage*, Applied Thermal Engineering 252, 123717, 2024.
2. 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.
3. 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.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Teaching materials for the e-course are available on the e-learning platform - Merlin.	20	20
B. Halasz, *Uvod u termodinamiku*, Fakultet strojarstva i brodogradnje Sveučilišta u Zagrebu, 2015	10	20
F. Bošnjaković, *Nauka o toplini I Dio*, Tehnička knjiga Zagreb, 1978.	10	20
F. Bošnjaković, Nauka o toplini II Dio, Tehnička knjiga Zagreb, 1976.	10	20

1.13. Quality Assurance

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The quality of studying is continuously monitored in accordance with the ISO 9001 system implemented at the Faculty of Maritime Studies in Rijeka. An annual analysis of exam pass rates is conducted, and a student survey is carried out once per semester (attached with the faculty description). All data, including exams, written work, and grading, are at all times publicly available to all students enrolled in the course.

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3.2. Course description

Generic information			
Head of Course	Goran Vizentin, PhD		
Course	Numerical methods in engineering		
Study Programme	Marine Engineering and Maritime Transport Technology		
Type of Course	Compulsory		
Year of Study	1		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		6
	Number of Hours (L+E+S)		30+30+0

1. GENERAL COURSE DESCRIPTION		
1.1. Course Objectives		
Introducing students to the basics of numerical methods that are most commonly used to solve problems in the field of mechanical engineering and other engineering fields.		
1.2. Prerequisites for Course Registration		
None.		
1.3. Expected Learning Outcomes		
After passing the exam, students will be able to do the following: 1. Interpret the basic concepts of mathematical modelling. 2. Evaluate the characteristics of individual generations of programming languages. 3. Evaluate the applicability of individual numerical methods for solving mathematical problems without an analytical solution. 4. Argue the significance and impact of rounding errors on the accuracy of numerical calculation results. 5. Analyse and apply numerical schemes to individual differential equations. 6. Evaluate the results obtained by numerical methods.		
1.4. Course Outline		
Mathematical modelling. Computer languages. Rounding errors. Solving linear equations. Numerical differentiation and integration. Methods of approximate solution of equations: secant method, tangent method, general iteration method. Approximate determination of extrema. Finite difference method: approximate expression of derivatives by finite differences. Presentation of modeling and analysis using computer programs. Numerical solution of ordinary and partial differential equations. Optimization.		
1.5. Modes of Instruction	☒ Lectures ☒ Seminars and workshops ☒ Exercises ☐ E-learning ☐ Field work	☐ Practical work ☒ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments	-	

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1.7. Student Obligations

Class attendance (minimum 70%), solving assignments during class, writing seminar paper.

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper	2	Experiment	
Written exam		Oral exam	1	Essay		Research	
Project		Continuous Assessment	1	Presentation		Practical work	
Portfolio							

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The process of evaluating the acquired learning outcomes is carried out according to the Regulations on Studies of the University of Rijeka and the Regulations on Studies at the Faculty of Maritime Studies in Rijeka in the following way:

- through continuous assessment during the semester (70% of learning outcomes)
- seminar paper - learning outcomes 1-6 (30%),
- through final exam (30% of learning outcomes (4-5)) with passing rate set at minimum 50% of final exam points.

Examples of assessment of learning outcomes in relation to the set learning outcomes are:

1. Choose a suitable numerical scheme for solving an ordinary differential equation.
2. For a given example from engineering practice, create a computer program using the finite difference method.
3. Compare the results obtained by numerical analysis with the results obtained by analytical and/or experimental methods and assess their validity.

1.10. Main Reading

1. Course material available on the course instructor's website

2. Steven C.Chapra, Raymond P. Canale:Numerical Methods for Engineers, McGraw-Hill, 2010.

1.11. Recommended Reading

1. M.S.H. Al-Furjan, M. Rabani Bidgoli, R. Kolahchi, A. Farrokhian, and M.R. Bayati: Application of Numerical Methods in Engineering Problems Using MATLAB®, CRC Press, 2023.
2. J. Kiusalaas: Numerical methods in engineering with python, Cambridge University press, 2005.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*

1.13. Quality Assurance

According to ISO 9001 system set at Faculty of Maritime Studies, Rijeka. Once a year analysis of passing exam rate. Once a semester anonymous students online survey.

[1] NOTE: Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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General Information		
Head of Course	**Ana Perić Hadžić, Ph.D.** **Dražen Žgaljić, Ph.D.**	
Course	Project Management	
Study Programme	Marine Engineering and Maritime Transport Technology	
Type of Course	Elective	
Year of Study	1	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	**5**
	Number of Hours (L+E+S)	**30+15+0**

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The objective of this course is to explain the importance of projects and international projects, as well as the role of project management in developing business systems. Emphasis is placed on strategic preparation, evaluation, initiation, and development of project management models at various management levels to enable students to manage projects in the context of modern economic development.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

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

1. Interpret fundamental theoretical and practical concepts of project management and apply them in the development of business systems.
2. Differentiate and explain key project management processes (strategic preparation, initiation, implementation, control).
3. Analyze and evaluate the impact of various stakeholders (interest and influence groups).
4. Apply advanced skills and competencies for effective project implementation and resolution of complex organizational and related project management issues.
5. Define and interpret concepts related to the structure of projects financed by EU funds and programs.
6. Develop, analyze, and formulate their own project idea and prepare a comprehensive project proposal.

1.4. Course Outline

Theoretical-methodological definition of project management (definition of project, project management, project life cycle, stakeholders). Project management processes (project planning, organization, leadership, control). Strategic aspects of project management, enterprise development project management (development policy, investment policy, investment project evaluation). Management of international projects. EU organization and programs (with an emphasis on programs funding transport development), EU project planning, Logical Framework (Logframe), measuring goal achievement, managing work packages and project results, consortium agreements and intellectual property protection, communication and project team management, exploitation, dissemination, and sustainability of EU projects, quality planning, quality assurance and control, risk management. Case Studies: Business Plan for a Port, Feasibility Study for a Concession on Maritime Domain, EU Project.

1.5. Modes of	**x** Lectures	**x** Practical Work

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Instruction	☐ Seminars and workshops x Exercises ☐ E-Learning ☐ Field work	☐ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. *Comments*		

1.7. *Student Obligations*

Students must attend at least 70% of lectures and exercises, pass midterm exams (continuous assessment), and submit a project to qualify for the final exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	1,5	Class participation		Seminar paper		Experiment	
Written exam		Oral exam	1	Essay		Research	
Project	1	Continuous Assessment	1,5	Presentation		Practical work	
Portfolio							

1.9. *Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam*

The final grade for the course is the sum of the percentage achieved during the course (70% of the grade) and the percentage achieved on the final exam (30% of the grade), in accordance with the Regulations on Studies of the University of Rijeka and the Regulations on Study at the Faculty of Maritime Studies in Rijeka. Continuous Assessment of knowledge:

- a minimum of 50% of the grading points must be achieved.
- project - students must demonstrate acquired knowledge and the application of project methodology on a selected example

Final Exam:
A minimum of 50% of the grading points must be achieved on the final exam.

Examples of Evaluating Learning Outcomes in Relation to Set Learning Objectives:

1. Draw the project life cycle and identify the key phases of the project life cycle.
2. List the basic processes/functions of project management and explain their purpose.
3. Explain who the primary and secondary stakeholders (interest groups) are and describe their role in the project.
4. Using a given example, present the sequence of project activities using the Critical Path Method, identify the critical path of project activities, calculate the total project duration, and depict the sequence of project activities using a Gantt chart.
5. Explain the role of structural funds and European Union programs in financing projects related to sustainable transport development.
6. Formulate your own project proposal, independently or in a team, which includes a project description, the relevance of the project application, the implementation capacities of the applicant and partners (if applicable), project efficiency and feasibility, project budget, and project sustainability.

1.10. Main reading

2. Authorized lectures on the e-learning platform (online materials).
3. Ivica Veža et al., "Upravljanje projektima," University of Split, Faculty of Electrical Engineering, Mechanical Engineering, and Naval Architecture, 2011.
4. Anton Hauc, "Projektni menadžment i projektno poslovanje," Business and Management College, Zagreb, 2007.
5. Marčelo Dujanić, "Projektiranje organizacije i upravljanje projektima," Polytechnic of Rijeka, 2006.
6. Mislav Ante Omazić, "Projektni menadžment," Synergy Publishing, Zagreb, 2005.

[1] NOTE: Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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1.11. Supplementary Literature (at the time of study program proposal submission)

1. Online Manual on EU Projects, https://irmo.hr/prirucnik-o-eu-projektima/
2. Maletić, Ivana; Kosor, Kristina; Japunčić, Tea; Žagar, Davorka; Čakanić, Tomislav: A Guide to EU Programs and Funds 2021 – 2027, Funding Opportunities for Projects in Croatia.
3. Ana Odak, Marija Rajaković, Marko Žabojec: The Financial Perspective of the European Union 2021 – 2027, with a Focus on Cohesion Policy, 2021, Školska Knjiga.
4. Vajde Horvat, R., Smolčić Jurdana, D. (Eds.), EU Project Management – Challenges and Aspects, University of Rijeka, Rijeka 2009.
5. Project Management Institute, A Guide to the Project Management Body of Knowledge (PMBOK Guide), Fourth Edition, 2008.
6. Guidelines for Managing the Project Cycle, Volume 1, Support for Effective Implementation of the European Commission's External Aid, Central State Office for Development Strategy and Coordination of European Union Funds, Zagreb, October 2008 (translated into Croatian).

1.12. Number of Copies of Required Literature in Relation to the Number of Students Currently Enrolled in the Course

Title	*Number of examples*	*Number of students*
Authorized lectures on the e-learning platform (online materials).	-	15
Ivica Veža et al: Project Management, Split: University of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, 2011.	2	15
Anton Hauc: Project Management and Project Business, College of Business and Management, Zagreb, 2007.	5	15
Omazić, Mislav Ante: Project Management, Zagreb, Sinergija Publishing, 2005.	5	15
Dujanić, Marčelo: Designing Organizations and Project Management, Textbooks of the Polytechnic of Rijeka = Manualia Collegium Politechnic Fluminensis, Rijeka: Polytechnic, 2006	1	15

1.13. The methods for monitoring quality that ensure the acquisition of learning outcomes, skills, and competencies include:

The quality of studies is monitored in accordance with the ISO 9001 system and European standards and guidelines for quality assurance (ESG), which are implemented at the Faculty of Maritime Studies in Rijeka. Once a year, pass rates are analyzed, and appropriate measures are taken.

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Table 2.

3.2. Course description

Generic information		
Head of Course	Predrag Kralj, Professor, Ph.D., BME	
Course	Refrigerating Container Systems	
Study Programme	Marine Engineering and Transport Technology	
Type of Course	Elective	
Year of Study	1	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5
	Number of Hours (L+E+S)	30+15+0

1. GENERAL COURSE DESCRIPTION		
1.1. Course Objectives		
The course aims to enable students to become proficient in design, optimization and advanced diagnostics of refrigerating container and other familiar systems.		
1.2. Prerequisites for Course Registration		
None		
1.3. Expected Learning Outcomes		
It is expected that the student will be able: 1. To recognize the elements of unknown refrigerating container system and its functions, the electric energy elements and system and the system of automatic operation. 2. To analyze the automatic operation of the refrigerating system, above all the system of refrigeration capacity regulation. 3. To diagnose malfunctions in the system and to plan and manage the overhaul procedure. 4. To design new solutions with aim to optimize the operation and increase the level of protection.		
1.4. Course Outline		
1. Basics of refrigerating container systems 2. Main manufacturers ant types 3. Management of operation and diagnostics 4. Exploitation of refrigerating container systems 5. The refrigerating container electric energy systems 6. The refrigerating container electronic regulation systems 7. The refrigerating container electric and electronic systems diagnosis		
1.5. Modes of Instruction	☒ Lectures ☐ Seminars and workshops ☒ Exercises ☐ E-learning ☐ Field work	☐ Practical work ☒ Multimedia and Network ☒ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments		
1.7. Student Obligations		

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Students enrolled at the Faculty of Maritime Studies are expected to observe *the code of conduct* required by the academic institution, and regularly attend lectures and practical work sessions.

1.8. Assessment of Learning Outcomes

Course attendance	1,5	Class participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	
Project		Continuous Assessment	1,5	Presentation		Practical work	0,5
Portfolio		Final exam	1,5				

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

Through Partial Exams, Seminar Paper and Evaluation of Student's Practical Work on the Simulator Student achieves up to 70%. First partial exam deals with theory of refrigeration and applied solutions and characteristics of refrigerating container systems (Learning Outcomes from 1 to 3). The second partial exam deals with the systems of electric energy and electronic regulation (Learning Outcomes from 1 to 3). The practical work is evaluated on the simulators (Learning Outcomes from 1 to 3). With the written Final Exam (Learning Outcomes from 1 to 4) Student achieves up to 30% of total Score.
Examples of Assessment of Learning Outcomes:

1. on schematic representation and on the simulator recognize the type of the compressor and method of refrigeration regulation (Learning Outcomes from 1 to 3)
2. on the simulator perform starting procedure and manage the normal operation of the system (Learning Outcomes from 1 to 3)
3. recognize the malfunction on the simulator and list possible causes (Learning Outcomes from 1 to 3)

In case of insufficient number of students listed on the course, classes could be replaced with seminar paper.

1.10. Main Reading

1. Kralj, Predrag, Lecturers' notes published on official webpage and e-learning system Merlin
2. Martinović, Dragan, Brodski rashladni uređaji, Školska knjiga, Zagreb

1.11. Recommended Reading

1. Ozretić Velimir, Brodski pomoćni strojevi i uređaji, Ship management, Split, 1996.
2. Knak Christen, Diesel Motor Ships – Engines and Machinery, G-E-C GAD Publishers, Copenhagen, 1979.
3. Vorkapić, A. – Martinović, D. – Kralj, P.: *The analysis of the maintenance systems of a LPG carrier's liquefaction system main components*, Scientific journal of maritime research – Pomorstvo, Rijeka, God. 31 (2017), Vol. 1, pp.3-9
4. Vorkapić, A. – Kralj, P. – Bernečić, D.: *Ship systems for natural gas liquefaction*, Scientific journal of maritime research – Pomorstvo, Rijeka, God. 30 (2016), Vol. 2, pp.105-112
5. Glujić, D., Kralj, P., Martinović, D., *A Simple Mathematical Model for Refrigerating Compressor Optimization. // Pomorstvo : scientific journal of maritime research, 32 (2018), 1; 146-151*

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
	web	

1.13. Quality Assurance

Internal:

- Student feedback (SET - Student evaluation of teaching) at the end of academic year.
- Course review by the head of course at the end of academic year.

External:
Programme quality review carried by the QA Agency.

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3.2. Course description

Generic information		
Head of Course	Dean Bernečić, Ph.D.	
Course	Marine transmissions system	
Study Programme	Marine Engineering and Maritime Transport Technology	
Type of Course	Obligatory	
Year of Study	1.	
Estimated Student Workload and Methods of Instruction	ECTS student workload coefficient	5
	Number of hours (M+V+S)	30+15+0

1. 1. GENERAL COURSE DESCRIPTION

1.1. Course objectives

The aim of the course is to introduce students to modern marine power transmissions, clutches, multi-engage gear transmissions of marine propulsion systems, and fluid power transmissions.

1.2. Prerequisites for Course Registration

1.3. Expected learning Outcomes

After passing the exam, students will be able to:
1. Interpret the classification and application of mechanical power transmissions.
2. Identify marine propulsion couplings.
3. Calculate the load capacity of belt, chain and friction transmission.
4. Recognize the types, load and utilization of gear transmissions.
5. Distinguish between simple multi-mesh gear transmissions, planetary transmissions, and combined multi-mesh gear transmissions.
6. Analyze fluid power transmission systems and implement acquired knowledge into complex hydraulic and pneumatic systems.

1.4. Course Outline

1. Classification and application of mechanical power transmissions for ship propulsion.
2. Marine propulsion system couplings.
3. Belt, chain and friction transmission.
4. Types, geometry, load and efficiency of gear transmissions.
5. Gear transmissions in ship propulsion system reducers
   - Standard gear transmissions
   - Gear transmissions with multiple engagement
   - Ordinary gear transmissions with multiple engagement (with power coupling and with power coupling and sharing)
   - Planetary transmissions

1.5. Modes of Instruction		
	☒ Lectures	☒ Practical work
	☐ Seminars and workshops	☐ Multimedia and network
	☒ Exercises	☐ Laboratory
	☐ E-learning	☐ Mentorship
	☐ Fieldwork	☐ Other _____

1.6. Comments	

1.7. Student obligations

In addition to mandatory lectures and exercises, the student is required to create a complex program. Final exam.

1.8. Assessment1 of Learning Outcomes

Course attendance		Class participation	1	Seminar paper		Experiment	
Written exam	1	Oral exam		Essay		Research	
Project	2	Continuous Assessment		Presentation		Practical work	
Portfolio							

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The evaluation process of acquired learning outcomes is carried out according to the Regulations on Studies of the University of Rijeka and the Regulations on Studying at the Faculty of Maritime Studies in Rijeka in the following way: 70% in class, 30% in the final exam (outcomes 1 - 5). Of the possible 70% during the semester, 50% is for the developed program and 20% for the developed exercises.

The requirement for taking the final exam, according to the regulations, is 35%.
Examples of evaluation by individual outcome in the preliminary and final exams:

1. 20% is for correctly completed exercises. (learning outcomes 1,2,3,4,5)
2. 50% goes to the programming task (learning outcomes 1,2,3,4,5) with the mandatory creation of the program in CAD.
3. The final exam includes an oral examination of outcomes 1,2,3,4,5.

Examples of evaluation by individual outcome in exercises and the final exam:
1. Based on the given parameters, calculate and determine all necessary elements of the reduction gearbox according to the attached materials. learning outcomes 1,2,3,4,5.
2. Final exam: Explain examples of power distribution of a reducer with two inputs and one output learning outcomes 1,2,3,4,5.

1.10. Main Reading

Karl-Heinz Deecker, Elementi strojeva, Tehnička knjiga, Zagreb 2006.
Koljesnikov O., Bukša A., Zupčani prijenosi brodskog porivnog sustava, Pomorstvo, god. 23, br. 2 (2009), str. 515 – 525.
Bukša A.,- Kralj P., Martinović D., Istraživanje raspodjele opterećenja kod planetarnih prijenosa s elastičnim osovinama u brodskim reduktorima, Brodogradnja, god. 4, br. 1, Zagreb, 2001.
Bukša A. - Kralj P., Zupčani prijenosi u brodskim reduktorima porivnog sustava, "Naše more" (1998)1-2, str. 33-38.
Bukša A.: Izjednačenje opterećenja kod zupčanih prijenosa s višestrukim zahvatom u brodskim reduktorima i njihova konstruktivna rješenja, Zbornik radova Pomorskog fakulteta u Rijeci, God. 10, Rijeka 1996.

1.11. Recommended Reading

Bukša A., Istraživanje raspodjele opterećenja kod običnih zupčanih prijenosa s dijeljenjem ili spajanjem snage u brodskim reduktorima, "Naše more", (1997)3-4, str. 135-141.
Bukša A., - Kralj P., - Martinović D., Opterećenje vijenca centralnog zupčanika s unutrašnjim ozubljenjem kod planetarnih prijenosa u brodskim reduktorima, "Naše more", (1999) 2-3, str. 96-102.
Bukša A., - Kralj P., Opterećenje vijenca centralnog zupčanika s vanjskim ozubljenjem kod planetarnih prijenosa u brodskim reduktorima, Pomorstvo, god. 13, Rijeka 1999.

1.12. Number of Main Reading Examples

Title	*Number of copies*	*Number of students*
Bukša, A., Grafičke komunikacije – Zbirka zadataka, Pomorski fakultet Rijeka, 2001.	10	20
The course material is available on the e-learning system – Merlin in electronic form.	-	20

1.13. Quality Assurance

The quality of studies is constantly monitored in accordance with the ISO 9001 system implemented at the Faculty of Maritime Studies in Rijeka. An analysis of exam taking is prepared annually, and a survey among students is conducted once a semester.

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3.2. Course description

Generic information			
Head of Course			
Course	Maintenance Systems		
Study Programme	Marine Engineering and Maritime Transport Technologies		
Type of Course	Obligatory		
Year of Study	I		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		4
	Number of Hours (L+E+S)		15+0+15

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

Introducing students to the fundamental principles of failure occurrence and transferring that knowledge to ship and ship systems. Familiarization with advanced diagnostic techniques and targeted maintenance strategy determination.

1.2. Prerequisites for Course Registration

None.

1.3. Expected Learning Outcomes

After passing the exam, the student will be able to:
1. Determine the basic concepts of maintenance strategies, and the influence of technical equipment, operating conditions and type of application on maintenance strategies.
2. Evaluate the basic advantages and disadvantages of individual maintenance strategies.
3. By using the RCM method evaluate and define targeted maintenance strategy.

1.4. Course Outline

Maintenance costs. Damage and failures. Reliability of technical systems. Maintenance technology and organization. Maintenance strategies. SPM (Shock Pulse Method). RCM (Reliability Centered Maintenance). FMEA (Failure Modes and Effects Analysis). Key performance indicators in maintenance. Information systems for maintenance support.

1.5. Modes of Instruction	☒ Lectures ☒ Seminars and workshops ☐ Exercises ☐ E-learning ☒ Field work	☒ Practical work ☒ Multimedia and Network ☐ Laboratory ☒ Mentorship ☐ Other _____
1.6. Comments		

1.7. Student Obligations

Regular attendance at classes and preparation of seminars.

1.8. Assessment[1] of Learning Outcomes

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Course attendance		Class participation		Seminar paper	3	Experiment	
Written exam	1	Oral exam		Essay		Research	
Project		Continuous Assessment		Presentation		Practical work	
Portfolio							

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The process of evaluating the acquired learning outcomes is carried out according to the Regulations on Studies of the University of Rijeka and the Regulations on Studying at the Faculty of Maritime Studies in Rijeka in the following way:
• seminar paper – learning outcomes 1-3 (70%),
• 30% of the acquired learning outcomes are evaluated in the final exam, whereby the student must achieve a minimum of 50% of points to pass the final exam.
Examples of evaluating learning outcomes in relation to the set learning outcomes are:
1. Define a variant of the maintenance strategy for defined goals and technical equipment.
2. Evaluate the advantages and disadvantages of the selected maintenance strategy.
3. Define the basic steps of applying the RCM method for a given example.

1.10. Main Reading

- Šegulja, Bukša, Tomas: Maintenance of ship systems, Faculty of Maritime Studies in Rijeka, 2007;

1.11. Recommended Reading

1. I.Berezovski: Reliability Theory and Practise
2. A.Kelly: Maintenance Planning nad Control
3. B.Vučinić: Maintenance Concept Adjustement of Design.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
- Šegulja, Bukša, Tomas: Maintenance of ship systems, Faculty of Maritime Studies in Rijeka, 2007;	20	20

1.13. Quality Assurance

The quality of studies is monitored in accordance with the ISO 9001 system and in accordance with European standards and guidelines for quality assurance implemented at the Faculty of Maritime Studies in Rijeka. Once a year, the passing results are analyzed and appropriate measures are adopted.

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3.2. Course description

Generic information			
Head of Course	**Radoslav Radonja, Ph. D., associate professor**		
Course	**Ecology in Maritime Transport**		
Study Programme	Marine Engineering and Maritime Transport Technology		
Type of Course	Obligatory		
Year of Study	**1**		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		**5**
	Number of Hours (L+E+S)		**30 + 15 + 0**

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The main goal of the course is to acquire knowledge about the principles and laws of environmental protection, and to understand the theoretical, technical and legislative considerations of pollution.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

After passing the exam, it is expected that students will be able to do the following:
1. Critically assess the diversity of coastal sea and open ocean ecosystems.
2. Identify sources of marine pollution (including noise pollution)
3. Argue the impact of the ship as a source of pollution and analyse the environmental impacts of different types of ships
4. Evaluate the causes of acidification and eutrophication of the sea
5. Assess the impact of climate change on maritime business
6. Review requirements and development of legislation and analyse their impact on maritime business
7. Suggest the sustainable development of maritime affairs from the ecological, bioethical and technological aspect
8. Select marine pollution prevention measures, pollution contingency plans and cooperation in the framework of integrated coastal zone management
9. Argue the impacts of seabed mining on its ecosystem
10. Assess the environmental impacts of autonomous vessels.

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1.4. Course Outline

Basic concepts of sustainable development and sustainable maritime affairs. Differences in coastal sea and open ocean ecosystems. Ship as a source of environmental pollution. Acidification and eutrophication of the sea. Climate change and maritime business. Environmental legislative requirements in maritime affairs and their development. Sustainable development of maritime affairs from the ecological, bioethical and technological aspect. Integrated coastal zone management and marine pollution contingency plans. Seabed mining and its impact on its ecosystems. Ecological aspects of autonomous vessels.

1.5. Modes of Instruction	☒ **Lectures** ☐ Seminars and workshops ☒ **Exercises** ☐ E-learning ☐ Field work	☐ Practical work ☒ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments		

1.7. Student Obligations

Active attendance at classes and exercises (at least 70%). Preparation of a seminar paper on an agreed topic and final oral exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	1,5	Class participation		Seminar paper	1,5	Experiment	
Written exam		Oral exam	2,0	Essay		Research	
Project		Continuous Assessment		Presentation		Practical work	
Portfolio							

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The procedure for evaluating the acquired learning outcomes takes place in accordance with University's and Faculty's normative acts as follows:
• preparation of a seminar paper on an agreed topic (70%)
• At the final part of the exam, 30% of the acquired learning outcomes are evaluated (1-10), whereby the student must realize a minimum of 50% of points in order to pass the final exam.

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

1. Explain the differences in the ecosystems of the coastal area and the open oceans ??
2. List and explain possible sources of marine pollution with special reference to noise pollution (what can be the reasons for their occurrence and impact)? What impact on the marine environment comes from submarine seismic survey vessels? ...
3. List and explain possible adverse environmental impacts coming from crude oil tankers / cruise ships / etc.? ...
4. Explain the possible sources of sea acidification? Explain the origin and reasons for the appearance of 'sea blooms'? ...
5. How can the 'opening of the northern route' affect maritime business and what impact can it have on the ecosystems there? ...
6. Compare the development of environmental legislation at the global level and the legislation of the European Union? How is this reflected at national levels? Can the state pass 'mild' or 'stringent' regulations? ...
7. Explain the impact of environmental technology development and maritime applications (SCR, EGR, scrubbers, …)? ...
8. Explain interstate cooperation in the framework of action in cases of incidental marine pollution? ...
9. Analyze the causes and impacts of seabed mining? What are your personal views in the context of the possible development of seabed mining legislation?
10. State your personal thinking in the context of the development of autonomous vessels and explain their impact on the environment that you expect?

1.10. Main Reading

1. IMO, MARPOL 73/78., Consolidated Edition, London 2013.

1.11. Recommended Reading

2. Teacher lectures - available in electronic form
3. Botkin, D., Keller, E., Environmental science, J. Wiley & sons, Inc., New York, 1995.
4. Sarić, I., Radonja, R., Noise as a source of marine pollution, Pomorstvo – Scientific Journal of Maritime Research, Vol. 28 (2014), pgs. 31-39
5. Radonja, R., Koljatić, V., The marine ecosystem as a functional whole, Pomorstvo – Scientific Journal of Maritime Research, Vol. 24/1 (2010), pgs. 3-18.
6. Radonja, R., Jugović, A., Ship owners' business policy in the context of development in the environmental legislation , Pomorstvo – Scientific Journal of Maritime Research, Vol. 25/2 (2011), pgs. 319-341

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Teacher lectures - available in electronic form	-	30
IMO, MARPOL 73/78., Consolidated Edition, London 2013.	1	30

1.13. Quality Assurance

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Course quality review carried in accordance with ISO 9001 system and European standards and guidance for quality assurance carried through on Maritime faculty. Student Success is evaluated, and corrective measure implemented yearly.

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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3.2. Course description

Generic information		
Head of Course	Goran Vizentin, PhD	
Course	Application of Numerical Methods in Engineering	
Study Programme	Marine Engineering and Maritime Transport Technology	
Type of Course	Compulsory	
Year of Study	1	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	6
	Number of Hours (L+E+S)	15+30+30

1. GENERAL COURSE DESCRIPTION		
1.1. Course Objectives		
Adoption of theoretical and practical knowledge of numerical structural modelling and strength analysis.		
1.2. Prerequisites for Course Registration		
None.		
1.3. Expected Learning Outcomes		
After passing the exam, students will be able to do the following: 1. Numerically model given bodies and engineering structures. 2. Perform the discretization of the given example with a mesh of finite elements. 3. Determine the stress and displacement distribution for discretized bodies. 4. Apply finished computer programs to given examples from engineering practice. 5. Interpret, evaluate and correctly interpret the results of numerical analysis.		
1.4. Course Outline		
CAE systems overview. Introduction to the application of numerical methods in solving structural problems. Defining geometry for assigned problem. Mathematical modelling. Defining loads and boundary conditions. Application of finite element method for assigned structural problem.		
1.5. Modes of Instruction	☒ Lectures ☒ Seminars and workshops ☒ Exercises ☐ E-learning ☐ Field work	☐ Practical work ☒ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments	-	
1.7. Student Obligations		
Class attendance (minimum 70%), solving assignments during class, writing reports.		

1.8. Assessment[1] of Learning Outcomes

Course attendance	2,5	Class participation	1	Seminar paper	2,5	Experiment	
Written exam		Oral exam		Essay		Research	
Project		Continuous Assessment		Presentation		Practical work	
Portfolio							

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The process of evaluating the acquired learning outcomes is carried out according to the Regulations on Studies of the University of Rijeka and the Regulations on Studies at the Faculty of Maritime Studies in Rijeka in the following way:

- through continuous assessment during the semester (70% of learning outcomes)
  - seminar paper - learning outcomes 1-4 (30%),
- through final exam (30% of learning outcomes (4-5)) with passing rate set at minimum 50% of final exam points.

Examples of assessment of learning outcomes in relation to the set learning outcomes are:

1. Build numerical one-, two- or three-dimensional model of a given body or engineering structure.
2. Select an appropriate finite element type and perform discretization of the given example.
3. Perform numerical analysis of stresses and displacements for the discretized body or structure.
4. For a given example from engineering practice, select an appropriate computer program and perform strength analysis.
5. Compare the results obtained by numerical analysis with the results obtained by analytical and/or experimental methods and assess their validity.

1.10. Main Reading

Meštrović, M.: „Metoda konačnih elemenata“, Građevinski fakultet, Zagreb, 2020.

1.11. Recommended Reading

Brnić, J., Čanađija, M.: „Analiza deformabilnih tijela metodom konačnih elemenata“, Fintrade, Rijeka, 2009.
Brnić, J.: „Osnove optimizacije mehaničkih konstrukcija“, Tehnički fakultet, Rijeka, 2013.
Sorić, J.: „Metoda konačnih elemenata“, Golden marketing-Tehnička knjiga, Zagreb, 2004.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Meštrović, M.: „Metoda konačnih elemenata“	10	10

1.13. Quality Assurance

According to ISO 9001 system set at Faculty of Maritime Studies, Rijeka. Once a year analysis of passing exam rate. Once a semester anonymous students online survey.

[1] NOTE: Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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3.2. Course description

Generic information			
Head of Course	Prof. Dean Bernečić, PhD., Prof. Goran Vukelić, PhD.		
Course	Welding and material testing		
Study Programme	Marine Engineering and Maritime Transport Technology, MSc.		
Type of Course	Elective		
Year of Study	1		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	6	
	Number of Hours (L+E+S)	30+30+0	

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

Acquiring theoretical and practical knowledge in cutting, welding, and non-destructive testing of materials.

1.2. Prerequisites for Course Registration

None.

1.3. Expected Learning Outcomes

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

1. Explain basic techniques of welding, soldering, and cutting of metals.
2. Apply certain techniques of welding, soldering, and cutting of metals.
3. Analyze the differences, advantages and disadvantages of welding techniques and determine the optimal application for individual cases and materials.
4. Explain the basic methods and techniques of non-destructive testing.
5. Apply selected methods and techniques of non-destructive testing in practice.
6. Analyze the results of non-destructive testing.

1.4. Course Outline

Introduction to the basics of welding construction steel, stainless steel, cast iron, copper and copper alloys, aluminum and the selection of the optimal welding or soldering method. Basic techniques of arc cutting and welding: MAG, MIG, TIG techniques, plasma and water cutting. Cutting, welding, and soldering with gas mixtures: acetylene-oxygen, propane-butane-oxygen, hydrogen-oxygen.
Introduction to non-destructive testing (NDT). Material flaws. Principles of NDT method selection. NDT equipment and instruments. Basic NDT methods: visual, penetrant, ultrasonic, magnetic particle, eddy current, radiography. Other NDT methods: leak testing, vibration testing.

1.5. Modes of Instruction	☒ Lectures ☐ Seminars and workshops ☒ Exercises ☐ E-learning ☐ Field work	☐ Practical work ☐ Multimedia and Network ☒ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments	-	

1.7. Student Obligations

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Attending the lectures and lab. exercises, complying with all other teaching activities.

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation	1	Seminar paper		Experiment	
Written exam	1	Oral exam		Essay		Research	
Project		Continuous Assessment		Presentation		Practical work	2
Portfolio							

[1] NOTE: Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

According to the study rulebooks of the University of Rijeka and the Faculty of Maritime Studies:

- through continuous assessment during the semester, 60% of learning outcomes:
  - lab. work (welding) – learning outcomes 2-3 (30%),
  - lab. work (NDT) – learning outcomes 5-6 (30%)
- through final exam 40% acquired learning outcomes (1, 4) with passing rate set at min. 50% of final exam points.

Examples of evaluation in correlation to learning outcomes:

1. Explain certain methods of welding and soldering.
2. Select and apply a particular method to a given example with respect to material, optimality and quality of welds.
3. Analyze the influence of each method on the deformation of the material.
4. Explain the principles of a selected NDT method.
5. Select the suitable NDT method according to the assigned example.
6. Asses the validity of obtained NDT results.

1.10. Main Reading

G. Meden, A. Pavelić, D. Pavletić: „Osnove zavarivanja“, Tehnički fakultet, Rijeka, 2000.
P.E. Mix: „Introduction to Nondestructive Testing“, Wiley&Sons, 2005.

1.11. Recommended Reading

Additional literature and lectures on Merlin.
G. Vukelić, G. Vizentin: Composite wrap repair of a failed pressure vessel - Experimental and numerical analysis, Thin-walled structures, 2021.
G. Vukelić, D Pastorčić, G. Vizentin, Ž. Božić: Failure investigation of a crane gear damage, Engineering failure analysis, 2020.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
G. Meden, A. Pavelić, D. Pavletić: Osnove zavarivanja	1	10
P.E. Mix: Introduction to Nondestructive Testing	1	10

1.13. Quality Assurance

According to the ISO 9001 system set at the Faculty of Maritime Studies, Rijeka. Once a year, an analysis of the passing exam rate is conducted. Once a semester, an anonymous online survey of students is conducted.

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3.2. Course description

Generic information			
Head of Course	Prof. Goran Vukelić, PhD.		
Course	Project assignment 1		
Study Programme	Marine Engineering and Maritime Transport Technology, MSc.		
Type of Course	Elective		
Year of Study	1		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5	
	Number of Hours (L+E+S)	0+0+60	

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

Developing independent research capabilities by browsing published references and applying research methods in fulfilling a given project assignment that is linked to one or two principal courses.

1.2. Prerequisites for Course Registration

None.

1.3. Expected Learning Outcomes

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

1. Analyze the current mechanical condition of the engineering structure.
2. Assess the possible solutions for improving the condition of the engineering structure.
3. Propose new optimized solutions.
4. Apply research methods in fulfilling the given project assignment.
5. Produce the final solution.

1.4. Course Outline

Literature review. Defining a project assignment. Planning, organisation, management, and control of the project. Experimental and numerical analysis of selected engineering structures. Assessing the obtained solution. Writing the final report. Managing the results.

1.5. Modes of Instruction	☐ Lectures ☒ Seminars and workshops ☐ Exercises ☐ E-learning ☐ Field work	☒ Practical work ☒ Multimedia and Network ☒ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments	-	

1.7. Student Obligations

Attending the lectures and lab. exercises, complying with all other teaching activities.

1.8. Assessment[1] of Learning Outcomes

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Course attendance		Class participation		Seminar paper		Experiment	0.5
Written exam		Oral exam		Essay		Research	2
Project	2	Continuous Assessment		Presentation		Practical work	0.5
Portfolio							

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

According to the study rulebooks of the University of Rijeka and the Faculty of Maritime Studies:

- through continuous assessment during the semester 70% of learning outcomes (1-5)
- through the final exam, 30% of the learning outcomes (1-5).

Examples of evaluation in correlation to learning outcomes:

1. Experimentally and numerically analyze the selected engineering structure.
2. Perform a literature review for the selected problem.
3. Perform the numerical optimization of the selected engineering structure according to the set goal.
4. Define project plan.
5. Asses the optimized solution.

1.10. Main Reading

According to the principal course selected for the project assignment.

1.11. Recommended Reading

D. Glujić, G. Vukelić, D. Bernečić, G. Vizentin, D. Ogrizović: Coupling CFD and VR for advanced firefighting training in a virtual ship engine room, Results in engineering, 2024.
G. Vukelić, G. Vizentin, Š. Ivošević: Tensile strength behaviour of steel plates with corrosion-induced geometrical deteriorations, Ships and Offshore Structures, 2022.
G. Vukelić, G. Vizentin, R. Bakhtiari: Failure analysis of a steel pressure vessel with a composite wrap repair proposal, International Journal of Pressure Vessels and Piping, 2021.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*

1.13. Quality Assurance

According to the ISO 9001 system set at the Faculty of Maritime Studies, Rijeka. Once a year, an analysis of the passing exam rate is conducted. Once a semester, an anonymous online survey of students is conducted.

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Course description

Generic information			
Head of Course	Vlado Frančić, Full Professor, Ph.D.		
Course	International Maritime Safety System		
Study Programme	Marine Engineering and Maritime Transport Technology		
Type of Course	Elective		
Year of Study	1	Semester 2	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		5
	Number of Hours (L+E+S)		**30 + 15 + 0 (2 + 1 + 0)**

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The course objectives are to familiarize students with the fundamental characteristics, principles, and regularities of the International Maritime Safety System and marine pollution prevention, as well as its implementation in national legislation. The course provides a general overview of the international maritime safety system, based on international and national regulations, including industry standards. Furthermore, it explains the principles of ship surveys and the work of recognized organizations (ROs), certification procedures, and the procedures of port state control (PSC) inspections. Special emphasis is placed on the technology of decision-making and regulation at the political, technological, and implementation levels, as well as their impact on the business efficiency of shipping companies at both the international and national levels.

1.2. Prerequisites for Course Registration

It is expected that students possess at least basic knowledge about the International Maritime Organization (IMO) and associated requirements related to the safety of navigation.

1.3. Expected Learning Outcomes

It is expected that the student will be able to:

1. Discuss the principles of the international maritime safety system.
2. Determine the legal framework related to maritime safety and marine environmental protection.
3. Present and outline the structure and functioning of the IMO.
4. Compare the most significant conventions related to maritime safety.
5. Establish the rights and obligations of recognized organizations (ROs).
6. Elaborate on the role of port state control inspections (PSC inspections).
7. Compare the procedures of ship survey and ship inspection (PSC inspections).
8. Present the procedures for inspection of foreign ships under the provisions of the Paris Memorandum of Understanding.
9. Assess the impact of safety measures on the economic performance of shipowners and shipping companies.

1.4. Course Outline

Principles of implementation and management of safety of navigation. Marine environment protection and the navigation safety system. The safety of navigation and marine environment protection and its position in respect of the international legal framework. International Maritime Organization (IMO) structure and organizational activities, goals. IMO Convention - organization, principles and activities. Assembly, committees, and sub-committees. The most important maritime conventions: SOLAS, COLREG, MARPOL, STCW, MLC 2006, SAR, TONNAGE, LOADLINE, AFS, BWM. Recommendations and codes adopted by the IMO. Implementation of the international sources related to the safety of navigation on the national level and the ship operators' level. Privileges and obligations of the state to ships sailing under the national flag (Flag State Control – FSC). Privileges, obligations and the role of the Recognized organizations (ROs). Classification societies and IACS. Harmonized System of Survey and Certification (HSSC).
Rights and obligations of the coastal state related to ships sailing under a foreign flag (Port State Control – PSC). Port State Control Regime. Regional cooperation. Rights and obligations and procedures according Paris Memorandum of Understanding. Future development of the safety of navigation. Influence and limitations of modern technological solutions. Influence of the safety measures to the business efficiency of the ship operators and ship-owners.

1.5. Modes of Instruction	☒ Lectures ☐ Seminars and workshops ☒ Exercises ☐ E-learning ☐ Field work	☒ Practical work ☒ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments		

1.7. Student Obligations

Active participation in classes, with at least 70% attendance. Preparation of a research paper. Oral exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	1,5	Class participation		Seminar paper		Experiment	
Written exam		Oral exam	2	Essay		Research	1,5
Project		Continuous Assessment		Presentation		Practical work	
Portfolio							

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

Through oral examination and seminar Paper (research article) students will achieve learning outcomes.
On the final exam (oral exam) students need to present theoretical knowledge in the field of the international maritime safety system, where it is necessary to achieve a minimum of 50% of the required theoretical knowledge.
Examples of Assessment of Learning Outcomes:

1. Explain certification process and port state control inspection procedures (Learning Outcomes 4,5,6)
2. Determine the ship risk profile of the specific ship type according the rules of the Paris MoU. (Learning Outcomes 7, 8)

1.10. Main Reading

1. Lecturer's notes published on official e-learning platform - Merlin (https://moodle.srce.hr)
2. Recognized Organizations Code, IMO.
3. Paris Memorandum of Understanding on Por State Control – latest annex.
4. Damir Zec, Sigurnost na moru, University textbook, Faculty of Maritime Studies Rijeka, 2001.

1.11. Recommended Reading

1. Relevant IMO Resolutions, Circular letters, recommendations, Codes and circular letters) of IMO in electronic and paper form.
2. Original texts of the basic International Maritime Organization's conventions: SOLAS, MARPOL, MLC 2006, STCW.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
1-3	Web	30
4	5	5

1.13. Quality Assurance

The quality of studies is continuously monitored in accordance with the ISO 9001 system implemented at the Faculty of Maritime Studies in Rijeka. An analysis of exam pass rates is conducted annually, and a student survey is carried out once per semester. For this course, all relevant data and information are available to all students via the course instructors' website/e-learning platform.

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3.2. Course description

Generic information		
Head of Course	Predrag Kralj, Professor, Ph.D., BME	
Course	Cogeneration Plants	
Study Programme	Marine Engineering and Transport Technology	
Type of Course	Elective	
Year of Study	1	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5
	Number of Hours (L+E+S)	15+0+30

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

Introduction to the methods of more efficient energy consumption on board ships, the basis of marine cogeneration and tri-generation plants and their management systems design, as well as to the problems emerging during their exploitation.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

It is expected that the student will be able:
1. To analyze the energy transformation processes in cogeneration and tri-generation marine plants.
2. To optimize the power plants with different engine types and to determine the energy ratio and overall efficiency.
3. To compare marine equipment applied in the processes of main engines waste heat recuperation and to give explanations of their effect on the total efficiency coefficient of the process.
4. To design the cogeneration and tri-generation main components and to determine the possibilities of efficiency improvement of each element and the system altogether.
5. To create the basic concept of a cogeneration and tri-generation plant and its managing system.

1.4. Course Outline

Basics of cogeneration: energy transformation, mechanical work, waste heat, waste heat recuperation, heat balance and total efficiency coefficient increase. Marine systems and equipment used in waste heat recuperation processes: waste heat steam generators, thermal fluid systems, fresh water generators, refrigeration systems etc. Examples of cogeneration plants. Techno-economic analysis of fresh water generators. Techno-economic analysis of refrigeration processes. Application in three-generation plants. Influencing factors on plants and its managing systems design. The Plants Exploitation expenses and plants optimization.

1.5. Modes of Instruction	☒ Lectures ☒ Seminars and workshops ☐ Exercises ☐ E-learning ☐ Field work	☐ Practical work ☒ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments		

1.7. Student Obligations

Students enrolled at the Faculty of Maritime Studies are expected to observe *the code of conduct* required by the academic institution, and regularly attend lectures and practical work sessions.

1.8. Assessment of Learning Outcomes

Course attendance	1,5	Class participation		Seminar paper	1	Experiment	
Written exam		Oral exam	0,5	Essay		Research	1
Project		Continuous Assessment	1	Presentation		Practical work	
Portfolio							

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

Through Partial Exams, Seminar Paper and written Practical Work Report Student achieves up to 70% (Learning Outcomes from 1 to 5), while with the written Final Exam (Learning Outcomes from 1 to 5) up to 30% of total Score.
Examples of Assessment of Learning Outcomes:

1. Marine Power Plants Comparison with the Objective of Total Efficiency Coefficient Determination (Learning Outcomes 1, 3, 5)
2. Specify several Methods of Marine Power Processes Efficiency Coefficient Increase and several Methods used to determine the Efficiency and explain their advantages and disadvantages (Learning Outcomes 2,3, 5)
3. Demonstrate familiarization with tri-generation Processes using a Model (Learning Outcomes 1, 4, 5)

1.10. Main Reading

1. Kralj, Predrag, Lecturers' notes published on official webpage and e-learning system Merlin
2. Prelec, Z. Energetika u procesnoj industriji, Školska knjiga, Zagreb, 1994.
3. Lior, N., Measurement and control in water desalination, Elsevier, Amsterdam, 1986.
4. Martinović, D., Brodski rashladni uređaji, Školska knjiga, Zagreb, 1994.

1.11. Recommended Reading

1. Ozretić Velimir, Brodski pomoćni strojevi i uređaji, Ship management, Split, 1996.
2. Knak Christen, Diesel Motor Ships – Engines and Machinery, G-E-C GAD Publishers, Copenhagen, 1979.
3. Vorkapić, A. – Martinović, D. – Kralj, P.: *The analysis of the maintenance systems of a LPG carrier's liquefaction system main components*, Scientific journal of maritime research – Pomorstvo, Rijeka, God. 31 (2017), Vol. 1, pp.3-9
4. Vorkapić, A. – Kralj, P. – Bernečić, D.: *Ship systems for natural gas liquefaction*, Scientific journal of maritime research – Pomorstvo, Rijeka, God. 30 (2016), Vol. 2, pp.105-112
5. Glujić, D., Kralj, P., Martinović, D., *A Simple Mathematical Model for Refrigerating Compressor Optimization. // Pomorstvo : scientific journal of maritime research, 32 (2018), 1; 146-151*

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Kralj, Predrag, Lecturers' notes published on official webpage and e-learning system Merlin	web	

1.13. Quality Assurance

Internal:

- Student feedback (SET - Student evaluation of teaching) at the end of academic year.
- Course review by the head of course at the end of academic year.

External:
Programme quality review carried by the QA Agency.

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3.2. Course description

Generic information			
Head of Course	**Radoslav Radonja, Ph. D., associate professor**		
Course	**Process Ship Systems**		
Study Programme	**Marine Engineering and Maritime Transport Technology**		
Level	Graduate		
Type of Course	Obligatory		
Year of Study	**2**		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		**5**
	Number of Hours (L+E+S)		**30 + 15 + 0**

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The main goal of teaching the study subject is to acquire knowledge about the principles and laws of selection, management and supervision of process ship systems.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

After passing the exam, it is expected that students will be able to do the following:
1. Assess the basic concepts of process ship systems
2. Valorize individual ship processes according to the general theory of the system
3. Examine the method of determining the factors influencing the selection of the system and its reliability
4. Classify ship process systems and apply system definition forms
5. Establish and apply methods of selecting a process system from different points of view (environmental, exploitation or energy consumption, …)

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1.4. Course Outline

Basic terms. Development and definition of ship systems according to general system theory. Determining the factors influencing system selection and its reliability. Forms for defining the system. Methods of selecting a process system from different points of view. Process ship systems on a fully automated / autonomous ship.

1.5. Modes of Instruction		
	☒ **Lectures**	☐ Practical work
	☐ Seminars and workshops	☒ Multimedia and Network
	☒ **Exercises**	☐ Laboratory
	☐ E-learning	☐ Mentorship
	☐ Field work	☐ Other _____
1.6. Comments		

1.7. Student Obligations

Active attendance at classes and exercises (at least 70%). Preparation of a seminar paper on an agreed topic and final oral exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	1,5	Class participation		Seminar paper	1,5	Experiment	
Written exam		Oral exam	2,0	Essay		Research	
Project		Continuous Assessment		Presentation		Practical work	
Portfolio							

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The procedure for evaluating the acquired learning outcomes takes place in accordance with University's and Faculty's normative acts as follows:
• preparation of a seminar paper on an agreed topic (70%)
• At the final part of the exam, 30% of the acquired learning outcomes are evaluated (1-10), whereby the student must realize a minimum of 50% of points in order to pass the final exam.

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

1. Explain the difference between data and information? Explain the concept of interaction and information interaction? Explain the concepts of 'leveling' and 'sampling'? What does the 'sampling theorem' say? How to turn a change in the behavior of a system into information and how to transmit it so that it can be responded to in 'real time'? ...
2. Explain the terms isomorphism and homomorphism of the system and give an example? Explain the elements (potentials) of the technological system and what does its development mean? List and explain the types of system theory? Explain the definition of a system on an object from a particular point of view? What are the basic features of the system? Explain the properties of the system that produce the behavior of the system? Explain how the system can be defined according to the general system theory and the UC and ST structure of the system? How are system boundaries determined? ...
3. List and explain the sets of values involved in establishing a system according to Wymore? Explain cotyledons (input-output / technological / feasibility)?
4. State and explain the language format for defining the system? Give an example of a ship's process system and determine its possible states? Analyze the selected system in terms of inputs, state transition functions and state outputs? Determine the elements of the observed system and their interrelationships? Specify external sizes for the selected system? ...
5. State an example to explain the methods of selecting a marine process system from a particular point of view? ...

1.10. Main Reading

1. Klir, G. J., Trends in General Systems Theory, John Wiley & Sons Inc., New York, 1972

1.11. Recommended Reading

2. Teacher lectures - available in electronic form

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Teacher lectures - available in electronic form	-	30
Klir, G.J., Trends in General Systems Theory, John Wiley& Sons Inc., New York, 1972.	1	30

1.13. Quality Assurance

Course quality review carried in accordance with ISO 9001 system and European standards and guidance for quality assurance carried through on Maritime faculty. Student Success is evaluated, and corrective measure implemented yearly.

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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3.2. Course description

Generic information			
Head of Course	Goran Vizentin, PhD		
Course	Project assignment 2		
Study Programme	Marine Engineering and Maritime Transport Technology		
Type of Course	Compulsory		
Year of Study	2		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		5
	Number of Hours (L+E+S)		0+0+60

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The main goal of the course is enabling students for research of scientific papers and other materials and application of scientific methods in project designing covered previously by one or two courses.

1.2. Prerequisites for Course Registration

None.

1.3. Expected Learning Outcomes

After passing the exam, students will be able to do the following:
1. Evaluate the system, equipment or application condition and suggest optimal improvement.
2. Suggest new solutions aiming to optimize operation of the system, equipment or application and to increase efficiency or safety level.
3. Evaluate solutions available on the market that could be applied with small adaptations only or to create new one.
4. Evaluate scientific methods applied in the project.
5. Select techno-economic analysis of both existing and new solution.
6. Give final solution with comparison and improvement achieved

1.4. Course Outline

Definition of the project. Project planning, organization, leading, control. Techno-economic evaluation of the project. Goal achievement measurement. Project results management.

1.5. Modes of Instruction	☐ Lectures ☒ Seminars and workshops ☐ Exercises ☐ E-learning ☐ Field work	☒ Practical work ☒ Multimedia and Network ☒ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments	-	

1.7. Student Obligations

Class attendance (minimum 70%), solving assignments during class, writing seminar paper.

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1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper	2	Experiment	0,5
Written exam		Oral exam		Essay		Research	1
Project		Continuous Assessment		Presentation		Practical work	
Portfolio							

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The process of evaluating the acquired learning outcomes is carried out according to the Regulations on Studies of the University of Rijeka and the Regulations on Studies at the Faculty of Maritime Studies in Rijeka in the following way:

- through continuous assessment during the semester in accordance with the regularity of consultations with the subject teacher(s), the quality of cooperation during the preparation of the seminar paper and the quality of the seminar paper (70% of learning outcomes)
  - seminar paper - learning outcomes 1-6,
- an additional 30% of the grade is achieved based on a public presentation of the work in front of the mentor(s) (outcomes 1-6).

Examples of assessment of learning outcomes in relation to the set learning outcomes are:

1. Develop a numerical model and compare with experimental results (outcomes 4, 5)
2. Develop a computer application (outcomes 4, 5)
3. Simulate different solutions on a machine room simulator and optimize (outcomes 1, 2, 6)

1.10. Main Reading

Main reading depends on the course or courses student selected for the topics of the project.

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1.11. Recommended Reading

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1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*

1.13. Quality Assurance

According to ISO 9001 system set at Faculty of Maritime Studies, Rijeka. Once a year analysis of passing exam rate. Once a semester anonymous students online survey.

[1] NOTE: Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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3.2. Course description

Generic information			
Head of Course	Robert Baždarić, Ph.D.		
Course	Controlling Technical Systems		
Study Programme	Marine Engineering and Maritime Transport Technology		
Type of Course	Elective		
Year of Study	2nd		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		5
	Number of Hours (L+E+S)		30+15+0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The aim of this course is to acquire adequate knowledge in the control of technical systems. The principles of combining different maritime technical systems into a hierarchically organized system control are considered. To impart theoretical knowledge about the definition of requirements for the design of control systems, their measurement methods, effects and their evaluation procedures.

1.2. Prerequisites for Course Registration

There are no prerequisites.

1.3. Expected Learning Outcomes

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

1. determine and explain the characteristics of the principles of management and management of technical systems
2. classify requirements for the control of technical systems
3. select the techniques of structural system classification
4. suggest ways to link technical process and computer
5. review and explain redundancy management
6. evaluate the assessment methods of the technical process control system
7. select and explain the application of fault-tolerant control systems.

1.4. Course Outline

Definitions, main features and principles of control and management of technical systems. Components of computerized process control systems. An example of an intelligent online system. A complex process control system. Interfaces for connection to external units, programmable logic controllers, architecture, management, programming. Methods for controlling and managing technical systems (optimal, adaptive, etc.). Basic procedures for setting up a process control system. New techniques of sensor signal processing. Hierarchical architecture of distributed computer systems. Function and organization of the hierarchical levels of the control system. Examples of computer control systems in shipping. Fault tolerant control systems.

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1.5. Modes of Instruction	☒ Lectures ☐ Seminars and workshops ☒ Exercises ☐ E-learning ☐ Field work	☒ Practical work ☐ Multimedia and Network ☒ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments		
1.7. Student Obligations		
Attendance in the course, 1st colloquium, 2nd colloquium, presentation of the research assignment and final examination.		
1.8. Assessment[1] of Learning Outcomes		

Course attendance	1,5	Class participation		Seminar paper	0,5	Experiment	
Written exam		Oral exam	1	Essay		Research	
Project		Continuous Assessment	2	Presentation		Practical work	
Portfolio							

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The procedure for the assessment of acquired learning outcomes is carried out in accordance with the Study Regulations of the University of Rijeka and the Study Regulations of the Faculty of Maritime Studies in Rijeka as follows:

- through continuous knowledge tests during class, 70% of the acquired learning outcomes are assessed through the 1st colloquium, learning outcomes 1-4 (25%), the 2nd colloquium, learning outcomes 5-7 (25%), the presentation of the research task (seminar), learning outcomes 1-7 (20%). The student must achieve at least 50% of the points for each colloquium, while the presentation of the research task is assessed on the basis of the developed assessment criteria.
- in the final part of the examination, 30% of the acquired learning outcomes (1-7) are assessed, and the student must achieve at least 50% of the points to pass the final examination.

Examples of the assessment of learning outcomes in relation to the defined learning outcomes are:

1. Name and explain the characteristics and principles of controlling technical systems.
2. Define the requirements for the individual parts of the technical system.
3. How to create a mathematical model of a multivariable dynamic system?
4. Break down the functions and organization of the hierarchical levels of the control system.
5. Explain error handling in the redundant pair for the system shown in the figure.
6. How do you evaluate solutions for adaptive control systems and related technologies?
7. Draw and explain the organization chart of a fault tolerant control system for different approaches.

1.10. Main Reading

1. B. Novaković: Metode vođenja tehničkih sistema, Školska knjiga – Zagreb, 1990.
2. Steven X. Ding: Model-Based Fault Diagnosis Techniques: Design Schemes, Algorithms and Tools, Springer, London, 2015.

1.11. Recommended Reading

1. V. Tomas, "Upravljanje tehničkim sustavima", authorized lectures, available on the e-learning system – Merlin
2. V. Tomas, "Nastavni materijal za vježbe e-kolegij", available on the e-learning system – Merlin
3. Kongsberg manual, "Integrated ship control-Functional specification-Power management system, process control unit, signal acquisition unit"

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
V. Tomas, "Upravljanje tehničkim sustavima", authorized lectures, available on the e-learning system - Merlin	NA	15

1.13. Quality Assurance

The quality of the study programme is constantly monitored in accordance with the ISO 9001 system introduced at the Faculty of Maritime Studies in Rijeka. Examinations are analyzed annually and a student survey is conducted once a semester.

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3.2. Course description

Generic information			
Head of Course	Dario Ogrizović, PhD		
Course	Simulation and Modelling		
Study Programme	Marine Engineering and Maritime Transport Technology		
Type of Course	Elective		
Year of Study	2nd		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		6
	Number of Hours (L+E+S)		30 + 30 + 0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The course is intended to introduce students to simulation modelling and its application in the analysis and design of business processes. Simulation modelling enables the creation of dynamic business process models, execution of simulation experiments with the model and the evaluation of business process performance. Discrete event simulation allows the development of detailed queue system models.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

After finishing the course, the students will be able:

1. Distinguish between types of systems, models and modeling
2. Analyze and compare types of simulations
3. Identify problems in the field of business systems that can be solved by different methods of simulation modelling
4. Apply simulation modeling to analyze and design business processes
5. Create simulation models using software tools that support simulation modeling methods and techniques and their verification
6. Create appropriate methods for conducting simulation experiments
7. Analyze and interpret solutions from conducted simulation experiments
8. Create business decision processes based on the results of simulation experiments

1.4. Course Outline

Basic ideas of simulation. Simulation modelling. Modelling and computers. Simulation in decision making. Types of simulation models. Simulation models development. Basic concepts of discrete event simulation. Structure of computer tools for simulating discrete events. Conceptual simulation models. Activity cycle diagrams. Simulation performance strategies. Time shift mechanisms. Simulation strategies. FlexSim simulation software. Simulation software selection criteria. Basic concepts, method of modelling, execution of simulation experiments and their analysis. Modelling and simulation of several problems with FlexSim software. Computer model verification. Evaluation of the conceptual model. Input data analysis. Statistical distributions. Estimation of distribution parameters. Simulation experiments planning. Design of simulation experiments. Variance reduction techniques. Output data analysis of simulation experiments.

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1.5. Modes of Instruction	☒ Lectures ☐ Seminars and workshops ☒ Exercises ☒ E-learning ☐ Field work	☒ Practical work ☒ Multimedia and Network ☒ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments		

1.7. Student Obligations

The student must attend at least 70% of the total hours of lectures and exercises, and must have passed the exams (continuous assessment) to take the final exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation	1	Seminar paper		Experiment	
Written exam	1	Oral exam		Essay		Research	
Project	1	Continuous Assessment	1	Presentation		Practical work	
Portfolio							

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The process of evaluation of the acquired learning outcomes takes place during continuous assessments (through class activities (10%), preparation and presentation of a project (20%), 2 midterm exams - total 40%) and at the final part of the exam (30%). A minimum of 50% of points must be achieved in individual knowledge assessments.

Examples of evaluating learning outcomes in relation to the learning outcomes that are set are:
1. Distinguish between types of systems, models and modeling
2. Analyze and compare types of simulations
3. Identify problems in the field of business systems that can be solved by different methods of simulation modelling
4. Apply simulation modeling to analyze and design business processes
5. Create simulation models using software tools that support simulation modeling methods and techniques and their verification
6. Create appropriate methods for conducting simulation experiments
7. Analyze and interpret solutions from conducted simulation experiments
8. Create business decision processes based on the results of simulation experiments

1.10. Main Reading

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. Recommended Reading

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

1.12. Number of Main Reading Examples

Title	*Number of examples*	*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 Assurance

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.

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3.2. Course description

Generic information			
Head of Course	**Robert Baždarić, Ph.D.**		
Course	Automatic control of floating crafts		
Study Programme	Marine Engineering and Maritime Transport Technology		
Type of Course	Elective		
Year of Study	2nd		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		6
	Number of Hours (L+E+S)		30+30+0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The aim of the course is to acquire knowledge of the principles and techniques of ship control, navigation and management, with particular emphasis on ship autopilots, dynamic positioning systems and propulsion control systems.

1.2. Prerequisites for Course Registration

There are no prerequisites.

1.3. Expected Learning Outcomes

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

1. Evaluate and discuss the notation characteristic of the field of ship navigation and control and interpret the application of the individual reference frames and the movement of the ship in six degrees of freedom.
2. Understand the mathematical background of models of ship kinematics and dynamics in the horizontal plane and explain how and why these models are used for the steering and control of ships.
3. Name and explain in detail models of environmental impact and discuss how certain external disturbances are dealt with in ship management systems.
4. Describe the structure of the dynamic positioning system and interpret the meaning and purpose of the individual parts of the system.
5. Discuss the use of computational estimators in ship control systems (adaptive autopilots, dynamic positioning) with particular reference to the Kalman filter (possibilities, applications, advantages, disadvantages).
6. Explain the feedback loop of multivariable ship process control and its advanced part with particular reference to applications in adaptive autopilots and dynamic positioning systems.
7. Compare and discuss different approaches to solving the problem of thrust distribution.
8. Analyze and explain the concepts of propulsion control.

1.4. Course Outline

Definitions, basic features and principles of ship steering, control, navigation and management. Structure of ship control systems (autopilots, dynamic positioning). Notation and coordinate systems. Modelling of surface vessels (kinematics, dynamics). Modelling of environmental loads (wind, waves, ocean currents). Construction modelling (ship propellers without and with nozzle, azimuth thruster). Allocation of propulsion systems. Management of propulsion systems. Advanced methods of ship steering and control (optimal, adaptive, remote control without crew). Adaptive autopilots. Dynamic positioning systems. Integrated navigation systems. Autonomous navigation and autonomous maritime systems and equipment. Development trends and perspectives.

1.5. Modes of Instruction	☒ Lectures ☐ Seminars and workshops ☒ Exercises ☐ E-learning ☐ Field work	☐ Practical work ☒ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments		

1.7. Student Obligations

Attendance in the course, 1st colloquium, 2nd colloquium and final examination.

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper		Experiment	
Written exam	1	Oral exam	1	Essay		Research	
Project		Continuous Assessment	2	Presentation		Practical work	
Portfolio							

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The procedure for the assessment of acquired learning outcomes is carried out in accordance with the Study Regulations of the University of Rijeka and the Study Regulations of the Faculty of Maritime Studies in Rijeka as follows:

- 70% of the acquired learning outcomes are assessed by continuous knowledge tests during the lessons through the 1st colloquium - learning outcomes 1-4 (35%), 2nd colloquium - learning outcomes 5-8 (35%)
- depending on the success of the colloquium examination, the student can decide whether this exempts them from the obligation to be assessed in the written part of the examination
- in the final part of the examination, 30% of the acquired learning outcomes (1-8) are assessed. In order to pass the final examination, the student must achieve at least 50% of the points in the written and oral parts of the examination.

Examples of the assessment of learning outcomes in relation to the defined learning outcomes are:

1. Enter all six degrees of freedom in a table. Indicate the type of movement, the name of the degree in Croatian and English, forces and torques, linear and angular velocities, position and orientation.
2. Make a sketch to analyze the dynamics of the ship in the horizontal plane. Clearly indicate the position and orientation of the ship, the characteristic coordinate systems, the characteristic angles and force vectors and briefly describe any physical quantities of interest.
3. The mobile offshore base (MOB) in the form of a cuboid is dynamically positioned (u = v ≈ 0). It is symmetrical and homogeneous, the origin of {b} lies in the CG. The basic dimensions are L_{oa} = 100 m, B = 40 m, H = 10 m and T = 4 m. The density of seawater is ρ_{mv} = 1025 kg/m^3, that of air ρ_{air} = 1,23 kg/m^3. he gyrocompass shows the current course ψ = 70°, and the anemometer provides data on the current wind speed and direction V_{wind} = 20 knots and β_{wind} = 140°. The wind load coefficients can be approximated as a function of the wind angle of attack γ_{wind} as follows: $C_X(\gamma_{wind}) = -0{,}6\cos(\gamma_{wind})$, $C_Y(\gamma_{wind}) = 0{,}8\sin(\gamma_{wind})$, and $C_N(\gamma_{wind}) = 0{,}1\sin(2\gamma_{wind})$.
   a) Sketch the position of the MOB in relation to {n} and draw all characteristic angles and vectors.
   b) Express the angle γ_{wind} in terms of β_{wind} and ψ, and calculate it.
   c) Calculate the wind load vector $\boldsymbol{\tau}_{wind} = [X_{wind}, Y_{wind}, N_{wind}]^T$ and the resulting wind force.
4. Sketch the part of the structure of the classical dynamic positioning system that relates to thrust allocation. Clearly indicate what enters and what leaves each block.
5. What does estimation refer to in dynamic positioning systems? Describe in detail and discuss the two basic applications of the Kalman filter in ship control systems.
6. DP system control logic:
   a) Sketch the control feedback loop of a non-linear multivariable PID controller with wind feedforward.
   b) Explain the individual blocks, inputs and outputs of each block.
   c) Define the control vector $\boldsymbol{\tau}_c$, express it using the control law of the controller and explain it.
   d) What is a wind feedforward control and what is it used for in a DP system?
7. Thrust allocation:
   a) Explain the process of thrust allocation, in particular for a fixed pitch propeller (FPP) and in particular for a controllable pitch propeller (CPP).
   b) Determine the configuration matrix $\boldsymbol{B}$ in the case of three azimuth thrusters and one tunnel thruster and indicate which part of the matrix refers to which thruster.
   c) Set up the allocation equation for the above case and provide a solution using a pseudo-inverse matrix.
8. Propulsion control:
   a) Name the basic properties (quantities, terms, units) of the fixed pitch propeller in the nozzle under open water conditions.
   b) Sketch the K_T-K_Q-η_0-J diagram and explain its application in dynamic positioning systems.
   c) Explain the advantages and disadvantages of the propeller in a nozzle, especially with regard to the application profile of DP ships.

1.10. Main Reading

Teaching material on the Merlin e-learning system (https://moodle.srce.hr).

1.11. Recommended Reading

1. *Fossen, T.I. (2011). Handbook of Marine Craft Hydrodynamics and Motion Control. John Wiley & Sons Ltd, Chichester, UK.*
2. Sørensen, A.J. (2013). *Marine Control Systems: Propulsion and Motion Control of Ships and Ocean Structures*. Lecture Notes, Department of Marine Technology, NTNU, Trondheim, Norway. Available online: http://folk.ntnu.no/assor/publications/marcyb.pdf
3. Valčić, M. (2020). *Optimization of thruster allocation for dynamically positioned marine vessels*. PhD Thesis. University of Rijeka, Faculty of Engineering, Rijeka.
4. Valčić, M. (2015). *Inteligentna estimacija u sustavima za dinamičko pozicioniranje plovnih objekata*. Doktorska disertacija. Sveučilište u Rijeci, Pomorski fakultet u Rijeci, Rijeka.
5. Mandžuka, S. (2009). *Automatsko upravljanje plovnim objektima*. Sveučilište u Rijeci, Pomorski fakultet u Rijeci, Rijeka.
6. Baždarić, R., Matko, D., Leban, A., Vončina, D., & Škrjanc, I. (2017). Fuzzy model predictive control of a DC-DC boost converter based on non-linear model identification. *Mathematical and Computer Modelling of Dynamical Systems*, *23*(2), 116-134.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Teaching material on the Merlin e-learning system (https://moodle.srce.hr)	NA	15

1.13. Quality Assurance

The quality of the study programme is constantly monitored in accordance with the ISO 9001 system introduced at the Faculty of Maritime Studies in Rijeka. Examinations are analyzed annually and a student survey is conducted once a semester.

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3.2. Course Description

Generic information		
Head of Course	Igor Vio, PhD.	
Course	Maritime Labour Law	
Study Programme	Marine Engineering	
Level	Graduate degree programme	
Type of Course	Elective (Deactivated)	
Year of Study	2	
Estimated Student Workload and Methods of Instruction	ECTS Coefficient of Student Workload	4
	Number of Hours (L+E+S)	30 + 0 + 0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The aim of the course is to introduce students to the characteristics of labour relations in general and the specifics of labour relations between seafarers, namely: sources of labour law, essential elements of employment contracts, protection of the life, health and dignity of workers, working hours, holidays and permits, wages and remuneration, compensation for damages, termination of employment contracts, protection of rights under employment relations, collective entities of labour relations, collective bargaining and collective agreements.

1.2. Prerequisites for Course Registration

none

1.3. Expected Learning Outcomes

After passing the exam, students will be able:

1. Define and interpret fundamental concepts of labour law.
2. Explain the rights of seafarers from employment relationships.
3. Explain how the rights of seafarers from employment relationships are exercised.
4. Determine ways to protect the rights of seafarers from employment relationships.
5. Analyze the specifics of maritime employment relationships.
6. Analyze the rights and obligations of workers and employers with regard to occupational safety7. Explain the role of trade unions and employers' associations in contracting rights and obligations in employment relations.

1.4. Course Outline

The concept, legal sources, entities and basic characteristics of the employment contract. Features and elements of the employment contract. Protection of life, health and dignity of workers, working hours, holidays and permits, salaries and remuneration, compensation of special reference to compensation for damages due to an accident at work or occupational disease, termination of the employment

contract, protection of rights from employment relationships, collective entities of labour relations, collective bargaining and collective contracts.

1.5. Modes of Instruction		
	☒ Lectures	☐ Practical work
	☐ Seminars and workshops	X Multimedia and Network
	X Exercises	☐ Laboratory
	X E-learning	☐ Mentorship
	☐ Field work	☐ Other _____

1.6. Comments

1.7. Student Obligations

Students enrolled at the Faculty of Maritime Studies are expected to observe the code of conduct required by the academic institution, and regularly attend lectures and practical work sessions.

1.8. Assessment[1] of Learning Outcomes

Course attendance	1,0	Class participation		Seminar paper		Experiment	
Written exam		Oral exam	2,0	Essay		Research	
Project		Continuous Assessment	1,0	Presentation		Practical work	
Portfolio							

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

Through continues assessment student achieves up to 70% (Learning Outcomes from 1 to 6), while with the written Final Exam (Learning Outcomes from 1 to 6) up to 30% of total Score.
Examples of Assessment of Learning Outcomes:

1. Explain the application of labor law principles.
2. List the seafarer's rights related to their employment.
3. Analyze the extrajudicial and judicial exercise of rights related to their employment.
4. Analyze the specificity of employment and stay at the workplace.
5. Explain the employer's responsibility for occupational safety.
6. Determine the role of seafarers' unions in protecting seafarers' rights.

1.10. Main Reading

Učur, Marinko: Radnopravni status pomoraca, Pravni fakultet Sveučilišta u Rijeci, 2004
Course teaching material available on e-learning system - Merlin (https://moodle.srce.hr)

1.11. Recommended Reading

Convention of the International Labour Organization, www.ilo.org

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Učur, Marinko: Radnopravni status pomoraca, Pravni fakultet Sveučilišta u Rijeci, 2004	20	40

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

Course teaching material available on e-learning system - Merlin	Web	Web

1.13. Quality Assurance

The quality of study is monitored in accordance with the ISO 9001 system and in accordance with European quality assurance implemented at the Faculty of Maritime Studies in Rijeka. Once a year, the results of the student pass rate and adopt appropriate measures.

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3.2. Course description

Generic information			
Head of Course	Vladimir Pelić, PhD		
Course	SHIP PROPULSION		
Study Programme	Marine Engineering and Maritime Transport Technology		
Type of Course	Elective		
Year of Study	2.		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		5
	Number of Hours (L+E+S)		30 + 15 + 0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

Acquiring specific competencies in ship propulsion. Developing skills for solving problems in the field of propulsion energy in the maritime sector.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

After completing and passing the course, students will be able to:

1. Explain and distinguish phenomena in water flow around a ship's hull.
2. Evaluate ship resistance and analyze ship resistance components.
3. List the main characteristics of ship propellers and analyze the principle of their operation.
4. Explain and evaluate the interaction of the propulsion engine and ship's propeller.
5. Explain and analyze the connection between ship resistance and propulsion.
6. Explain and compare different solutions for ship propulsion systems.
7. Evaluate the energy efficiency of a ship.

1.4. Course Outline

Ship's hull form parameters. Operating regimes. Water flow around the ship's hull. Ship resistance. Ship resistance components. Methods for determining ship resistance. Ship propulsion and propulsion devices. Screw propeller. Geometry of the screw propeller. Theory of propeller action. Other propulsion devices: paddle, sail, paddle wheel, vertical-axis propeller, waterjet, transverse and azimuthing propellers, podded propellers. Interaction of screw propeller and hull. Propulsive coefficients. Propeller cavitation. Matching of propeller with propulsion engine. Propeller design point. Engine layout diagram. Examples of different loads. Influence of ship propeller on ship exploitation. Marine diesel engine propulsion systems. Marine diesel-electric propulsion systems. Energy efficiency of the ship.

1.5. Modes of Instruction	☒ Lectures ☐ Seminars and workshops ☒ Exercises ☐ E-learning ☐ Field work	☐ Practical work ☒ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____

1.6. Comments	

1.7. Student Obligations

Regular attendance of classes (at least 70%).

1.8. Assessment[1] of Learning Outcomes

Course attendance	1,5	Class participation		Seminar paper		Experiment	
Written exam		Oral exam	1,5	Essay		Research	
Project		Continuous Assessment	2	Presentation		Practical work	
Portfolio							

[1] NOTE: Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The evaluation process of acquired learning outcomes is carried out according to the Regulations on Studies of the University of Rijeka and the Regulations on Studies at the Faculty of Maritime Studies in Rijeka in the following way:
- continuous assessment of knowledge
  - partial exam 1 (35%)
  - partial exam 2 (35%)
- final exam (30%) learning outcomes (1-7) whereby for a passing grade the student must achieve at least 50% on all knowledge assessments.

Examples of evaluation of learning outcomes in relation to the set learning outcomes are:
1. Explain the phenomena of water flow around the hull of a ship. (outcome 1)
2. List the parameters on which the ship's resistance depends and explain how these parameters affect individual components of the ship's resistance. (outcome 2)
3. List and explain the main characteristics of ship propellers and compare the way they work. (outcome 3)
4. Explain the interaction between the propulsion engine and the ship's propeller and, using the example of the propeller power absorption curve and the engine diagram, explain how to select the operating point of the ship's propeller. (outcome 4)
5. Explain the connection between resistance and ship propulsion and list the parameters that affect the overall efficiency of ship propulsion. (outcome 5)
6. Compare different solutions for ship propulsion systems and choose one favorable solution for a certain type of ship. (outcome 6)
7. Explain the method of evaluating the energy efficiency of a ship and list ways in which efficiency could be improved. (outcome 7)

1.10. Main Reading

1. Teaching material - lecture presentations - available on the e-learning system - Merlin
2. Šegulja, I., Propulzijska energetika u pomorstvu, interna skripta, Pomorski fakultet u Rijeci, Rijeka, 2016.
2. Basic Principles of Ship propulsion, MAN Energy Solutions, Copenhagen, 2018

1.11. Recommended Reading

1. Ridley, J., Ship Stability, Powering and Resistance, Reeds Marine Engineering and Technology Series, 13, 2014.
2. Carlton, J. S., Marine Propellers and Propulsion, Butterworth-Heinemann, Oxford, 2007.
3. 2014 Guidelines on the Method of Calculation of the Attained Energy Efficiency Design Index (EEDI) for New Ships, Res MEPC.245(66), IMO, 2014

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
References (1.10) available in electronic form.	1	30

1.13. Quality Assurance

Course quality review carried in accordance with ISO 9001 system and European standards and guidance for quality assurance carried through on Maritime faculty. Student Success is evaluated, and corrective measure implemented yearly.

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3.2. Course description

Generic information		
Head of Course	**Đani Mohović, PhD, Full professor**	
Course	Risk management in shipping	
Study Programme	Nautical Studies and Maritime Transport Technology	
Level	University graduate study program	
Type of Course	Mandatory	
Year of Study	2.	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5
	Number of Hours (L+E+S)	45+0+15 (3+0+1)

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The aim of the course is to introduce students to the theoretical and practical basis for maritime risk analysis. Detailed introduction and analysis of specific factors that influence risk identification. Introduction to risk identification methods. Definition of acceptable risk and measures to reduce maritime risk. Ability to identify risks using specific examples.

1.2. Prerequisites for Course Registration

No special requirements for enrolling in the course.

1.3. Expected Learning Outcomes

It is expected that after passing the exam, students will be able to:
1. apply theoretical and practical foundations for maritime risk analysis
2. identify and analyze specific factors that influence risk determination
3. select and apply methods for risk determination
4. select an appropriate method and assess acceptable risk
5. select options and apply common measures for maritime risk reduction
6. determine risk on specific examples

1.4. Course Outline

The risk concept. What is an accident? Risk picture. Accident statistics. Preventive and ameliorating measures. Safety management – monitoring of the risk level. Risk objectives and data. Statistical analysis of safety oriented decision alternatives. Maritime traffic models. Probability of grounding and collision. Risk analysis methods: Hazard analysis, FTA, ETA, FMECA, HazOp. Formal safety assessment (FSA). Cost-benefit analysis of safety measures. Analysis and modelling of ships casualties. Cost-benefit analysis of controls. Analysis and modelling of ship accidents. Human reliability and error mechanisms. Catastrophe behaviour, evacuation and rescue. Training, drills and human-machine simulation. Regulation and official control of maritime safety. National and international control authorities. Safety and quality management. ISO standards. Auditing. Safety case.

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1.5. Modes of Instruction	☒ Lectures ☒ Seminars and workshops ☐ Exercises ☐ E-learning ☒ Field work	☐ Practical work ☐ Multimedia and Network ☐ Laboratory ☒ Mentorship ☐ Other _____
1.6. Comments		

1.7. Student Obligations

Regular class attendance, continuous learning, active class participation, group work on risk analysis examples, preparing and writing seminars, presenting research in seminars, studying and taking the final exam (oral).

1.8. Assessment[1] of Learning Outcomes

Course attendance	1.5	Class participation		Seminar paper	2	Experiment	
Written exam		Oral exam	1.5	Essay		Research	
Project		Continuous Assessment		Presentation		Practical work	
Portfolio		Final exam					

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

During the course, the quality of the seminar paper, mastery of the material and the seminar presentation are assessed. After the course, the oral exam is assessed. The evaluation percentage is 70% in class and 30% in the final exam (according to the Regulations on Studies of the University of Rijeka and the Regulations on Studies at the Faculty of Maritime Studies in Rijeka).

Knowledge assessment during the course:

Through mentoring work when writing the seminar paper and during the presentation of the seminar paper, where knowledge of the theoretical foundations and their application in the seminar paper are assessed.

Final exam:

The final exam (oral exam) tests the completeness of theoretical knowledge in the field of Maritime Risk Management - it is necessary to achieve at least 50% of the required theoretical knowledge.

1.10. Main Reading

1. Authorized lecture, Ph.D.sc. Đani Mohović, Ph.D. sc. Robert Mohović, Rijeka, 2011/2012..
2. "Manging risk in shipping"- The Nautical Institute, London, 1999.
3. "Safety Management and Risk Analysis" – Svein Kristiansen, Butterworth-Heinemann, 2004.

1.11. Recommended Reading

1. "Risk and reliability in marine technology"- COMETT Programme, Wegemt, 1993.
2. "Good practice in risk assessment and risk management 1"- Hazel Kemshall and Jacki Pritchard, Bristol, Jessica Kingsley Publ., 1996.
3. "Acceptable risk"- Baruch Fischoff, Cambridge, Cambridge University Press, 1981.
4. "General Security Risk Assessment"- ASIS International Guidelines Commission, Alexandria, Virginia, 2003.
5. "Procjena opasnosti za opasne tvari", Janeš V., Čavrak B., ZIRS, Intergrafika, Zagreb 1999.
6. "Risk analysis and its applications"- David B. Hertz and Howard Thomas, Chichester: Wiley, 1983.
7. "Quantitative risk analysis: a guide to Monte Carlo simulation modelling" – David Vose, Chichester: John Wiley, 1996.
8. "The risk ranking technique in decision making"- John. C. Chicken and Michael R. Hayns, Oxford: Pergamon Press, 1989.
9. "Reliability, maintainability and risk", Smith J. David, 2001.
10. "Offshore Risk Assessment", Vinnem J. E., Trondheim, Kluwer Academic Publisher, 1999.
11. "Metode procjene i upravljanja rizikom u procesnoj industriji", Enconet International, Zagreb, 1999.
12. Mario Šikić, Andro Jančić, Mihovil Jureško, Đani Mohović, „Analysis of Risks Arising from the Use of Autonomous Vessels“, pregledni rad, Pomorski zbornik 63 (2023), 63-74

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
1. Authorized lecture, Ph.D.sc. Đani Mohović, Ph.D. sc. Robert Mohović, Rijeka, 2011/2012..	*unlimited*	
2. Manging risk in shipping- The Nautical Institute, London, 1999.	*1*	*20-30*
3. Safety Management and Risk Analysis – Svein Kristiansen, Butterworth-Heinemann, 2004.	*2*	
	2	

1.13. Quality Assurance

The quality of study is monitored in accordance with the ISO 9001 system and in accordance with the European standards and guidelines for quality assurance carried out at the Faculty of Maritime Studies in Rijeka. Once a year, exam passing results are analyzed and appropriate measures are adopted.

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3.2. Course description

Generic information			
Head of Course	Vladimir Pelić, PhD		
Course	Power supply systems		
Study Programme	Marine Engineering and Maritime Transport Technology		
Type of Course	Obligatory		
Year of Study	2.		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		6
	Number of Hours (L+E+S)		45 + 0 + 15

1. GENERAL COURSE DESCRIPTION		
1.1. Course Objectives		
The main objective of the course is to acquire knowledge about available energy sources, energy transformations and energy systems used on land, at coastal and offshore facilities.		
1.2. Prerequisites for Course Registration		
-		
1.3. Expected Learning Outcomes		
After completing and passing the course, students will be able to: 1. Explain and analyze concepts related to energy and energy transformations. 2. Explain and analyze processes that occur in energy systems. 3. Distinguish between the forms of energy and analyze the basics of energy transformations. 4. Distinguish and analyze the principles of operation of different energy systems, and list their advantages and disadvantages. 5. Analyze factors that influence the efficiency, environmental acceptability and economic sustainability of energy systems. 6. Evaluate energy systems and processes, and manage process parameters in application so that the energy system operates reliably and efficiently with available primary energy.		
1.4. Course Outline		
Basic terms (work, force and energy, exergy and anergy). Forms of energy and energy transformation. Basic functions of the energy system. The principle of operation and energy transformations that take place in energy systems with respect to the energy source or energy source used. Analysis of energy efficiency, environmental acceptability and economic sustainability of energy systems. Selection of the optimal energy system.		
1.5. Modes of Instruction	☒ Lectures ☒ Seminars and workshops ☐ Exercises ☐ E-learning ☐ Field work	☐ Practical work ☒ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments		

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1.7. Student Obligations

Regular attendance of classes (at least 70%). Creating a seminar paper.

1.8. Assessment[1] of Learning Outcomes

Course attendance	2,0	Class participation	0,5	Seminar paper	1,5	Experiment	
Written exam		Oral exam	2,0	Essay		Research	
Project		Continuous Assessment		Presentation		Practical work	
Portfolio							

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The evaluation procedure for acquired learning outcomes is carried out according to the Regulations on Studies of the University of Rijeka and the Regulations on Studying at the Faculty of Maritime Studies in Rijeka in the following way:
- continuous assessment of knowledge,
  - partial exam 1 (35%)
  - partial exam 2 (35%)
- final part of the exam (30%) learning outcomes (1-6) whereby for a passing grade the student must achieve at least 50% in all knowledge assessments.

Examples of evaluating learning outcomes in relation to set learning outcomes are:
1. What is the difference between exergy and anergy? How is the exergy of a heat flow determined? In what forms does energy appear? What energy transformations are necessary to transform the chemical energy of fuel into mechanical energy? How to achieve direct transformation of thermal energy into electrical energy. (outcome 1)
2. Show and explain the energy system of a liquid fuel thermal power plant with a block diagram. Explain the transformation of wind energy into electrical energy. Show and explain the principle of operation of a solar power plant with parabolic trough collectors using a block diagram. Show and explain the energy system of a ship with diesel-electric propulsion using a block diagram (outcomes 2, 3 and 4).
3. Analyze the energy efficiency, ecological and economic sustainability of run-of-river and storage hydropower plants. How to improve the efficiency of ship energy systems? (outcome 5)
4. Explain methods for assessing the economic sustainability of energy systems. (outcome 6).

1.10. Main Reading

1. Teaching material - lecture presentations - available on the e-learning system - Merlin
2. Šljivac, D i Šimić, Z. : OBNOVLJIVI IZVORI ENERGIJE, FER 2009.
3. Nag, P. K. POWER PLANT ENGINEERING, McGraw-Hill

1.11. Recommended Reading

1. Bošnjaković F.: NAUKA O TOPLINI, knjiga 1 i 2, Tehnička knjiga Zagreb,
2. Požar, H.: OSNOVE ENERGETIKE, knjiga 1, 2 i 3, Školska knjiga Zagreb, 1992.
3. Prelec, Z.: ENERGETIKA U PROCESNOJ INDUSTRIJI, Školska knjiga Zagreb, 1994.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
References (1.10) available in electronic form.	-	30

1.13. Quality Assurance

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Course quality review carried in accordance with ISO 9001 system and European standards and guidance for quality assurance carried through on Maritime faculty. Student Success is evaluated, and corrective measure implemented yearly.

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3.2. Course description

Generic information			
Head of Course			
Course	Master of Science Thesis		
Study Programme	Marine Engineering and Transport Technology		
Type of Course	Obligatory		
Year of Study	2		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		15
	Number of Hours (L+E+S)		

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The objective of the thesis paper writing and its successful presentation is to prove the student's capability:

- To apply both theoretical and practical knowledge acquired during the study
- To analyze actual domestic and foreign literature in the research and graduation theme writing process
- To analyze relevant scientific and technology findings, conclusions and facts published in the up to date literature
- To define and interpret graphics (tables, schemes, photos, drawings) in respect of applied research methodology

1.2. Prerequisites for Course Registration

Students gain access to registration for the course upon registration in forth semester of the graduation study. Prerequisites for the registration are: successful completion of the courses from the third (winter) semester and lack of third semester courses exam application blockage.

1.3. Expected Learning Outcomes

After successful presentation of the graduation essay the student will be able to:

1. Compare and apply theoretical and practical knowledge acquired during study
2. Analyze and interpret the selected (given) theme
3. Apply methodology and technology necessary to write the graduation essay
4. Present conclusions and findings in respect of selected theme and performed research within the essay

1.4. Course Outline

Graduation essay is an expert and scientific analysis of the defined theme. With this essay student proves its competencies and possession of learning outcomes in resolving problems in respect to the courses of the Marine engineering and transport technology graduation study and successful application of theoretical and practical knowledge acquired during study. During the complete process student must prove competences in theoretical and practical knowledge in the field of marine engineering.
Graduation essay is, in general, written and presented in Croatian but, it could be in special circumstances written and presented in foreign language. The presentation is given to the Comity consisting of (usually) three members.

1.5. Modes of Instruction	☐ Lectures ☐ Seminars and workshops ☐ Exercises ☐ E-learning ☐ Field work	☒ Practical work ☒ Multimedia and Network ☒ Laboratory ☒ Mentorship ☒ Other (research, cooperation with the industry experts, analysis of practical examples and data…)
1.6. Comments		

1.7. Student Obligations

The student is obliged to write the essay using constant consultations with the mentor and successfully present the theme in front of the Comity. The method of application, writing, presentation and evaluation of the process is defined by the Faculty's rules and regulations.

1.8. Assessment[1] of Learning Outcomes

Course attendance		Class participation		Seminar paper		Experiment	
Written exam		Oral exam	4	Essay		Research	4
Project	5	Continuous Assessment		Presentation		Practical work	
Portfolio		Mentorship	2				

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

In accordance with University of Rijeka Application of student papers authenticity information system directive, the mentor must check authenticity of the graduation essay using *Turnitin (www.turnitin.com)* service. Based on the analysis mentor completes the Report on authenticity – Appendix C and within states essay data and the approval to continuation of the procedure. The mentor's positive mark and positive authenticity report are preconditions for the graduation theme presentation term determination. The theme presentation is given to the Comity consisting of (usually) three members. The Comity members could ask questions about theoretical backgrounds of the essay, practical implementation or other themes not necessary connected directly with the theme (in general all marine engineering themes could be covered). The proceedings have written form in which all data (comity members' names, questions etc.) are noticed.
Examples of learning outcomes evaluation:

1. Student gives a presentation in duration of approximately 15 mins about the essay (LO 1 – 4)
2. Student answers to the comity member question explaining the scheme from the essay (LO 1 – 4)

1.10. Main Reading

- Main reading for the course from which the graduation theme is selected
- Additional literature suggested by the mentor
- Graduation essay writing directions, editors: dr.sc. I. Kolanović, dr.sc. A. Perić Hadžić, dr.sc. Č. Dundović, dr.sc. I. Jurdana, dr.sc. I. Rudan, Pomorski fakultet u Rijeci, Sveučilište u Rijeci, Rijeka, 2014. – available at https://www.pfri.uniri.hr/web/hr/studij BS.php

1.11. Recommended Reading

- Recommended reading for the course from which the graduation theme is selected
- Additional literature suggested by the mentor

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Graduation essay writing directions, editors: dr.sc. I. Kolanović, dr.sc. A. Perić Hadžić, dr.sc. Č. Dundović, dr.sc. I. Jurdana, dr.sc. I. Rudan, Pomorski fakultet u Rijeci, Sveučilište u Rijeci, Rijeka, 2014.	Available at *https://www.pfri.uniri.hr/web/hr/studij BS.php*	

1.13. Quality Assurance

Course quality review carried in accordance with ISO 9001 system and European standards and guidance for quality assurance carried through on Maritime faculty. Student Success is evaluated, and corrective measure implemented yearly.

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3.2. Course description

Generic information		
Head of Course	**Jasmin Ćelić, PhD**	
Course	Intelligent Transportation Systems	
Study Programme	Marine Engineering and Maritime Transport Technology	
Type of Course	Elective	
Year of Study	2.	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5
	Number of Hours (L+E+S)	30+0+15

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The main objectives of this course are to acquire fundamental knowledge in the field of Intelligent Transport Systems (ITS) and to understand the basic principles and techniques used in the design and operation of modern systems.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

Upon passing the exam, students will be able to:

1. Identify the fundamental principles on which ITS is based.
2. Compare network-based control principles and choose the optimal solution.
3. Evaluate the development of ITS.
4. Assess and select appropriate procedures for ITS implementation in transport infrastructure.
5. Justify the relevance and benefits of ITS implementation.
6. Recommend telematics solutions for transport systems.
7. Compare the operating principles of electronic systems in transport entities.
8. Review prerequisites for development and provide recommendations for ITS service deployment.

1.4. Course Outline

Introduction to Intelligent Transport Systems. Standards and norms. Basics of systems theory and cybernetics. Physical and logical architecture of ITS. Traffic modelling. Communications in ITS. Expert systems and AI applications in transport. Intelligent navigation systems. ITS and control systems. Expert systems in maintenance. Diagnostics in ITS.

1.5. Modes of Instruction	☒ Lectures ☒ Seminars and workshops ☒ Exercises ☐ E-learning ☐ Field work	☒ Practical work ☒ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments		

1.7. Student Obligations

1st preliminary exam, 2nd preliminary exam, research task and presentation, final exam

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1.8. Assessment[1] of Learning Outcomes

Course attendanc	1,5	Class participation	0,5	Seminar paper	1	Experiment	
Written exam		Oral exam	1	Essay		Research	
Project		Continuous Assessment	1	Presentation		Practical work	
Portfolio							

9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The procedure for evaluating the acquired learning outcomes is carried out according to the Regulations on Studies of the University of Rijeka and the Regulations on Studying at the Faculty of Maritime Studies in Rijeka in the following way:

- 70% of the acquired learning outcomes are evaluated through continuous knowledge assessment during classes:
  through the 1st preliminary exam – learning outcomes 1-4 (25%), 2nd preliminary exam – learning outcomes 5-8 (25%), presentation of the research task (seminar) – learning outcomes 1-8 (20%); in each preliminary exam, the student must achieve a minimum of 50% of the points, while the presentation of the research task is evaluated based on the developed assessment criteria;
- 30% of the acquired learning outcomes (1-8) are evaluated in the final part of the exam, and in order to pass the final exam, the student must achieve a minimum of 50% of the points;
- the final ECTS grade is defined based on the achieved total % of knowledge, skills and competences and the numerical grade after the final/remedial exam as follows:
  - excellent grade (5) corresponds to grade A on the ECTS scale and a success rate of 90 to 100%,
  - very good grade (4) corresponds to grade B on the ECTS scale and a success rate of 75 to 89.9%,
  - good grade (3) corresponds to grade C on the ECTS scale and a success rate of 60 to 74.9%,
  - satisfactory grade (2) corresponds to grade D on the ECTS scale and a success rate of 50 to 59.9%,
  - unsatisfactory grade (1) corresponds to grade F on the ECTS scale and a success rate of 0 to 49.9%.

Examples of learning outcome evaluations in relation to the set learning outcomes are:

1. List and explain the phases of the ITS lifecycle. (LO #1)
2. List and describe the four types of guidance. (LO #2)
3. What architecture includes the physical, logical and communication views? (LO #3)
4. What are the basic steps in the requirements discovery process? (LO #4)
5. How can the level of service (QoS) of intelligent roads be measured? (LO #5)
6. What does ITS vehicle adaptation involve? (LO #6)
7. List the types of sensors. (LO #7)
8. What are the visible benefits of ITS? Explain. (LO #8)

1.10. Main Reading

1. Teaching material available on the Merlin e-learning system (https://moodle.srce.hr)
2. Bošnjak, I. (2006). Intelligent Transport Systems 1, Faculty of Transport Sciences, Zagreb, Croatia
3. Williams, B. (2008.). Intelligent Transport Systems Standards, Artech House, Boston, USA.

1.11. Recommended Reading

- Ćelić, J., Mandžuka, B., Tomas, V., Tadić, F. (2024.). Driver-centric urban route planning: Smart search for parking, Sustainability 16 (2), 856.
- Grupa autora. (2000.). Intelligent Transportation Primer, Institute of Transportation Engineers, Washington, USA.
- Chen, Y., Li, L. (2013.). Advances in Intelligent Vehicles, Elsevier, Academic Press.
- Zilouchian, A., Jamshidi, M. (2001.). Intelligent Control Systems Using Soft Computing Methodoligies, CRC Press, London, UK.

- Gupta, M., Sinha, N. K. (1995.). Intelligent Control Systems - Concept and Applications, IEEE Press, Piscataway NJ, USA.
- Internet:

http://local.iteris.com/arc-it/

http://its.dot.gov/

https://www.itsa.org/technology-scan-assessments

https://www.etsi.org/technologies/

https://www.pcb.its.dot.gov/eprimer/default.aspx

https://www.ieee-itss.org/its-transactions

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Bošnjak, I. (2006). Intelligent Transport Systems 1, Faculty of Transport Sciences, Zagreb, Croatia	10	40
Williams, B. (2008.). Intelligent Transport Systems Standards, Artech House, Boston, USA.	10	40

1.13. Quality Assurance

The quality of studies is constantly monitored in accordance with the ISO 9001 system implemented at the Faculty of Maritime Studies in Rijeka. An analysis of exam taking is prepared annually, and a survey among students is conducted once a semester.

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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3.2. Course description

Generic information			
Head of Course	**Radoslav Radonja, Ph. D., associate professor**		
Course	**Ship Propulsion Optimization**		
Study Programme	**Marine Engineering and Maritime Transport Technology**		
Level	Graduate		
Type of Course	Elective		
Year of Study	**2**		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		**5**
	Number of Hours (L+E+S)		**30 + 15 + 0**

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The main goal of the course is to acquire knowledge about the principles and laws of optimal use and management of ship resources.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

After passing the exam, it is expected that students will be able to do the following:
1. Valorize the methods of optimizing ship movement in water
2. Determine and explain methods of optimizing energy conversion and its transmission
3. Assess the methods of ship control and management optimization
4. Analyze and evaluate the application of new technologies and alternative solutions.

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1.4. Course Outline

Optimizing ship construction and its main components. Underwater paints and coatings. Reduction of resistance. Optimizing fuel and oil consumption of the main and auxiliary engines. Heat recovery systems. Switching to fuel of different qualities (grades). Improving the efficiency of the propeller. Ship fleet management. Transport management. Navigation in accordance with weather conditions and sea currents. Optimizing ship speed. Optimizing electricity production. Connections to onshore power sources. Possibilities of using alternative fuels on ships. Possibilities of applying renewable energy sources. Possibilities of application of fuel cells on ships. The effect of automation on shipping costs. Autonomous vessels.

1.5. Modes of Instruction		
	☒ **Lectures**	☐ Practical work
	☐ Seminars and workshops	☒ Multimedia and Network
	☒ **Exercises**	☐ Laboratory
	☐ E-learning	☐ Mentorship
	☐ Field work	☐ Other _____
1.6. Comments		

1.7. Student Obligations

Active attendance at classes and exercises (at least 70%). Preparation of a seminar paper on an agreed topic and final oral exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	1,5	Class participation		Seminar paper	1,5	Experiment	
Written exam		Oral exam	2,0	Essay		Research	
Project		Continuous Assessment		Presentation		Practical work	
Portfolio							

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The procedure for evaluating the acquired learning outcomes takes place in accordance with University's and Faculty's normative acts as follows:
• preparation of a seminar paper on an agreed topic (70%)
• At the final part of the exam, 30% of the acquired learning outcomes are evaluated (1-4), where the student must realize a minimum of 50% of points to pass the final exam.

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

1. Explain how the design of the bow bulb affects the resistance to movement of the ship? List and explain several technological solutions of rudder design that reduce the resistance to the movement of the ship? Explain the impact of asymmetric stern design on ship movement? ...
2. List and explain the methods of reducing fuel consumption of the main / auxiliary engines on board? List and explain some of the heat recovery systems on board? Analyze and explain the benefits of connecting a ship to land-based power sources? ...
3. Analyze and explain the possibilities of optimizing the speed of the ship? Analyze and explain the optimization of navigation in accordance with weather conditions and sea currents? ...
4. Analyze and explain the application of alternative fuels on ships? Analyze and explain the possibilities of applying renewable energy sources to ships? Analyze and explain the possibilities of introducing autonomous vessels? ...

1.10. Main Reading

1. Schoppmeyer, D., W., F., "Preservation of Resources in Vessel Operations and Monitoring of Ship Emissions, Gauss mbH, Bremen, 2010.

1.11. Recommended Reading

2. Teacher lectures - available in electronic form
3. 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
4. Radonja, R., Pelić, V., Pavić, D., Glujić, D., Methodological approach on optimizing the speed of navigation to reduce fuel consumption and increase energy efficiency of the cruising ship, Pomorstvo – Scientific Journal of Maritime Research, Vol. 33/2 (2019), pgs. 222-231
5. Radonja, R., Bebić, D., Glujić, D., Methanol and Ethanol as Alternative Fuels for Shipping, Promet - Traffic & Transportation, Vol. 31, No. 3 (2019), pgs. 321-327.
6. 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), pgs. 251-256
7. Vorkapić, A., Radonja, R., Zec, D., Cost Efficiency of Ballast Water Treatment Systems Based on Ultraviolet Irradiation and Electrochlorination, Promet - Traffic & Transportation, Vol. 30/3 (2018), pgs. 343-348
8. Vorkapić, A., Radonja, R., Babić, K., Martinčić-Ipšić, S., Machine learning methods in monitoring operating behavior of marine two-stroke diesel engine, Transport vol. 35/5, 2020 pgs. 474-485

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
References: 1 - 8 : available in electronic form	unlimited	30

1.13. Quality Assurance

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Course quality review carried in accordance with ISO 9001 system and European standards and guidance for quality assurance carried through on Maritime faculty. Student Success is evaluated, and corrective measure implemented yearly.

[1] **NOTE:** Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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3.2. Course description

Generic information		
Head of Course	**Predrag Kralj, Professor, Ph.D., BME** **Darko Glujić, PhD**	
Course	Marine Process Advanced Diagnostics	
Study Programme	Marine Engineering and Maritime Transport Technology	
Type of Course	Elective	
Year of Study	I	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	**5**
	Number of Hours (L+E+S)	**15 + 30 + 15**

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The aim of the course is to familiarize the student with advanced methods and techniques as well as the importance of continuous monitoring machinery devices for the purpose of fault diagnosis.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

After passing the exam students will be able to:
1. Explain and analysis the function of measuring instruments
2. Identify and explain essential marine systems and essential alarms for the safety of ship propulsion
3. To analyse the interdependence of the measured parameters and the casual relationships
4. Identify measuring points, control points, detect irregularities in operation of measuring devices and signal transmission and examine the correctness.
5. Analyse and explain faults in the ship's main propulsion systems and auxiliary systems

1.4. Course Outline

Malfunction diagnostics of propulsion and auxiliary machinery systems, malfunctions of asynchronous electric motors, malfunction diagnostics of three-phase synchronous generators, processing of sensor signals, types of diagnostic systems, programmable logic controllers, control devices, expert systems in operation, malfunctions in ship propulsion system, tolerances, failures in power systems, failures of auxiliary marine devices

1.5. Modes of Instruction	☒ Lectures ☐ Seminars and workshops ☒ Exercises ☐ E-learning ☐ Field work	☐ Practical work ☒ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments		

1.7. Student Obligations

In addition to the obligatory lectures and exercises, the student is obliged to pass the partial examinations and the final exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	1	Class participation		Seminar paper	2	Experiment	
Written exam		Oral exam	1	Essay		Research	
Project		Continuous Assessment	1	Presentation		Practical work	
Portfolio							

1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

Procedure for evaluating acquired learning outcomes:
- The final grade in the subject is the sum of the points that the student has achieved during the course (70% of the grade) and the points earned on the final exam (30% of the grade) according to the Regulations on Studies of the University of Rijeka and the Regulations on Studying at the Faculty of Maritime Studies in Rijeka.
- Continuous assessment:
colloquium - it is necessary to achieve a minimum of 50% of the predicted number of points
- Final exam:
At the final exam (oral exam) the completeness of knowledge in the field of Advanced diagnostics of ship processes is checked - a minimum of 50% of points is required.

Examples of evaluation by individual outcome at the colloquium and final exam:
1. Identify each element on the electrical diagram, explain the device function and possible faults
2. On the basis of the operating parameters, diagnose the fault and properly regulate the system
3. Critically evaluate and analyse the local and remote indication of the measured parameters on engines and electrical devices and predict possible failure

1.10. Main Reading

1. Predrag Kralj, Ivica Šegulja, Brodski cjevovodi, Pomorski fakultet, Rijeka, 2018.
2. Dragan, Brodski strojni sustavi, Sveučilište u Rijeci, Rijeka, 2005.

1.11. Recommended Reading

1. Instructio book of different propulsion engines and auxiliary equipment
2. Advance electrotehnology for marine engineers, Christopher Lavers, Edmund Krall, 2014
3. Ship automation for marine engineers & Eto's, Alexandar Yakimchuk, 2012
4. Pounder's Marine Diesel Engines and Gas Turbines, Doug Woodyard, 2009
5. Martinović Dragan, Brodski strojni sustavi, Pomorski fakultet, 2005.
6. Matković Milan, Protupožarna zaštita na brodovima, Pomorski fakultet, Rijeka, 1995.
7. Marsh, R. W., Olivo, C. T., Refrigeration, Delmar Publishers, Inc., Bombay, 1966.
8. Golber, P. F., Refrigeration Servicing, Delmar Publishers, Inc., Bombay, 1971.
9. Knak Christen, Diesel Motor Ships – Engines and Machinery, G-E-C GAD Publishers, Copenhagen, 1979.
10. 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
11. Pavić, D. – Kralj, P. – Lenac, D.: *Legionella pneumophilia on board ship's freshwater systems and technological and organizational measures of prevention and suppression*, Scientific journal of maritime research – Pomorstvo, Rijeka, God. 31 (2017), Vol. 1, pp.81-83
12. Vorkapić, A. – Martinović, D. – Kralj, P.: *The analysis of the maintenance systems of a LPG carrier's liquefaction system main components*, Scientific journal of maritime research – Pomorstvo, Rijeka, God. 31 (2017), Vol. 1, pp.3-9
13. 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

1.12. Number of Main Reading Examples

[1] NOTE: Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

Title	*Number of examples*	*Number of students*
Predrag Kralj, Ivica Šegulja, Brodski cjevovodi, Pomorski fakultet, Rijeka, 2018.	100	2
Martinović Dragan, Brodski strojni sustavi, Sv. u Rijeci, Rijeka, 2005.	15	2

1.13. Quality Assurance

The quality of study is monitored in accordance with the ISO 9001 system and in accordance with European standards and guidelines for quality assurance carried out at the Faculty of Maritime Studies in Rijeka. Once a year, the results of the transience are analysed, and appropriate measures are adopted.

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3.2. Course description

Generic information			
Head of Course	Jakov Karmelić, PhD		
Course	International Shipping Business		
Study Programme	Marine Engineering and Maritime Transport Technology		
Type of Course	Mandatory		
Year of Study	2	University graduate study program	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		5
	Number of Hours (L+E+S)		30+15+0 (2+1+0)

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The aim of the course is to provide students with a comprehensive insight and understanding of business in the international shipping markets (freight, new-building, sale and purchase, and demolition market) for different types of shipping (liner, dry bulk, tanker, passenger, and offshore).

Through this course, students will get acquainted with the goals and structure of the work of international maritime and trade organizations, the business of shipping companies and other entities in maritime trade, the structure of overseas trade, and the world fleet.

The course provides a scientific foundation for further specialized study in this multidisciplinary course.

During exercises, by studying specific cases, students will acquire basic knowledge of doing business in the international shipping industry.

1.2. Prerequisites for Course Registration

1.3. Expected Learning Outcomes

1. Explain the basic characteristics of each segment of the international shipping market.
2. Distinguish the basic principles, objectives, and working methods of international maritime and trade organizations.
3. Analyze and interpret the structure of world overseas trade by cargo types and ship types.
4. Explain the importance and role of maritime transport service entities in all types of shipping, especially shipowners, shipbrokers, and agents.
5. Analyze and interpret freight indices in all types of shipping, interpret maritime market cycles, and analyze and interpret shipbrokers' reports.
6. Define and explain the basic procedures for designing maritime liner services.
7. Explain the reasons for cooperation and different types of shipowner cooperative agreements.
8. Analyze and demonstrate the connection between overseas commodity flows of individual types of goods, specific technologies and categorizations of ships for the transport of these types of goods, and methods of contracting for transport.
9. Analyze the connection of the freight market with the shipbuilding, secondhand, and demolition markets and the application of standardized contracts.

1.4. Course Outline

Analysis of world overseas trade by cargo types and regions, structure of the world merchant fleet by ship types, age structure of ships, and structure of the world fleet by ownership (countries) and operators.
Overview of international maritime and trade organizations. Shipowners and operators in all types of shipping. Specifics of the work of shipbrokers and maritime agents.
Segmentation of the shipping market. Categorization of ships in the transport of bulk, liquid, gaseous, containerized cargo and the offshore industry. Freight indices by all types of shipping. Shipping market cycles. Supply and demand in the shipping market.
Regulations on market competition in the maritime industry. Organizational structure of shipping companies. Outsourcing jobs in the maritime industry: ship management, D/A Desk, C/P Desk, service sharing centers, planning centers, etc.
Basics of designing maritime liner services. Criteria for selecting the optimal maritime service and shipping company from the user's perspective.

1.5. Modes of Instruction	☒ Lectures ☒ Seminars and workshops ☒ Exercises ☐ E-learning ☐ Field work	☐ Practical work ☐ Multimedia and Network ☐ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments	Email communication with the Head of course: jakov.karmelic@pfri.uniri.hr	

1.7. Student Obligations

The student must be present at lectures and exercises for at least 70% of the total hours and prepare and present a written seminar paper on a given topic that should be positively assessed before taking the final oral exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	1,5	Class participation		Seminar paper	1,5	Experiment	
Written exam		Oral exam	2	Essay		Research	
Project		Continuous Assessment		Presentation		Practical work	
Portfolio							

[1] NOTE: Name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course. Use empty fields for additional activities.

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1.9. Assessment of Learning Outcomes and Examples of Evaluation during Classes and on the Final Exam

The procedure for evaluating the acquired learning outcomes is performed according to the Ordinance on Studies of the University of Rijeka and the Ordinance on Studying at the Faculty of Maritime Studies in Rijeka, as follows:

A) Requirements for taking the oral exam:

- Active class attendance
- Preparation and presentation of seminar paper (40 points)

A. Prerequisite for passing the oral exam (60 points):

- At least 50% of complete theoretical knowledge of the course of International Shipping Business

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

1. Explain the characteristics of each segment of maritime shipping markets.
2. Describe the principles, goals, and modes of operation of international maritime and trade organizations.
3. Interpret the structure of world overseas trade by types of cargo and types of ships.
4. Describe the role of maritime transport entities in all types of shipping, especially shipowners, operators, shipbrokers, and agents.
5. Interpret freight indices, shipping market cycles, and brokers' reports in all types of shipping.
6. Explain the basic procedures for designing maritime liner services.
7. Explain the reasons for the cooperation and the different types of shipping cooperation agreements among the shipowners and operators.
8. Demonstrate the connection between the overseas flows of certain types of goods, specific technology and segmentation of ships for the transport of these types of goods, and the ways of contracting sea transport.

During the preparation of the research seminar, individual topics from the field of international shipping business are researched in more detail.

1.10. Main Reading

1.) Domijan-Arneri, I.: Poslovanje u morskom brodarstvu, Redak, Split, 2014.
2.) Hess, M., Kos, S.: Ugovaranje u pomorstvu, Pomorski fakultet u Rijeci, 2013.
3.) Review of Maritime Transport, UNCTAD, New York and Geneva, web edition
4.) Shipping and Shipbuilding Markets, Annual Review Barry Rogliano Salles, web edition

1.11. Recommended Reading

1) Stopford, M.: Maritime Economics, Routledge, 2009.
2) Batalić, M., Mitrović, F.: Financiranje u pomorstvu, Pomorski fakultet u Splitu, Split, 2010.
3) Karmelić, J.: Kooperacije među brodarima, Pomorstvo, god. 21, br. 2, 2007.
4) Karmelić, J.: Sporazum o raspodjeli brodskog prostora, Pomorstvo, god. 24, br. 2, 2010.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Domijan-Arneri, I.: Poslovanje u morskom brodarstvu, Redak, Split, 2014.	5	40
Hess, M., Kos, S.: Ugovaranje u pomorstvu, Pomorski fakultet u Rijeci, 2013	5	40
Review of Maritime Transport, UNCTAD, New York and Geneva, web edition	40	40
Shipping and Shipbuilding Markets, Annual Review Barry Rogliano Salles, web edition	40	40
Shipping Statistcs and Market Review, ISL (Institute of	1	40

Shipping Economics and Logistics), Bremen		

1.13. Quality Assurance

The quality of studies is monitored in accordance with the ISO 9001 system and in accordance with European standards and guidelines for quality assurance, which is carried out at the Faculty of Maritime Studies in Rijeka. Once a year, the results of the examination pass rate are analyzed, and appropriate measures are adopted.