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3.2. Course description

Generic information		
Head of Course	Marko Gulić, PhD	
Course	Algorithms and Data Structures	
Study Programme	Marine Electronic Engineering and Information Technology	
Type of Course	Elective	
Year of Study	1st	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5
	Number of Hours (L+E+S)	30+30+0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The objective of the course is to acquire advanced knowledge of widely applicable algorithms, such as searching and sorting algorithms, and data structures, including linked lists, queues, and stacks. Students will also develop skills in applying advanced programming techniques, such as recursion, for the purpose of developing complex and optimized computer programs. The course prepares students to analyze, design, and implement sophisticated algorithms and data structures.

1.2. Prerequisites for Course Registration

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1.3. Expected Learning Outcomes

After attending and passing the course, students will be able to:
1. Describe the use of various data structures and algorithms.
2. Evaluate the complexity of algorithms.
3. Implement an appropriate sorting algorithm in a computer program.
4. Implement an appropriate searching algorithm in a computer program.
5. Identify the appropriate data structure (list, queue, or stack) for solving a specific problem and develop a computer program.
6. Apply an advanced programming technique as required in the development of a computer program.

1.4. Course Outline

Review of elementary programming. Sorting algorithms. Searching algorithms. Introduction to pointers. Dynamic memory allocation. Pointers and dynamic arrays. Pointers and linked lists. Stack and queue. Recursion. Selected algorithms.

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	Classes are conducted through a combination of classroom instruction and	

	individual work in the computer laboratory. Upon enrolment in the course, students will be directed to use the online learning platform. A detailed schedule of lectures and exercises will be published in the course implementation plan.

1.7. Student Obligations

- Regularly attend classes (lectures and exercises) and take short quizzes at the beginning of each exercise session
- Take the 1st and 2nd midterm exams
- Take the final (written/oral) exam if the requirements for attendance and assessment have been met

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper		Experiment	
Written exam		Oral exam	1	Essay		Research	
Project		Continuous Assessment	2	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 is carried out according to the Regulations on Studies of the University of Rijeka and the Rulebook on Studies at the Faculty of Maritime Studies in Rijeka as follows:

- Continuous assessment during classes accounts for 70% of the achieved learning outcomes:
  – Midterm Exam 1 – Learning Outcomes 1–4 (30%)
  – Midterm Exam 2 – Learning Outcomes 5–6 (30%)
  – Quick quizzes during exercises – Learning Outcomes 1–6 (10%)
  In each midterm exam, the student must achieve at least 50% of the total points.

- The final (oral) exam accounts for 30% of the achieved learning outcomes (1–4, 6), and the student must achieve at least 50% of the points on the final exam to pass.

Examples of assessment tasks aligned with learning outcomes:

1. Explain the steps of the selection sort algorithm on a given example and describe its functionality.
2. Explain the time complexity of the insertion sort algorithm in the best, worst, and average cases.
3. Write a program that uses sequential search to find an element in a sorted integer array.
4. Create a program for binary search in a sorted integer array.
5. Based on the description of a given problem, select an appropriate data structure (e.g., list, queue, stack) and implement the solution in a program.
6. Write a recursive function that calculates the factorial of a given number.

1.10. Main Reading

- Julijan Šribar, Boris Motik: Demistificirani C++, Dobro upoznajte protivnika da biste njime ovladali, 5th revised editionElement, Zagreb, 2018.
- Course materials are available on the e-learning platform Merlin (https://moodle.srce.hr)

[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. Recommended Reading

• Helmut Knebl: Algorithms and Data Structures: Foundations and Probabilistic Methods for Design and Analysis, Springer, 2020.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Julijan Šribar, Boris Motik: Demistificirani C++	2	
E-course teaching materials available on the Merlin e-learning system	unlimited	

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. At the end of each semester, an anonymous evaluation of the quality of instruction is conducted by the students. Additionally, an annual analysis of student success in the course is performed (the percentage of students who passed the course and their average grades).

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3.2. Course description

Generic information		
Head of Course	Sanjin Valčić, PhD Zoran Mrak, PhD	
Course	Application of maritime radiocommunication systems	
Study Programme	Marine Electronic Engineering and Information Technology	
Type of Course	Mandatory	
Year of Study	1	
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 objective of the course is to acquire advanced knowledge in the field of maritime radio communications with an emphasis on digital terrestrial and satellite data exchange systems, which are not defined by the requirements of the International Maritime Organization related to navigation safety. In addition, the objective is to introduce students to the possibilities of applying these systems and acquire the ability to choose an appropriate system depending on specific requirements.

1.2. Prerequisites for Course Registration

1.3. Expected Learning Outcomes

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

1. *Classify the division of the frequency spectrum for terrestrial and satellite maritime communications.*
2. *Understand, analyze and distinguish between the propagation modes of radio waves in maritime digital terrestrial communication systems.*
3. *Evaluate and calculate wireless link parameters of terrestrial maritime RF communication systems.*
4. *Evaluate the parameters of satellite communication link and analyze the structure of satellite communication systems for maritime applications.*
5. *Establish the basic characteristics of very small aperture satellite terminals (VSAT), as well as the calculation of the communication link (uplink and downlink).*

1.4. Course Outline

Digital terrestrial communication systems: VHF Data Exchange System - Terrestrial (VDES - Ter), GSM, HF Data, UHF and SHF internal ship communications, etc. Possibilities of application of 5G technologies in maritime environment. Satellite communication systems: VSAT, Inmarsat, Iridium, Thuraya, Orbcomm, VHF Data Exchange System - Satellite (VDES - Sat), etc. Ship Security Alert System. Long Range Identification and Tracking.

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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	Students will be assigned to project tasks, which they will have to master during seminars and workshops.	

1.7. Student Obligations

Regular course attendance (lectures and exercises), taking midterms, submitting project assignment and taking an oral 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] **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 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:

- *70% of the acquired learning outcomes are assessed through continuous assessment during classes; through 1st midterm exam – learning outcomes 1-3 (20%), 2nd midterm exam – learning outcomes 4-5 (20%); and project assignment task*
- *in the final part of the exam, 30% of the acquired learning outcomes (1-5) are evaluated, and in order to pass the final exam, the student must achieve a minimum of 50% of the grade points.*

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

1. *In which part of the spectrum are frequencies allocated for satellite communications and why?*
2. *Calculate the total effective range for establishing communication of the VDES system if the transmitting and receiving antennas are at heights of 1390 m and 20 m, respectively.*
3. *Assuming a maximum output power of a 4G LTE mobile phone of 250 mW at a frequency of 1900 MHz and assuming that the mobile phone antenna is 80% efficient and has a radiation pattern of maximum directivity of 1.76 dBi, it is necessary to determine the power received by a tower 20 km away with an antenna gain of 17 dBi.*
4. *Argue the basic advantages and disadvantages of using shipboard satellite terminals with small aperture antennas (VSATs) and compare their differences.*
5. *It is necessary to carry out a link budget analysis between the satellite terminal on the passenger ship and the Inmarsat GX5 satellite. Technical data of the SAILOR 1000 XTR GX-R2 terminal and the Inmarsat GX5 satellite can be found within the e-course on the Merlin e-learning system.*

1.10. Main Reading

1. Recommendation ITU-R M.2092: Technical characteristics for a VHF data exchange system in the VHF maritime mobile band, online publikacija
2. David Tse, Pramod Viswanath (2005.), Fundamentals of Wireless Communication, Cambridge University Press, https://web.stanford.edu/~dntse/wireless_book.html

1.11. Recommended Reading

1. Recommendation ITU-R M.2135: Technical characteristics of autonomous maritime radio devices operating in the frequency band 156-162.05 MHz
2. Te Wei, Wei Feng, Yunfei Chen, Cheng-Xiang Wang, Ning Ge, Jianhua Lu: Hybrid Satellite-Terrestrial Communication Networks for the Maritime Internet of Things: Key Technologies, Opportunities, and Challenges, CoRR abs/1903.11814 (2019)
3. Valčić, Sanjin; Brčić, David; Žuškin, Srđan; Škrobonja, Antonio: Monitoring the Utilization of the VHF Maritime Mobile Band in the Northern Adriatic Using Software-Defined Radio Scanner, Proceedings of the 10th International Conference on Maritime Transport, Barcelona: Universitat Politècnica de Catalunya. Iniciativa Digital Politècnica, (2024)
4. Valčić, Sanjin; Brčić, David: On Detection of Anomalous VHF Propagation over the Adriatic Sea Utilising a Software-Defined Automatic Identification System Receiver. Journal of marine science and engineering, 11 (2023)
5. Valčić, Sanjin ; Škrobonja, Antonio ; Maglić, Lovro ; Sviličić, Boris: GMDSS Equipment Usage: Seafarers' Experience. Journal of marine science and engineering, 9 (2021)

1.12. Number of Main Reading Examples

Title	Number of examples	Number of students
Course teaching materials available on the Merlin e-learning system (https://moodle.srce.hr)	Available online	30
David Tse, Pramod Viswanath (2005.), Fundamentals of Wireless Communication, Cambridge University Press, https://web.stanford.edu/~dntse/wireless_book.html	Available online	30

1.13. Quality Assurance

The quality of studies is monitored in accordance with the ISO 9001 system implemented at the Faculty of Maritime Studies in Rijeka and in accordance with European standards and guidelines for quality assurance implemented at the University of Rijeka, Faculty of Maritime Studies. 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	Sanjin Valčić, PhD		
Course	Application of mathematical tools in electrical engineering		
Study Programme	Marine Electronic Engineering and Information Technology		
Type of Course	Mandatory		
Year of Study	1		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5	
	Number of Hours (L+E+S)	30+30+0	

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The main objective of the course is to enable students to understand and solve problems in line and surface integrals, ordinary differential equations, Laplace transform and Fourier series and transform with emphasis on application in electrical engineering.

1.2. Prerequisites for Course Registration

1.3. Expected Learning Outcomes

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

1. *Set up, verify, and solve various line and surface integrals of scalar and vector fields.*
2. *Relate the integral calculus, Stokes and divergence theorem in the theory of electromagnetism, that is, with Maxwell's equations.*
3. *Apply and relate ordinary differential equations to the modeling of electrical RLC circuits.*
4. *Understand, interpret, apply and relate the properties of the Laplace transform to the analysis of time signals.*
5. *Compare the application of the Laplace transform for modeling electrical RLC circuits with set differential equations.*
6. *Determine the orthogonality of trigonometric functions and develop periodic functions into trigonometric Fourier series.*
7. *Apply Fourier transform in the theory of signal analysis, i.e. calculate the amplitude and phase spectrum of a signal.*

1.4. Course Outline

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Double integrals in a rectangular and polar coordinate system. Triple integrals in a rectangular, cylindrical and spherical coordinate system. Line integrals of scalar and vector fields. Surface integrals of scalar and vector fields. Stokes and Divergence Theorem. Application of integral calculus in theory of electromagnetism (Maxwell equations and wave equation). Ordinary first and second order differential equations. Application of ordinary differential equations in electrical RLC circuits. Laplace transforms. Analysis of transient phenomena in electrical RLC circuits using Laplace transform. The excitation, response and transfer function (in the Laplace domain) of electrical systems. Trigonometric and complex exponential Fourier series. Analysis of harmonics by the development of periodic functions in Fourier series. Fourier transform and integral.

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 course attendance (lectures and exercises), taking midterms with numerical and computer tasks, and taking an oral final exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper		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 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:

- *70% of the acquired learning outcomes are assessed through continuous assessment during classes; through 1st midterm exam – learning outcomes 1-2 (35%), 2nd midterm exam – learning outcomes 3-7 (35%)*
- *in the final part of the exam, 30% of the acquired learning outcomes (1-7) are evaluated, and in order to pass the final exam, the student must achieve a minimum of 50% of the grade points.*

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

1. *Calculate the electric field flow vec{E}(x,y,z)=x vec{i}+y vec{j}+z^3 vec{k} through the outside of the surface $x^2+y^2=z^2$, for which 0 <= z <= 1.*
2. *Using the appropriate theorem, explain Faraday's law of electromagnetic induction and write it in integral and differential form.*
3. *A variable resistance resistor r (t) = t Ω and a constant capacitor C = 1 F are connected to the series with variable voltage source $u(t)=e^t$ V in series. Set and solve the differential equation for the voltage across the capacitor as a function of time t, with the initial condition u_C (0) = 0 V.*
4. *Calculate the Laplace transform of the function g (t) = t^2u (t-2).*
5. *Determine the transfer function of the serial RLC circuit if the output is the voltage across the resistor. Then, with the parameters R = 4 Ω, L = 2 H and C = 1/2 F, determine the response of the circuit if the excitation e (t) = u (t) V.*
6. *Expand the periodic function f (x) = x, given at the interval [-π, π], in a form of a trigonometric Fourier series.*
7. *Determine the Fourier transform and the Fourier integral of the function f (t) = sin (3t), given at the interval [-π, π].*

1.10. Main Reading

1. *Course teaching materials available on the Merlin e-learning system (https://moodle.srce.hr)*
2. *Brnetić, I., Županović, V.: Matematika 3 – višestruki integrali, Element, Zagreb, 2009.*
3. *Elezović, N.: Matematika 2 – diferencijalne jednadžbe, Element, Zagreb, 2010.*
4. *Elezović, N.: Matematika 3 – Fourierov red i integral, Laplaceova transformacija, Element, Zagreb, 2010.*
5. *Korkut, L., Krnić, M., Pašić, M.: Matematika 3 – vektorska analiza, Element, Zagreb, 2009.*

1.11. Recommended Reading

1. *https://www.wolframalpha.com/about/*
2. *https://www.geogebra.org/about*

1.12. Number of Main Reading Examples

Title	Number of examples	Number of students
Course teaching materials available on the Merlin e-learning system (https://moodle.srce.hr)	Available online	30
Brnetić, I., Županović, V.: Matematika 3 – višestruki integrali, Element, Zagreb, 2009.	3	30
Elezović, N.: Matematika 2 – diferencijalne jednadžbe,	3	30

Element, Zagreb, 2010.		
Elezović, N.: Matematika 3 – Fourierov red i integral, Laplaceova transformacija, Element, Zagreb, 2010.	*2*	*30*
Korkut, L., Krnić, M., Pašić, M.: Matematika 3 – vektorska analiza, Element, Zagreb, 2009.	*3*	*30*
1.13. Quality Assurance		
The quality of studies is monitored in accordance with the ISO 9001 system implemented at the Faculty of Maritime Studies in Rijeka and in accordance with European standards and guidelines for quality assurance implemented at the University of Rijeka, Faculty of Maritime Studies. 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	Dario Ogrizović, PhD		
Course	Artificial intelligence		
Study Programme	Marine Electronic Engineering and Information 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

Acquiring basic theoretical and practical knowledge about artificial intelligence and the application of advanced algorithms.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

1. Explain the historical development and theoretical foundations of artificial intelligence.
2. Define and analyse problem-solving methodology and uncertainty modelling.
3. Analyse and classify machine learning.
4. Classify and evaluate artificial neural networks.
5. Define and analyse generative artificial intelligence.
6. Create basic artificial intelligence algorithms and apply them to simpler problems.
7. Create and apply artificial intelligence to optimization problems.
8. Critically evaluate the social aspects of artificial intelligence.

1.4. Course Outline

Historical development of artificial intelligence. Theoretical foundations of artificial intelligence. Problem solving methodology. Knowledge-based information system. Uncertainty modelling. Machine learning. Supervised, unsupervised and supported learning. Deep learning. Artificial neural networks. Generative artificial intelligence. Large language models. Nature-inspired optimization algorithms. Support vector method. Programming tools TensorFlow, H20.AI, Deeplearning4j, Google ML Kit, Apache Mahout, voice assistants (ALEXA, Google Assistant, Siri and Cogito). Application of artificial intelligence, optimization and planning of real problems in maritime and transport. Social aspects of artificial intelligence.

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

1. Attendance and activity in class
2. Attendance and activity in laboratory exercises
3. Project
4. Written exam (midterms and exam)

1.8. Assessment[1] of Learning Outcomes

Course attendance	1,5	Class participation	0,5	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. Explain the historical development and theoretical foundations of artificial intelligence.
2. Define and analyse problem-solving methodology and uncertainty modelling.
3. Analyse and classify machine learning.
4. Classify and evaluate artificial neural networks.
5. Define and analyse generative artificial intelligence.
6. Create basic artificial intelligence algorithms and apply them to simpler problems.
7. Create and apply artificial intelligence to optimization problems.
8. Critically evaluate the social aspects of artificial intelligence.

1.10. Main Reading

1. Norvig P. Artificial Intelligence: A Modern Approach, Pearson, 2021.
2. Alpaydin, E. 2021. Introduction to Machine Learning, fourth edition, MIT Press.
3. Study materials available at e-learning platform (https://moodle.srce.hr)

1.11. Recommended Reading

1. Chowdhary, K.R. 2020. Fundamentals of Artificial Intelligence, Springer-Nature.
2. Luger, G.F. 2005. Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Addison-Wesley

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Norvig P. Artificial Intelligence: A Modern Approach, Pearson, 2021.	3	40
Alpaydin, E. 2021. Introduction to Machine Learning, fourth edition, MIT Press.	5	40

1.13. Quality Assurance

The quality of study is constantly monitored in accordance with the ISO 9001 system implemented at the Faculty of Maritime Studies in Rijeka. An analysis of the exams is made annually and a student survey is conducted once a semester. All data, including exam, written work and assessment, are at all times public data for all students who have enrolled in the course (on the e-learning platform).

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3.2. Course description

Generic information		
Head of Course	Robert Baždarić, Ph.D.	
Course	Automatic Control of Marine Vessels	
Study Programme	Marine Electronic Engineering and Information 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+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 management 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	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 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 ($u = v \approx 0$). 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 $\tau_{wind} = [X_{wind}, Y_{wind}, N_{wind}]^T$ 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 τ_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 ***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	Dario Ogrizović, PhD		
Course	Big Data Analysis		
Study Programme	Marine Electronic Engineering and Information 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

Big data analysis includes structured, partially structured and unstructured data that are large and complex for processing and analysis in terms of scope, complexity, generation speed and different collection intervals.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

1. Explain the theoretical foundations of big data analysis.
2. Distinguish types of problems and categories of big data.
3. Indicate the sources and methods of data collection.
4. Application of big data analysis methodology.
5. Analyse and apply appropriate algorithms for processing data streams.
6. Design of a system for finding similar entities, frequent sets and groups in big data.
7. Compare storage systems and recommendation systems.
8. Critically assess privacy and ethics in big data analysis.

1.4. Course Outline

Historical development and theoretical foundations of big data analysis. Types of problems and categories of big data. Sources and methods of data collection. Data processing and formatting. Big data analysis methodology. Analysis of flows and links in data. Finding similar entities, frequent sets and groups in big data. Recommendation systems. Data visualization. Storage systems. Map-reduce/Hadoop, GFS/HDFS, Bigtable/HBASE and Spark software tools. Big data analysis in maritime and transport. Multicore and manycore processing systems. Computer clusters and cloud computing for big data analysis. Privacy and

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

1. Attendance and activity in class
2. Attendance and activity in laboratory exercises
3. Project
4. Written exam (midterms and exam)

1.8. Assessment[1] of Learning Outcomes

Course attendance	1,5	Class participation	0,5	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.

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. Explain the theoretical foundations of big data analysis.
2. Distinguish types of problems and categories of big data.
3. Indicate the sources and methods of data collection.
4. Application of big data analysis methodology.
5. Analyse and apply appropriate algorithms for processing data streams.
6. Design of a system for finding similar entities, frequent sets and groups in big data.
7. Compare storage systems and recommendation systems.
8. Critically assess privacy and ethics in big data analysis.

1.10. Main Reading

1. Obembe, F., Engel, O. 2024. A Hands-on Introduction to Big Data Analytics, SAGE Publications
2. Kelleher, J.D., Tierney, B. 2021. Znanost o podacima, MIT Press, Mate d.o.o.
3. Leskovec, J., Rajaraman, A., Ullman, J. D. 2014. Mining of Massive Datasets, Cambridge University Press.
4. Study materials available at e-learning platform (https://moodle.srce.hr)

1.11. Recommended Reading

1. Buyya, R., Calheiros, R. N., Dastjerdi, A. V. 2016. *Big Data: Principles and Paradigms*, Elsevier.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Obembe, F., Engel, O. 2024. A Hands-on Introduction to Big Data Analytics, SAGE Publications	3	40
Leskovec, J., Rajaraman, A., Ullman, J. D. 2014. *Mining of Massive Datasets,* Cambridge University Press.	5	40

1.13. Quality Assurance

The quality of study is constantly monitored in accordance with the ISO 9001 system implemented at the Faculty of Maritime Studies in Rijeka. An analysis of the exams is made annually and a student survey is conducted once a semester. All data, including exam, written work and assessment, are at all times public data for all students who have enrolled in the course (on the e-learning platform).

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3.2. Course description

Generic information			
Head of Course	Dario Ogrizović, PhD		
Course	Cloud computing		
Study Programme	Marine Electronic Engineering and Information Technology		
Type of Course	Elective		
Year of Study	1st		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		4
	Number of Hours (L+E+S)		30 + 15 + 0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

Cloud computing brings a simpler and more flexible environment for the end user, the theoretical foundations of cloud computing are explained, which relate to the emergence, etymology and characteristics of cloud computing, as well as virtualization as the basis for the emergence of cloud computing. The basic division of service models that are available using standard network technologies and protocols is stated, and the basic implementations and the most important cloud computing service providers are presented.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

1. Explain the theoretical foundations of cloud computing, which relate to the emergence, etymology and characteristics of cloud computing
2. Present virtualization as the basis for the emergence of cloud computing and types of virtualizations
3. Compare cloud computing architectures
4. List and distinguish between service models and cloud computing performance models
5. Describe and compare the most important cloud computing service providers through a historical overview, global network of data centers and CDN nodes
6. Distinguish and systematize the types and purposes of available public and private cloud computing services
7. Implement computer and network services and storage services
8. Analyse security issues and costs of doing business in cloud computing

1.4. Course Outline

Theoretical foundations of cloud computing. Origin, etymology and characteristics of cloud computing. Virtualization. Cloud computing architectures. Cloud computing service models. Cloud computing performance models. The most important cloud computing service providers. Global network of data centers and CDN nodes. Type and purpose of available cloud computing services. Multicloud. Security issues and their solutions. Costs of doing business in cloud computing.

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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

1. Attendance and activity in class
2. Attendance and activity in laboratory exercises
3. Project
4. Written exam (midterms and exam)

1.8. Assessment[1] of Learning Outcomes

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

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. Explain the theoretical foundations of cloud computing, which relate to the emergence, etymology and characteristics of cloud computing
2. Present virtualization as the basis for the emergence of cloud computing and types of virtualizations
3. Compare cloud computing architectures
4. List and distinguish between service models and cloud computing performance models
5. Describe and compare the most important cloud computing service providers through a historical overview, global network of data centers and CDN nodes
6. Distinguish and systematize the types and purposes of available public and private cloud computing services
7. Implement computer and network services and storage services
8. Analyse security issues and costs of doing business in cloud computing

1.10. Main Reading

1. Erl, T.: Cloud Computing: Concepts, Technology & Architecture, The Prentice Hall Service Technology Series, 2013.
2. Chopra, R.: Cloud Computing: An Introduction, Mercury Learning & Information, 2017.
3. Study materials available at e-learning platform (https://moodle.srce.hr)

1.11. Recommended Reading

1. Kavis, M.J.: Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS), Wiley, 2014.
2. Rafaels, R.: Cloud Computing: From Beginning to End, CreateSpace Independent Publishing Platform, 2015.

Selected papers from:

1. Journal of Cloud Computing, ISSN: 2192-113X
2. Future Generation Computer Systems, ISSN: 0167-739X

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Erl, T.: Cloud Computing: Concepts, Technology & Architecture, The Prentice Hall Service Technology Series, 2013.	5	40
Chopra, R.: Cloud Computing: An Introduction, Mercury Learning & Information, 2017.	5	40

1.13. Quality Assurance

The quality of study is constantly monitored in accordance with the ISO 9001 system implemented at the Faculty of Maritime Studies in Rijeka. An analysis of the exams is made annually and a student survey is conducted once a semester. All data, including exam, written work and assessment, are at all times public data for all students who have enrolled in the course (on the e-learning platform).

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3.2. Course description

Generic information		
Head of Course	Dario Ogrizović, PhD Ozren Rafajac, PhD	
Course	Electronic business	
Study Programme	Marine Electronic Engineering and Information Technology	
Type of Course	Elective	
Year of Study	1st	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5
	Number of Hours (L+E+S)	30 + 30 + 0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

Electronic business refers to the application of information technology and computer networks, mainly the Internet, in the process of buying and selling goods, services and information, but also refers to smart and social commerce, e-learning, e-services, e-government, social collaboration, collaborative and sharing economy, innovation, mobility, communication and information discovery using artificial intelligence, analytics and big data.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

1. Explain the theoretical foundations of electronic business relating to types of systems, models, methods, mechanisms, management programs and benefits.
2. List and differentiate electronic and mobile commerce, their content and implementations.
3. Describe social networks and applications for social commerce, advertising, CRM and entertainment, and social entrepreneurship systems.
4. Describe connected smart commerce, the Internet of Things and smart applications.
5. Describe consumer behaviour on the Internet, marketing and advertising in the web environment.
6. List security issues and their solutions in e-commerce.
7. Distinguish and systematize types of e-payments, mobile payments, digital currencies and their mining and trading.
8. Critically assess the ethical, legal, social and business environments in which electronic business operates.

1.4. Course Outline

Theoretical foundations of electronic business. Methods and models of selling goods, services and information via computer networks. Content and implementation of electronic and mobile commerce. Network and computer infrastructure. Business models of e-business. Types and structure of portals. Social networks and applications for social commerce, advertising, CRM and entertainment, and social entrepreneurship systems. Connected smart commerce, Internet of Things and smart applications. Consumer behaviour on the Internet, marketing and advertising in the web environment. Security issues and their solutions in electronic commerce. Types of e-payments, mobile payments and digital currencies in electronic commerce. Cryptocurrencies, mining and trading. Ethical, legal, social and business environments.

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

1. Attendance and activity in class
2. Attendance and activity in laboratory exercises
3. Project
4. Written exam (midterms and exam)

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation	0,5	Seminar paper		Experiment	
Written exam	1	Oral exam		Essay		Research	
Project	0,5	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. Explain the theoretical foundations of e-commerce relating to types of systems, models, methods, mechanisms, management programs and benefits.
2. List and differentiate electronic and mobile commerce, their content and implementations.
3. Describe social networks and applications for social commerce, advertising, CRM and entertainment, and social entrepreneurship systems.
4. Describe connected smart commerce, the Internet of Things and smart applications.
5. Describe consumer behaviour on the Internet, marketing and advertising in the web environment.
6. List security issues and their solutions in e-commerce.
7. Distinguish and systematize types of e-payments, mobile payments, digital currencies and their mining and trading.
8. Critically assess the ethical, legal, social and business environments in which e-commerce operates.

1.10. Main Reading

1. Turban, E., et al. 2018. Electronic commerce: A managerial and social networks perspective, Springer.
2. Schneider, G., P. 2017. Electronic Commerce, Gengage Learning.
3. Study materials available at e-learning platform (https://moodle.srce.hr)

1.11. Recommended Reading

1. Jelassi, T., et al. 2014. Strategies for E-business: Creating Value Through Electronic and Mobile Commerce: Concepts and Cases, 3rd ed., Harlow, England: FT Prentice Hall.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Turban, E., et al. 2018. Electronic commerce: A managerial and social networks perspective, Springer.	10	40
Schneider, G., P. 2017. Electronic Commerce, Gengage Learning.	10	40

1.13. Quality Assurance

The quality of study is constantly monitored in accordance with the ISO 9001 system implemented at the Faculty of Maritime Studies in Rijeka. An analysis of the exams is made annually and a student survey is conducted once a semester. All data, including exam, written work and assessment, are at all times public data for all students who have enrolled in the course (on the e-learning platform).

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3.2. Course description

Generic information		
Head of Course	**Nikola Lopac, PhD**	
Course	**Information Processing and Transmission**	
Study Programme	**Marine Electronic Engineering and Information Technology**	
Type of Course	**Mandatory**	
Year of Study	**1st**	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5
	Number of Hours (L+E+S)	30+30+0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The main objectives of the course are to develop the ability to analyze and process signals, to explain the structure and functionality of communication systems in information transmission, to introduce students to the concepts of entropy, its properties and applications in information theory, and to enable them to distinguish and apply procedures for encoding and decoding information, including code efficiency evaluation and the application of entropy coding methods.

1.2. Prerequisites for Course Registration

None.

1.3. Expected Learning Outcomes

Upon successful completion of the course, the student will be able to:

1. Analyze continuous-time and discrete-time signals, assess the influence of sampling and noise on their properties, and apply basic methods for signal analysis and processing.
2. Interpret and relate the elements of a communication system model to its functionality in information transmission.
3. Analyze entropy and its properties, and apply methods for entropy calculation to examples from information theory.
4. Distinguish between basic types of codes for information transmission based on calculated parameters, and apply encoding and decoding procedures to examples with graphical representations.
5. Assess code efficiency by calculating relevant measures on examples and compare results for different code types.
6. Apply entropy coding methods for information encoding and decoding, and evaluate their efficiency using practical examples.

1.4. Course Outline

Continuous-time and discrete-time signals. Signal sampling. Signal properties. Noise. Methods for signal analysis and processing. Information theory. Communication system model. Entropy. Entropy properties. Information encoding. Code decoding. Kraft's inequality. Efficient information encoding. Code efficiency measures. Graphical representation of codes. Shannon–Fano coding – encoding and decoding. Entropy coding methods (Huffman, arithmetic, LZW) – encoding and decoding.

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		
1st midterm exam, 2nd midterm exam, seminar paper, final exam		

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper	1	Experiment	
Written exam		Oral exam	0.5	Essay		Research	
Project		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 assessment and evaluation of achieved learning outcomes are conducted in accordance with the *Regulations on Study and Studying at the University of Rijeka* and the *Regulations on Studying at the University of Rijeka, Faculty of Maritime Studies*.

Achieved learning outcomes are assessed and evaluated during classes (continuous monitoring and evaluation) and in the final exam.

The evaluation of achieved learning outcomes in the course is expressed in percentage grade points on a 0–100% scale, where the minimum passing grade is at least 50% of the grade points.
Through continuous evaluation of achieved learning outcomes (during classes), the student can obtain 70% of the grade points, while the remaining 30% of the grade points can be obtained in the final exam.

Continuous evaluation of achieved learning outcomes (during classes) is conducted through two midterm exams and the preparation and presentation of a seminar paper, through which the corresponding achieved learning outcomes are verified, and a certain percentage of grade points can be obtained as follows:

- 1st midterm exam: learning outcomes 1–3 – 25% of the grade points,
- 2nd midterm exam: learning outcomes 4–6 – 25% of the grade points,
- seminar paper: learning outcomes 1–6 – 20% of the grade points.

Midterm exams consist of written assessments of the corresponding achieved learning outcomes. A passing threshold of 50% is defined for each midterm exam, i.e. the student must achieve at least 50% of the grade points allocated to each midterm exam. A student who does not achieve a sufficient number of grade points in a particular midterm exam will be allowed to retake that midterm exam during classes (1st and 2nd make-up midterm exam). The right to take the 1st make-up midterm exam is granted to a student who achieved less than 50% of the grade points in the 1st midterm exam, and the right to take the 2nd make-up midterm exam is granted to a student who achieved less than 50% of the grade points in the 2nd midterm exam. A student has the right to take each make-up midterm exam once.

Students work on a selected topic from the course field, write a seminar paper and present it. The evaluation of the seminar paper is based on the quality of the paper, its presentation, and the knowledge of the subject.

A student who in continuous evaluation achieves:

- from 0% to 34% of the grade points and/or does not meet the passing thresholds in one or both midterm exams (has not achieved at least 50% of the grade points allocated to each midterm exam) is not eligible to take the final exam and must re-enroll in the course,
- 35% or more of the grade points and meets the passing thresholds in both midterm exams (has achieved at least 50% of the grade points in each midterm exam) is eligible to take the final exam.

The final exam consists of an oral assessment of achieved learning outcomes (learning outcomes 1–6).

[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.

In the final exam, the student must achieve at least 15% of the grade points (50% of the grade points available in the final exam) to pass the course.

A student has the right to take the final exam for the course up to three times during the academic year.

For students who have met the conditions for passing the course, the final grade in the course is the sum of the grade points obtained through continuous monitoring and evaluation and the grade points obtained in the final exam.

The grade awarded for the achieved learning outcomes in the course is determined in accordance with the percentage ranges of grade points defined in the *Regulations on Studying at the University of Rijeka, Faculty of Maritime Studies*.

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

1. Explain the Nyquist–Shannon sampling theorem for continuous-time signals and illustrate the concept with a sketch.
2. Present a communication system model and explain the roles of its components.
3. Given two random variables: X with value set $S(X) = \{x_1, x_2, x_3\}$ and distribution $P_x = (0.5, 0.25, 0.25)$, and Y with value set $S(Y) = \{y_1, y_2, y_3\}$ and distribution $P_y = (0.4, 0.4, 0.2)$, which variable has greater entropy?
4. Using Kraft's inequality, determine whether there exists an instantaneous code ($a = 6$, $b = 2$, f) with codeword lengths {1, 3, 3, 3, 3, 3}.
5. A memoryless discrete source has an alphabet $A = \{x_1, x_2, x_3, x_4, x_5\}$, with symbol probabilities $P = \{P(x_1) = 0.35, P(x_2) = 0.17, P(x_3) = 0.17, P(x_4) = 0.16, P(x_5) = 0.15\}$. Given the binary code alphabet $B = \{0, 1\}$, use the Shannon–Fano coding procedure to determine the codewords, draw the code tree diagram, and calculate code efficiency measures.
6. A memoryless discrete source has an alphabet $A = \{x_1, x_2, x_3, x_4, x_5\}$, with symbol probabilities $P = \{P(x_1) = 0.30, P(x_2) = 0.25, P(x_3) = 0.20, P(x_4) = 0.15, P(x_5) = 0.10\}$. Given the binary code alphabet $B = \{0, 1\}$, use Huffman entropy coding to determine the codewords, draw the code tree diagram, and calculate the average codeword length and code efficiency.

1.10. Main Reading

1. Course materials available on the Merlin e-learning platform (https://moodle.srce.hr)
2. I. S. Pandžić et al.: Uvod u teoriju informacije i kodiranje, Element, Zagreb 2012

1.11. Recommended Reading

1. Ž. Ilić, A. Bažant, T. Beriša: Teorija informacije i kodiranje – zbirka zadataka, Element, Zagreb, 2014
2. B. P. Lathi, R. A. Green: Essentials of Digital Signal Processing, Cambridge University Press, Cambridge, 2014
3. N. Lopac, I. Jurdana, J. Lerga, N. Wakabayashi: Particle-Swarm-Optimization-Enhanced Radial-Basis-Function-Kernel-Based Adaptive Filtering Applied to Maritime Data, Journal of Marine Science and Engineering, 2021, 9, 4, 439
4. I. Jurdana, N. Lopac, N. Wakabayashi, H. Liu: Shipboard Data Compression Method for Sustainable Real-Time Maritime Communication in Remote Voyage Monitoring of Autonomous Ships, Sustainability, 2021, 13, 15, 8264
5. H. Liu, I. Jurdana, N. Lopac, N. Wakabayashi: BlueNavi: A Microservices Architecture-Styled Platform Providing Maritime Information, Sustainability, 2022, 14, 4, 2173

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Course materials available on the Merlin e-learning platform (https://moodle.srce.hr)	web	30
I. S. Pandžić et al.: Uvod u teoriju informacije i kodiranje, Element, Zagreb 2012	4	30

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1.13. Quality Assurance
The quality of teaching is continuously monitored in accordance with the ISO 9001 system implemented at the University of Rijeka, Faculty of Maritime Studies. An annual analysis of exam results is conducted, and student surveys are carried out each semester

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3.2. Course description

Generic information			
Head of Course	Jasmin Ćelić, PhD		
Course	Internet of Things		
Study Programme	Marine Electronic Engineering and Information Technology		
Type of Course	Mandatory		
Year of Study	1.		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5	
	Number of Hours (L+E+S)	30+30+0	

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

Acquiring knowledge about the principles of operation and design of smart devices, networking technologies, application development, security issues and principles of data processing within IoT networks. Training students for networking smart devices, implementing different platforms and intelligent environments, and working on developing solutions for different areas of application of IoT technology.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

Upon passing the exam, students will be able to:

1. identify the basic concepts and features of the Internet of Things
2. select an appropriate Internet of Things architecture
3. differentiate approaches in implementing IoT solutions
4. differentiate between network and communication protocols
5. identify security threats and ways to compromise privacy
6. propose appropriate IoT solutions for different areas of application

1.4. Course Outline

Internet of Things (IoT) in general, different approaches and concepts. IoT architecture, hardware, components, devices and modules. Sensors and actuators. Cloud and fog computing, EDGE computing. Networking, communication models and methods, standards and protocols. Data collection, transmission, processing and storage. Development and embedded computer systems. Security and privacy in IoT systems. Real-time signal processing and analysis. IoT solutions for different application areas. Internet of Things in industry and maritime.

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

1st preliminary exam, 2nd preliminary exam, final exam

1.8. Assessment[1] of Learning Outcomes

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

- 60% of the acquired learning outcomes are evaluated through continuous knowledge assessment during classes:
  through the 1st preliminary exam – learning outcomes 1-3 (30%), 2nd preliminary exam – learning outcomes 4-6 (30%); in each preliminary exam, the student must achieve a minimum of 50% of the points;
  The preliminary exams are of written type, and since the passing threshold for the mandatory continuous evaluation has been established, the student is allowed one repeated access to such evaluation.
- 40% of the acquired learning outcomes (1-6) 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. Name the technologies that enabled the development of the Internet of Things? (LO #1)
2. What is I2C and for what purpose is it used? (LO #2)
3. What is the difference between Cloud and EDGE IoT solutions? (LO #3)
4. What are the limitations of the IEEE 802.15.4 standard? (LO #4)
5. What security threats are recognized as the most significant in IoT solutions? (LO #5)
6. What classes of smart IoT objects are defined in the document RFC7228? (LO #6)

1.10. Main Reading

1. Teaching material available on the Merlin e-learning system (https://moodle.srce.hr)
2. Cirani, S., Ferrari, G., Picone, M., Veltri, L. (2019.). Internet of Things: Architectures, Protocols and Standards, 1st edition, Wiley, Hoboken, NJ, USA

1.11. Recommended Reading

- Elk, K. (2019). Embedded Software for the IoT, 3rd edition, De|G Press, Berlin, Germany
- Javed, A. (2016). Building Arduino Projects for the Internet of Things: Experiments with Real-World Applications, 1st edition, A press, Illinois, USA

- Ćelić, J., Cuculic, A., Valcic, M. (2012.). Remote sensing for ship emissions monitoring in Adriatic ports: an approach, IEEE, Proceedings ELMAR-2012, 263-266., Zadar, Croatia
- Panić, I., Ćelić, J., Cuculić, A. (2018). Wireless condition monitoring of machinery and equipment in maritime industry: an overview, Pomorstvo 32 (2), 201-210., Rijeka, Croatia

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Cirani, S., Ferrari, G., Picone, M., Veltri, L. (2019.). Internet of Things: Architectures, Protocols and Standards, 1st edition, Wiley, Hoboken, NJ, USA	10	30

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	Marko Gulić, PhD	
Course	Management Information Systems	
Study Programme	Marine Electronic Engineering and Information Technology	
Type of Course	Elective	
Year of Study	1st	
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 the course is to introduce students to the concepts and functioning of business information systems. Students will acquire fundamental knowledge of methodologies for developing information systems, with an emphasis on identifying problems and proposing appropriate solutions. Additionally, students will model business processes using analysis and modeling tools, enabling them to integrate functionally designed components of an information system into a coherent whole.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

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

1. Classify the types and categories of business information systems
2. Formulate the phases of business information system development and analyze development methodologies
3. Design a specific business process model and integrate elements such as products, organizational hierarchy, and entities
4. Evaluate and discuss the principles of information security in the context of business information systems, and assess security risks
5. Explain the organizational structure of ERP systems and critically evaluate their role in enterprise resource management
6. Create a prototype of a business information system

1.4. Course Outline

Basic concepts of business information systems. Structure, tasks, functions, and characteristics of information systems. The meaning and role of information systems in business management. Decision support information systems: concepts, objectives, models, and support for individual and group decision-making. Information systems and business systems: vertical and horizontal levels, methods of support, and data integration. Phases of information system development. Modelling of processes and data within information systems. Information system security. Application of commercial tools for business

process analysis and modelling.

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	Classes are conducted through a combination of classroom instruction and individual work in the computer laboratory. Upon enrolment in the course, students will be directed to use the online learning platform. A detailed schedule of lectures and exercises will be published in the course implementation plan.	

1.7. Student Obligations

- Regularly attend classes (lectures and exercises)
- Take the 1st and 2nd midterm exams
- Take the final (written/oral) exam if the requirements for attendance and assessment have been met

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							

1.9. 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 Rulebook on Studies at the Faculty of Maritime Studies in Rijeka as follows:

- Continuous assessment during classes accounts for 70% of the achieved learning outcomes:
  – Midterm Exam 1 – Learning Outcomes 1–3 (35%)
  – Midterm Exam 2 – Learning Outcomes 4–6 (35%)
  In each midterm exam, the student must achieve at least 50% of the total points.

- The final (oral) exam accounts for 30% of the achieved learning outcomes (1–6), and the student must achieve at least 50% of the points on the final exam to pass.

Examples of assessment tasks aligned with learning outcomes:

1. Classify types of business information systems and explain the fundamental tasks of information systems.
2. Analyze the phases of business information system development and explain development methodologies.
3. Design a graphical representation of a business process model that includes products, organizational elements, and entities.
4. Identify and discuss security and protection mechanisms of business information systems.
5. Justify the role of information systems in decision support by explaining decision-making goals and models.

[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.

6. Conceptualize, design, and develop a prototype of a business information system using real-world business examples.

1.10. Main Reading

- M. Pavlić: Informacijski sustavi, Školska knjiga, Zagreb, 2011.
- Course materials are available on the e-learning platform Merlin (https://moodle.srce.hr)

1.11. Recommended Reading

- V. Čerić, M. Varga (ur.), Informacijska tehnologija u poslovanju, Element, Zagreb, 2004.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
M. Pavlić: Informacijski sustavi	4	25
E-course teaching materials available on the Merlin e-learning system	unlimited	25

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. At the end of each semester, an anonymous evaluation of the quality of instruction is conducted by the students. Additionally, an annual analysis of student success in the course is performed (the percentage of students who passed the course and their average grades).

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3.2. Course description

Generic information		
Head of Course	**Aleksandar Cuculić, PhD**	
Course	**Marine electrical power grids**	
Study Programme	**Marine Electronic Engineering and Information 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)	45+15+0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The aim of this course is to provide students with appropriate knowledge in the field of design and analysis of shipboard electrical power networks

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

Upon successful completion of the course, the student will be able to:

1. Formulate the basic design criteria, components, and planning procedures of ship electrical power grids, and evaluate the factors affecting the stability of marine electrical power systems.
2. Classify energy efficiency indicators and integrate methods to improve the energy efficiency of marine electrical power systems.
3. Analyze power quality and assess issues related to electromagnetic compatibility within the shipboard electrical power network.
4. Evaluate the components of power and energy management systems in shipboard electrical power grid, implement energy storage methods, and apply energy storage systems.
5. Assess the concepts of shipboard electrical power systems with direct current (DC) distribution on vessels with battery and hybrid propulsion systems.
6. Evaluate the effectiveness of testing and measurement methods and apply regulations and standards in the maritime industry related to marine electrical power systems.

1.4. Course Outline

Topologies of marine electrical power grids according to the type and purpose of the vessel. Planning of shipboard electrical power system and fundamental calculations (power flow, short-circuit current, protection, stability, and reliability). Safety analysis. Software tools for network planning and technical documentation. Static and transient stability of shipboard electrical power grid. Voltage and frequency regulation. Energy efficiency. Power quality indicators. Electromagnetic compatibility. Power management systems. Types, applications, and installation methods of energy storage systems. Shipboard DC electrical grid. Battery systems in shipboard electrical power grid. Measurements and testing in marine electrical power grids. Regulations and standards.

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

	☐ Field work	☐ Other _____
1.6. Comments		

1.7. Student Obligations

Regular class attendance, continuous assessment, final exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper	1	Experiment	
Written exam		Oral exam	1	Essay		Research	
Project		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.

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 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 as follows:

1. Through continuous assessment during the course, where the student can earn up to 70% of the total grade points:
   - 1st midterm exam – 25% of grade points
   - 2nd midterm exam – 25% of grade points
   - Seminar paper – 20% of grade points

The midterm exams in given in written format. For each midterm exam, student must achieve at least 50% of the points. As the passing threshold for continuous assessment of learning outcomes is determined to be 50%, student is allowed one retake of each midterm exam.

2. Through the final exam, which the student may attend upon earning a sufficient number of grade points during the course:
   - Final exam – 30% of grade points

The final exam is oral. The student must achieve at least 50% of the points available on the final exam.

Examples of learning outcome assessment in relation to learning outcomes 1–6:

1. What are the key design criteria for marine electrical power grids, and how do they affect grid stability? Provide specific examples.
2. What are the main indicators of energy efficiency in ship electrical power systems, and which methods would you apply to improve them?
3. How is power quality assessed in marine electrical networks, and what are the main challenges related to electromagnetic compatibility?
4. Which components of the power and energy management system do you consider most important and why? How would you implement energy storage methods in a shipboard network?
5. What are the advantages and disadvantages of direct current (DC) distribution on vessels with battery and hybrid propulsion systems? Explain with examples.
6. Which testing and measurement methods do you consider most effective for marine electrical power grids, and how would you apply relevant regulations and standards in practice?

1.10. Main Reading

Teaching materials available on the e-learning platform Merlin (https://moodle.srce.hr)

1.11. Recommended Reading

1. *Patel, Mukund R. Shipboard electrical power systems. Crc Press, 2021.*
2. Borstlap, René, Hans Ten Katen, and Klaas Dokkum. Ships' Electrical Systems. Dokmar, 2011.

3. Cuculić, Aleksandar ; Draščić, Luka ; Panić, Ivan ; Ćelić, Jasmin Classification of Electrical Power Disturbances on Hybrid-Electric Ferries Using Wavelet Transform and Neural Network // Journal of marine science and engineering, 10 (2022), 9; 1190, 21. doi: 10.3390/jmse10091190
4. Panić, Ivan ; Cuculić, Aleksandar ; Ćelić, Jasmin Color-Coded Hydrogen: Production and Storage in Maritime Sector // Journal of marine science and engineering, 10 (2022), 12; 1995, 31. doi: 10.3390/jmse10121995
5. Cuculić, Aleksandar ; Panić, Ivan ; Ćelić, Jasmin ; Škrobonja, Antonio Implementation of Charging Stations for Hybrid and Electrical Ferries in Croatian Ports // Pomorski zbornik, Special edition (2022), 4; 147-160

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Teaching materials available on the e-learning platform Merlin	web	20
Patel, Mukund R. Shipboard electrical power systems – 2nd edition. Crc Press, 2021.	10	20

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 analyzed and appropriate measures are adopted.

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3.2. Course description

Generic information			
Head of Course	Boris Svilicic		
Course	Maritime Cyber Security		
Study Programme	Marine Electronic Engineering and Information Technology		
Level	Graduate		
Type of Course	Obligatory		
Year of Study	**5th**		
Estimated Student Workload and Methods of Instruction	**ECTS coefficient of Student Workload**	**5**	
	Number of Hours (L+E+S)	**2+2**	

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

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

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

General knowledge acquisition in the multidisciplinary domain of recognition and management of cyber risks that are specific for the maritime systems. Specific knowledge and skills acquisition for cyber security improvement and enhancement of the maritime systems.

1.4. Course Outline

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

1.5. Modes of Instruction	☒ Lectures	☐ Practical work
	☐ Seminars and workshops	☐ Multimedia and Network

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	☒ Exercises ☐ E-learning ☐ Field work	☒ Laboratory ☐ Mentorship ☐ Other _____

1.6. Comments

1.7. Student Obligations

Regular class attendance (all students are expected to abide by the class attendance policy set forth by the Faculty of Maritime Studies), and passed course work (achievement tests pass grade). A min of 35 credits.

1.8. Assessment[1] of Learning Outcomes

Course attendance	1	Class participation	1	Seminar paper		Experiment	
Written exam	1	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

Assessment of learning outcomes:
- During the classes by collecting 70 credits through the first colloquium (27 credits), second colloquium (27 credits), laboratory work (16 credits);
- On the final exam by collecting additional 30 credits.

Examples of Evaluation:
1. Define ship operational and information technologies.
2. Define shipboard critical systems and assets.
3. Explain maritime cyber security regulations and standards.
4. Explain working principles of basic attack techniques.
5. Explain working principles of the firewall.
6. Explain working principles of the anti-virus protection.
7. Explain working principles of the data cryptography.
8. Explain working principles of the VPN.
9. Explain working principles of the cyber security testing.
10. Explain procedure for recognition of cyber incidents.

1.1. Main Reading

Lecture materials.

1.2. Recommended Reading

- M. Egan, T. Mather. "The Executive Guide to Information Security: Threats, Challenges, and Solutions", Addison – Wesly, 2004.
- Svilicic, B., Kamahara, J., Rooks, M., Yano, Y. (2019). Maritime Cyber Risk Management: An Experimental Ship Assessment. Journal of Navigation, in press (https://doi.org/10.1017/S0373463318001157).

1.3. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Lecture materials	web	13
M. Egan, T. Mather. "The Executive Guide to Information Security: Threats, Challenges, and Solutions", Addison – Wesly, 2004.	1	13
Svilicic, B., et al (2019). Maritime Cyber Risk Management: An Experimental Ship Assessment. Journal of Navigation	1	13

1.4. Quality Assurance

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Internal: student feedback at the end of academic year and the course review by the head of course at the end of academic year.
External: Program quality review carried by the QA Agency.

[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	New Technologies in Diagnostics and Control Systems	
Study Programme	Marine Electronic Engineering and Information Technology	
Type of Course	Mandatory	
Year of Study	2nd	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5
	Number of Hours (L+E+S)	30+30+0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The main objectives of the course are to acquire the knowledge to perform diagnostic and trend analyses of the work of dynamic systems and the ability to develop and apply new technologies in the areas of diagnostics and automatic process control, with a focus on automatic ship 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. Recognize, present and explain the characteristics of diagnostic systems
2. Formulate the organization of the diagnostic process
3. Apply structural diagnostic techniques
4. Apply functional diagnostic techniques
5. Describe and explain redundancy management
6. Apply methods for evaluating diagnostic systems
7. Calculate the effects of diagnostic systems on the reliability and safety of controllers of marine machinery and equipment
8. Demonstrate and explain the use of diagnostic systems in ship control systems.

1.4. Course Outline

Introduction to diagnostics and automatic process control with fault tolerance. Characteristics of diagnostic systems. Organization of the diagnostic process. Techniques of structural and functional diagnostics. Diagnostics in computer control systems. Fault tolerance techniques in the diagnostic system, redundancy management, redundancy in the diagnostic system (hardware, information, software and time). Methods for evaluating diagnostic systems. The influence of diagnostics on the reliability and safety of controllers for electrical machinery and equipment at sea. New sensor signal processing techniques. Examples of the application of new technologies to ship systems and processes and, more broadly, to the maritime sector.

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, practical research task and final examination.		
1.8. Assessment[1] of Learning Outcomes		

Course attendance	2	Class participation		Seminar paper	0,6	Experiment	
Written exam	0,9	Oral exam		Essay		Research	
Project		Continuous Assessment	1,5	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.

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, i.e. by the 1st colloquium learning outcomes 1-4 (25%), the 2nd colloquium learning outcomes 5-8 (25%), by the submission of an essay from the exercises learning outcomes 1-8 (20%); (the presentation of the practical work or the laboratory exercise is assessed on the basis of elaborated assessment criteria)
- in the final part of the examination, 30% of the acquired learning outcomes (1-8) are assessed, whereby the student must achieve at least 50% of the points in order to pass the final examination
- Depending on the student's success in the continuous assessment, the student may acquire the right to be exempted from the assessment of the final examination.

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

1. Name and explain the characteristic features of diagnostic systems.
2. Draw and explain the organization chart of the diagnostic process for different remedies.
3. With the technique of structural diagnostics, when to apply the ATE or BITE concept with the computerized control system.
4. Explain the use of functional diagnostics for a real-time control system.
5. For the system shown in the figure, explain how to deal with the fault in the redundant pair.
6. Calculate the diagnosticity (probability of a correct diagnosis in a distributed diagnostic system).
7. Reliability of the redundant system with cold and warm backup as a function of fault coverage (Cd).
8. Name the techniques for analyzing the state of the ship's propulsion systems, when to use which and for which state.

1.10. Main Reading

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

1.11. Recommended Reading

1. Steven X. Ding: Model-Based Fault Diagnosis Techniques: Design Schemes, Algorithms and Tools, Springer, London, 2015.
2. Blanke, M., Kinnaert, M., Lunze, J., Staroswiecki, M., Diagnosis and Fault-Tolerant Control, Springer, Berlin, 2016.
3. Baždarić, R., Vončina, D., & Škrjanc, I. (2018). Comparison of novel approaches to the predictive control of a DC-DC boost converter, based on heuristics. *Energies, 11*(12), 3300.
4. Baždarić, R., Ćelić, J., & Vončina, D. (2023). Compensation of the Current Imbalance of an Interleaved DC–DC Buck Converter, Sensorless Online Solution Based on Offline Fuzzy Identification and Post-Linearization. *Energies, 16*(12), 4836.

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	17

1.13. Quality Assurance

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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	Marko Gulić, PhD	
Course	Management Information Systems	
Study Programme	Marine Electronic Engineering and Information Technology	
Type of Course	Elective	
Year of Study	1st	
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 the course is to introduce students to the concepts and functioning of business information systems. Students will acquire fundamental knowledge of methodologies for developing information systems, with an emphasis on identifying problems and proposing appropriate solutions. Additionally, students will model business processes using analysis and modeling tools, enabling them to integrate functionally designed components of an information system into a coherent whole.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

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

1. Classify the types and categories of business information systems
2. Formulate the phases of business information system development and analyze development methodologies
3. Design a specific business process model and integrate elements such as products, organizational hierarchy, and entities
4. Evaluate and discuss the principles of information security in the context of business information systems, and assess security risks
5. Explain the organizational structure of ERP systems and critically evaluate their role in enterprise resource management
6. Create a prototype of a business information system

1.4. Course Outline

Basic concepts of business information systems. Structure, tasks, functions, and characteristics of information systems. The meaning and role of information systems in business management. Decision support information systems: concepts, objectives, models, and support for individual and group decision-making. Information systems and business systems: vertical and horizontal levels, methods of support, and data integration. Phases of information system development. Modelling of processes and data within information systems. Information system security. Application of commercial tools for business

process analysis and modelling.

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	Classes are conducted through a combination of classroom instruction and individual work in the computer laboratory. Upon enrolment in the course, students will be directed to use the online learning platform. A detailed schedule of lectures and exercises will be published in the course implementation plan.	

1.7. Student Obligations

- Regularly attend classes (lectures and exercises)
- Take the 1st and 2nd midterm exams
- Take the final (written/oral) exam if the requirements for attendance and assessment have been met

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							

1.9. 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 Rulebook on Studies at the Faculty of Maritime Studies in Rijeka as follows:

- Continuous assessment during classes accounts for 70% of the achieved learning outcomes:
  – Midterm Exam 1 – Learning Outcomes 1–3 (35%)
  – Midterm Exam 2 – Learning Outcomes 4–6 (35%)
  In each midterm exam, the student must achieve at least 50% of the total points.

- The final (oral) exam accounts for 30% of the achieved learning outcomes (1–6), and the student must achieve at least 50% of the points on the final exam to pass.

Examples of assessment tasks aligned with learning outcomes:

1. Classify types of business information systems and explain the fundamental tasks of information systems.
2. Analyze the phases of business information system development and explain development methodologies.
3. Design a graphical representation of a business process model that includes products, organizational elements, and entities.
4. Identify and discuss security and protection mechanisms of business information systems.
5. Justify the role of information systems in decision support by explaining decision-making goals and models.

[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.

6. Conceptualize, design, and develop a prototype of a business information system using real-world business examples.

1.10. Main Reading

- M. Pavlić: Informacijski sustavi, Školska knjiga, Zagreb, 2011.
- Course materials are available on the e-learning platform Merlin (https://moodle.srce.hr)

1.11. Recommended Reading

- V. Čerić, M. Varga (ur.), Informacijska tehnologija u poslovanju, Element, Zagreb, 2004.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
M. Pavlić: Informacijski sustavi	4	25
E-course teaching materials available on the Merlin e-learning system	unlimited	25

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. At the end of each semester, an anonymous evaluation of the quality of instruction is conducted by the students. Additionally, an annual analysis of student success in the course is performed (the percentage of students who passed the course and their average grades).

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3.2. Course description

Generic information		
Head of Course	Marko Gulić, PhD	
Course	Object Oriented Programming	
Study Programme	Marine Electronic Engineering and Information Technology	
Type of Course	Compulsory	
Year of Study	1st	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5
	Number of Hours (L+E+S)	30+30+0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The objective of the course is to equip students with the knowledge and skills necessary for solving problems using object-oriented programming, and to enable them to develop more complex applications with a graphical user interface.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

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

1. Develop and write a program that uses specific control flow constructs, and identify and resolve compiler errors.
2. Explain the concept of classes and objects.
3. Evaluate the structure of a class, including the proper use of attributes, methods, and constructors.
4. Develop a computer program that implements simple numerical algorithms.
5. Implement a computer program using object-oriented programming with appropriate classes for problem-solving.
6. Develop a computer program that reads from and writes to a file.
7. Design and implement a computer program with a graphical user interface.

1.4. Course Outline

Basics of object-oriented programming. Simple numerical algorithms. Class definition (attributes, methods, constructors). Arrays and lists. File reading and writing. Use of collection classes, iterators, and other components from the standard library. Development of applications with a graphical user interface.

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	Classes are conducted through a combination of classroom instruction and	

	individual work in the computer laboratory. Upon enrolment in the course, students will be directed to use the online learning platform. A detailed schedule of lectures and exercises will be published in the course implementation plan.

1.7. Student Obligations

- Regularly attend classes (lectures and exercises) and take short quizzes at the beginning of each exercise session
- Take the 1st and 2nd midterm exams
- Create and present a project assignment
- Take the final (written/oral) exam if the requirements for attendance and assessment have been met

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper		Experiment	
Written exam		Oral exam	1	Essay		Research	
Project	0,5	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 procedure for evaluating the acquired learning outcomes is carried out according to the Regulations on Studies of the University of Rijeka and the Rulebook on Studies at the Faculty of Maritime Studies in Rijeka as follows:

- Continuous assessment during classes accounts for 70% of the achieved learning outcomes:
  – Midterm Exam 1 – Learning Outcomes 1–4 (20%)
  – Midterm Exam 2 – Learning Outcomes 5–7 (20%)
  – Project assignment – learning outcomes 1–7 (20%)
  – Quick quizzes during exercises – Learning Outcomes 1–7 (10%)
  In each midterm exam, the student must achieve at least 50% of the total points.

- The final (oral) exam accounts for 30% of the achieved learning outcomes (1-7), and the student must achieve at least 50% of the points on the final exam to pass.

Examples of assessment tasks aligned with learning outcomes:

1. Write a program that uses a loop to calculate the sum of two numbers, and then correct any syntax errors (if present).
2. Explain the concept of an object.
3. Create a program that defines a Person class with attributes, methods, and a constructor.
4. Create a program that reads 10 integers and stores them in a class named Numbers, which also includes a method to calculate the arithmetic mean of the entered numbers.
5. Write a program that uses an ArrayList to store and display information about students (first name, last name, GPA).
6. Create a program that adds new students to an existing file called student.txt and provides the functionality to read data about a specific student.
7. Design and develop a calculator program (basic mathematical operations – addition, subtraction, multiplication, division, modulo) with a graphical user interface.

[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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1.10. Main Reading

• Allen B. Downey, Chris Mayfield, Think Java (How to Think Like a Computer Scientist), Green Tea Press, Needham, Massachusetts, 2020. https://greenteapress.com/thinkjava7/thinkjava2.pdf

• Course materials are available on the e-learning platform Merlin (https://moodle.srce.hr)

1.11. Recommended Reading

• Walter Savitch, Kenrick Mock (2015.), Absolute Java, Global Edition, Pearson Higher Ed

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Think Java (How to Think Like a Computer Scientist)	unlimited	20
E-course teaching materials available on the Merlin e-learning system	unlimited	20

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. At the end of each semester, an anonymous evaluation of the quality of instruction is conducted by the students. Additionally, an annual analysis of student success in the course is performed (the percentage of students who passed the course and their average grades).

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3.2. Course description

Generic information		
Head of Course	Marko Gulić, PhD	
Course	Operating Systems	
Study Programme	Marine Electronic Engineering and Information Technology	
Type of Course	Elective	
Year of Study	1st	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5
	Number of Hours (L+E+S)	30+30+0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

To acquire fundamental knowledge of operating systems and the processes within them, including core concepts such as processes, process synchronization mechanisms, data and memory management, and to develop skills for advanced use of operating systems.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

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

1. Explain the fundamental functions of operating systems in relation to their structure.
2. Interpret program execution using processes and threads, and relate processes and threads to execution states.
3. Formulate mechanisms for mutual exclusion of processes and threads, and apply an appropriate exclusion mechanism to solve process and thread synchronization problems.
4. Classify memory management strategies and select an appropriate strategy for a given problem.
5. Explain types of file systems and evaluate the appropriate file system based on given specifications.
6. Relate components of the operating system to hardware for managing input/output devices.
7. Identify security mechanisms in operating systems and evaluate the application of protection functions in a specific operating system.

1.4. Course Outline

Introduction to operating systems: development of operating systems, fundamental tasks and structure of operating systems. Interaction between operating system and hardware: process and thread management, concurrency, synchronization, deadlocks, processor management. Memory management: paging, segmentation, placement strategies and memory protection. Resource and data management: resource allocation, working with files and directories. Input/output device management: drivers, hardware controllers, interrupt handling. Security and protection: security mechanisms, protection in process and thread execution.

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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	Classes are conducted through a combination of classroom instruction and individual work in the computer laboratory. Upon enrolment in the course, students will be directed to use the online learning platform. A detailed schedule of lectures and exercises will be published in the course implementation plan.	

1.7. Student Obligations

- Regularly attend classes (lectures and exercises)
- Take the 1st and 2nd midterm exams
- Take the final (written/oral) exam if the requirements for attendance and assessment have been met

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							

1.9. 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 Rulebook on Studies at the Faculty of Maritime Studies in Rijeka as follows:

- Continuous assessment during classes accounts for 70% of the achieved learning outcomes:
  – Midterm Exam 1 – Learning Outcomes 1–3 (35%)
  – Midterm Exam 2 – Learning Outcomes 4–7 (35%)
  In each midterm exam, the student must achieve at least 50% of the total points.

- The final (oral) exam accounts for 30% of the achieved learning outcomes (1–7), and the student must achieve at least 50% of the points on the final exam to pass.

Examples of assessment tasks aligned with learning outcomes:

1. Classify types of operating systems, sketch their components, and explain the fundamental tasks of an operating system.
2. Relate processes and threads in a program, interpret execution results, and comment on the outcome.
3. Design a program that coordinates the execution of multiple processes and threads using an appropriate mutual exclusion mechanism.
4. Select an appropriate memory management strategy for a given problem and explain the solution.
5. Select a file system based on given specifications and sketch file placement on disk.
6. Relate operating system activities to hardware components during input/output operations.
7. Identify security and protection mechanisms for a given operating system and justify their use.

[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.

1.10. Main Reading

- • D. Jakobović, L. Budin, L. Jelenković, M. Golub: Operacijski sustavi, Element, Zagreb, 2018.
- Course materials are available on the e-learning platform Merlin (https://moodle.srce.hr)

1.11. Recommended Reading

- A. Silberschatz, P. B. Galvin, G. Gagne: Operating Systems Concepts, Wiley, 2018.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Jakobović i ostali: Operacijski sustavi	-	25
E-course teaching materials available on the Merlin e-learning system	unlimited	25

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. At the end of each semester, an anonymous evaluation of the quality of instruction is conducted by the students. Additionally, an annual analysis of student success in the course is performed (the percentage of students who passed the course and their average grades).

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3.2. Course description

Generic information			
Head of Course	**Irena Jurdana**		
Course	**Optoelectronic systems**		
Study Programme	**Marine Electronic Engineering and Information Technology**		
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)		30+30+0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

Acquisition of knowledge about the fundamental characteristics of optical fibers and fiber optic communication networks and systems. Ability to independently measure the basic transmission parameters of fiber optic information transmission systems, operate basic measuring instruments, and perform basic maintenance of fiber optic systems. Competence to independently plan and design fiber optic networks.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

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

1. Comment on the physical principles and draw light propagation diagrams
2. Analyse types of optical fibres and cables
3. Classify the effects of attenuation and dispersion
4. Compare passive and active optical components
5. Analyse types and applications of fibre optic transmission systems
6. Develop proposals for methods and devices for measurements in fibre optic communication systems
7. Evaluate the reliability and availability of a fibre optic network
8. Design types and applications of optical sensors for a given use

1.4. Course Outline

History of fibre optic communications. Introduction to the physical fundamentals of optics. Fiber optic transmission systems – system elements, manufacturing, parameters. Optical components, fibers, cables. Applications of fiber optics in telecommunications. Other applications. Planning and construction of fiber optic transmission systems. Transmission fiber optic devices. Measurement of optical parameters of transmission systems. Measurement methods and instruments. Reliability and availability of fiber optic cable networks. Mathematical models of systems. Development trends in fiber optic telecommunication networks: WDM, DWDM, PON, FTTx. Fibre optic systems on ships. Optical sensors. Submarine fiber optic 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

Regular class attendance, first and second midterm exams, presentation of a practical exercise during exercise classes, final exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper		Experiment	
Written exam	0,5	Oral exam	0,5	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 process of evaluating acquired learning outcomes is carried out 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 as follows:

- Through continuous knowledge assessment during the course, 70% of the learning outcomes are evaluated via:
  1st midterm exam – learning outcomes 1–4 (25%)
  2nd midterm exam – learning outcomes 5–8 (25%)
  Including the presentation of a practical task – learning outcomes 1–8 (10% in each midterm).
  In each midterm exam, the student must achieve a minimum of 50% of the points.
- The final exam evaluates the remaining 30% of the learning outcomes (1–8), and the student must achieve at least 50% of the points to pass the final exam.

Examples of evaluation of learning outcomes in relation to the stated learning objectives are:

1. Comment on the physical principles of light propagation
2. Analyse types of optical fibres and cables
3. Classify and explain the various effects of attenuation and dispersion
4. Compare passive and active optical components
5. Analyse types and applications of fibre optic transmission systems
6. Describe and explain methods and devices for measurements on fibre optic systems and present measurement results in graphical and numerical form
7. Explain methods of mathematical modeling of fibre optic networks
8. Design the use of optical sensors for a given application

1.10. Main Reading

1. G.P. Agrawal: Fiber-Optic Communication Systems, John Wiley, 2010.
2. J.M. Lopez-Higuera (editor): Optical Fibre Sensing Technology, John Wiley & Sons, 2002.
3. R. Ramaswami, K.N. Sivarajan, G.H. Saski: Optical Networks: A Practical Perspective, 3rd ed., Elsevier, 2010.
4. J. Chesnoy: Undersea Fiber Communication Systems, Academic Press, 2002.
5. J.P.Dakin, Handbook of Optoelectronics, Taylor&Francis Group, 2006.
6. Bažant, A. i dr.: Telekomunikacije - tehnologija i tržište, Element, Zagreb, 2007.
7. Bažant, A. i dr.: Osnovne arhitekture mreža, Element, Zagreb, 2014.
8. Teaching material for lectures and exercises is available on the e-learning platform. - Merlin (https://moodle.srce.hr)

1.11. Recommended Reading

1. W.D. Grover, Mesh-based Survivable Networks:Options and strategies for Optical, MPLS, SONET and ATM networking, Prentice Hall PTR, 2004.
2. J.P. Vasseur, M. Pickavet, P. Demeester, Network recovery: Protection and Restoration of Optical, SONET-SDH, IP, and MPLS, Elsevier, 2004.
3. K. van Dokkum, Ship Knowledge: A Modern Encyclopedia, Dokmar, Netherland, 2003.
4. A. Selvarajan, S. Kar, T. Srinivas: Optical Fiber Communications: Principles and Systems, McGraw-Hill, 2006.
5. M.Ilyas, H.Mouftah, Optical communication Networks, CRC Press, 2003.
6. Jurdana, I., Modeliranje i analiza raspoloživosti svjetlovodne transmisijske mreže, znanstveni magistarski rad, Sveučilište u Zagrebu, Fakultet elektrotehnike i računarstva, Zagreb, 2007.
7. Jurdana, I., Heuristički model komunikacijskih mreža u povezivanju brodskih sustava primjenom svjetlovodne tehnologije, doktorski rad, Sveučilište u Rijeci, Pomorski fakultet u Rijeci, Rijeka, 2011.
8. Jurdana, Irena; Rukavina, Biserka; Tominac Coslovich, Sandra: Legal regime regulating the laying and protection of submarine cables in the Republic of Croatia. // Pomorstvo : scientific journal of maritime research, 35 (2021), 1; 118-127
9. Palaić, Darko; Lopac, Nikola; Jurdana, Irena; Brdar, Damir Advancements and Challenges in Underwater Wireless Optical Communication in the Marine Environment // Proceedings of 47th ICT and Electronics Convention (MIPRO) / Skala, Karolj; Mornar, Vedran (ur.). Rijeka: Croatian Society for Information, Communication and Electronic Technology - MIPRO, 2024. str. 1760-1765. doi: 10.1109/MIPRO60963.2024.10569767
10. Lopac, Nikola ; Jurdana, Irena ; Brnelić, Adrian ; Krljan, Tomislav Application of Laser Systems for Detection and Ranging in the Modern Road Transportation and Maritime Sector // Sensors, 22 (2022), 16; 5946, 27. doi: 10.3390/s22165946
11. Jurdana, Irena; Štrlek, Marko; Kunić, Srećko: Wireless optical networks-mobile communications by using visible light . // Pomorstvo : scientific journal of maritime research, 27 (2013), 1; 55-72
12. Jurdana, Irena; Ivče, Renato: Availability model of communication network in connecting ship systems using optical fibre technology. // Brodogradnja, 65 (2014), 3; 17-30
13. Ivče, Renato; Jurdana, Irena; Kos, Serđo: Ship's cargo handling system with the optical fiber sensor technology application. // Pomorstvo : scientific journal of maritime research, 28 (2014), 2; 118-127
14. Teaching material for lectures and exercises is available on the e-learning platform. - Merlin (https://moodle.srce.hr)

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of*
G.P. Agrawal: Fiber-Optic Communication Systems, John Wiley, 2010.	1	20
J.M. Lopez-Higuera (editor): Optical Fibre Sensing Technology, John Wiley & Sons, 2002.	1	20
R. Ramaswami, K.N. Sivarajan, G.H. Saski: Optical Networks: A Practical Perspective, 3rd ed., Elsevier, 2010.	1	20
J. Chesnoy: Undersea Fiber Communication Systems, Academic Press, 2002.	1	20
J.P.Dakin, Handbook of Optoelectronics, Taylor&Francis Group, 2006.	1	20
Bažant, A. i dr.: Telekomunikacije - tehnologija i tržište	1	20
Bažant, A. i dr.: Osnovne arhitekture mreža, Element, Zagreb, 2014.	1	20
Teaching material for lectures and exercises is available on the e-learning platform. - Merlin (https://moodle.srce.hr)	-	20

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1.13. Quality Assurance

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 results is conducted, and a student survey is carried out once per semester.

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General Information		
Head of Course	**prof. Ana Perić Hadžić, Ph.D.** **Assoc Prof. Dražen Žgaljić, Ph.D.**	
Course	**Project Management**	
Study Programme	**Marine Electronic Engineering and Information 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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General information		
Course holder	Ph.D., Jasminka Bonato	
Course	Reliability and safety of technical systems	
Study program	Marine Electronic Engineering and Information Technology	
Course status	optional	
Year of study	2. graduate study	
Score value and method of teaching	ECTS credits	5
	Number of hours (L+E+S)	30+15+0 (2+1+0)

1. DESCRIPTION OF THE SUBJECT

1.1. Course objectives

Presents and approximates the basic ideas of reliability theory; determining the reliability of the component (system); mathematical modeling of technical systems reliability.

1.2. Course enrollment requirements

Passed the course Applied Mathematics.

1.3. Expected learning outcomes for the course

1.Describe the basic quantities of reliability theory.

2. Analyze different configurations of technical systems.

3. Application in solving problems from the theory of reliability and availability of different configurations of technical systems.

4. Describe the possibilities of applying reliability theory in engineering and technology.

1.4. Course content

Starting terms relevant to the area of reliability of technical systems. Component reliability (fault density, fault frequency. Reliability, mean time to failure). Reproducibility of the component (renewal density, renewal frequency, reproducibility, mean time to renewal). Reliability of non-renewable systems with mutually independent components. Reliability of serial and parallel configuration systems. Reliability of non-renewable systems of parallel-serial and serial-parallel configuration. System reliability of "k of m" configuration. Reliability of non-renewable systems with interdependent components. Reliability of the standby system. Reliability of a renewable parallel configuration system.
Reliability of a renewable reserve system. Availability of a renewable one-component system. Availability of a renewable parallel configuration system. Availability of a renewable reserve system. Reliable design of technical systems. FMEA. Design and safety of technical systems.

1.5. Types of teaching		
	x lectures	x independent tasks
	☐ seminars and workshops	x multimedia and network
	x exercises	☐ laboratory
	☐ distance education	☐ mentoring work
	☐ field work	

1.6. Comments

1.7. Student obligations

Regular class attendance, taking colloquia, completing homework, as well as independent assignments through the merlin system, which students qualify for the final exam.

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1.8. Monitoring student work

Class attendance	2	Teaching activity (homework)		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	0,5
Project		Continuous assessment	1,5	Report		Practical work	
Portfolio		Final exam	1				

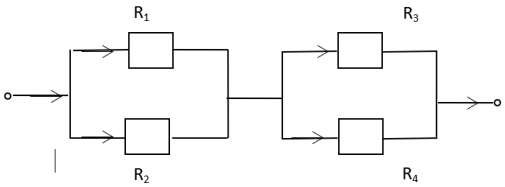
1.9. Procedure and examples of evaluation of learning outcomes during classes and at the final exam

During classes 70% (colloquia + seminar + dz) and final exam 30%.

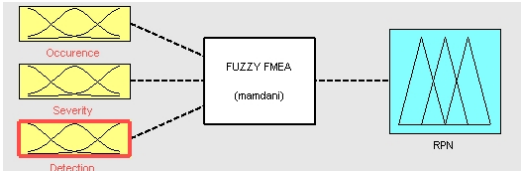
Examples of evaluating learning outcomes in relation to set outcomes:

1 Outcomes 1,2 i 3

Let the system consist of four independent components as shown in the figure. Their reliability at time t = 1000 h are: R1 = 0.6; R2 = 0.7; R3 = 0.8; R4 = 0.9. What is the reliability of the system at time t? Calculate the mean time to failure of this system! (picture)



2. Outcomes 4
Fuzzy FMEA, a method of security of technical systems



Final exam (outcomes 1,2,3 and 4)
1. Draw a statistical qualitative time diagram of the component failure frequency and write the name
2. What expression is used to determine the reliability of a component if the frequency of component failure when it is in operation is constant?
3. What is the process of failures in the operation of the technical system? Why?
4. What is true for a component with a constant refresh rate?
5. What expression is given to the reproducibility of a component with a constant renewal frequency?

1.10. Required literature (at the time of applying for the study program proposal)

1. Kraš, Antun; Bonato, Jasminka; Draščić Ban, Biserka: Reliability and availability of digital systems, Rijeka, 2017.
2. Notes from lectures and exercises.
3. V.Mikuličič, Z.Šimić: „Reliability, availability and risk models in the power system: Part 1 Analytical methods of reliability and availability calculatio“, Kigen, Zagreb, svibanj, 2008.
4. N. Elezović: Fourier series and integral
Laplace transformation, Školska knjiga, Zagreb

1.11. Supplementary literature (at the time of application of the study program proposal)

J. Bonato:“ Reliability and security of technical systems” Rijeka, 2020.

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1.12. Number of copies of required literature in relation to the number of students currently attending the course

Title	*Number of copies*	Number of students
Kraš, Antun; Bonato, Jasminka; Draščić Ban, Biserka Reliability and availability of digital systems: , Rijeka,2017.	5	30

1.13. Ways of monitoring quality that ensure the acquisition of output knowledge, skills and competencies

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. Student survey conducted at the end of the semester.

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3.2. Course description

Generic information			
Head of Course	Robert Baždarić, Ph.D.		
Course	Robotics		
Study Programme	Marine Electronic Engineering and Information Technology		
Type of Course	Mandatory		
Year of Study	1.		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		5
	Number of Hours (L+E+S)		30+30+0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The objectives of the course are learning outcomes that introduce the student through robotics to the basic theoretical, mathematical and physical environments of the creation of modern methods in automation, in their part of management and decision making with a high degree of autonomy in navigation and in general. They are thus useful for a high level of competence in the contents covered by the "STCW & IMO Model Courses" for the service of Electrical Engineering Officers.

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. To explain which automatic device we consider a robot and what influences the variability of their shapes.
2. Formulate the kinematic space, the degrees of freedom and the controllable variables of the different robots.
3. Formulate the equations of the direct and inverse kinematics of simple robot shapes.
4. Create a graphical and mathematical environment to set up the equations of the dynamics of simple robots.
5. Explain the complexity of robotic vision and discuss the purpose of features and extraction algorithms.
6. Explain the creation of a spatial map, trajectory planning and the methods of motion interpolation.
7. Explain the decomposition of management complexity and the hierarchical management of robots.
8. Explain the role of reactive and behavior-based control algorithms and their importance.

1.4. Course Outline

Kinematic chains, model-driven robotics on wheels, legs, on the sea and under the sea, non-visual sensors including global and local odometry solutions, robotic vision, sensor physics, modeling of sensor transfer function and possible interferences, sensor fusion, multi-layer decomposition of horizontal and vertical control, active and behavior-based control strategy, mapping-planning-decision making and autonomous navigation.

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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 and examination.		
1.8. Assessment[1] of Learning Outcomes		

Course attendance	2	Class participation	0,25	Seminar paper		Experiment	
Written exam	1	Oral exam	1	Essay		Research	
Project		Continuous Assessment	0,5	Presentation		Practical work	0,25
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:

- The learning outcomes are achieved through regular attendance and activity in class (10%), continuous assessment of knowledge through a colloquium (60%) and a final examination (30%).
- During class, a student can achieve a maximum of 70% of the assessment points in the following ways:
  a) Regular active participation in class 10% and writing 2 written colloquia within the given deadlines. Each colloquium can be awarded 30% of the assessment points. Written colloquia during class may, depending on the student's success and decision, completely replace the assessment by the written part of the examination in that academic year.
  b) Active participation in class (at least 70% of the lectures and at least 70% of the exercises).
  c) Final examination. The requirement for participation in the compulsory final examination is regular attendance, i.e. criterion b) and grade points from point a). Students who fulfil the requirement of regular class attendance and assessment by colloquia must register for the final examination (learning outcomes 1-8), which consists of a written and an oral form, and receive 30% of the assessment points for this. Their examination success means that they achieve 50% or more success for each form of the final examination separately.

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

1. Explain what makes robots robots and how we distinguish them from other automata in the air, on land, on and under the sea?
2. Write down in equations and then in matrix form the direct kinematics of the rotation of the robot gripper, which is only generated around the x-axis.
3. Write with symbols for the given example of the robot manipulator on the drawing the matrix of relative homogeneous transformations of the robot gripper, if we ignore its geometric dimensions.
4. Use the graphical symbols of the mechanical device in the figure to create a schematic representation of the kinematic chain, including the specified dimensions.
5. Which image features of a robot camera would we extrapolate if we were to used it to avoid an obstacle?
6. How will we record the plan of the desired movement in a language that the robot can understand?
7. What is decomposition of control complexity and name at least three characteristic levels of vertical decomposition in route planning.
8. What graphical tools do we use when we decompose control algorithms into solutions for behavior control?

1.10. Main Reading

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

1.11. Recommended Reading

1. J. Velagić (2012): Mobilna robotika, PIK, Sarajevo, BIH.
2. T. Surina, M. Crnekovic (1990): Industrijski roboti, Školska knjiga, Zagreb.
3. R.J. Schilling (1990): Fundamentals of Robotics - Analysis and Control, Prentice-Hall, Englewood Cliffs, New Jersey.
4. Y. Koren (1983): Computer Control of Manufacturing Systems, McGraw-Hill, New York.
5. Z. Kovacic, S. Bogdan, V. Krajci (2002): Osnove robotike, Graphis, Zagreb
6. R. Baždarić, I. Škrjanc, D. Matko (2016): Two Degrees of Freedom in the Control of a DC-DC Boost Converter, Fuzzy Identified Explicit Model in Feed-forward Line, Journal of Intelligent and Robotic Systems, Vol. 82, Issue 3, June 2016, pp. 479-483
7. R. Baždarić, J. Ćelić, (2024): Epistemic stability and nonlinear dynamics in selection of suboptimal cluster counts in medical images validation dataset as a cluster homogeneity measure, *Nonlinear dynamics, 112*(22), 19849-19869.

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	20
J. Velagić (2012): Mobilna robotika, PIK, Sarajevo, BIH.	5	20
T. Šurina, M. Crnekovic (1990): Industrijski roboti, Školska knjiga, Zagreb.	4	20

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	**Ines Kolanović, Full Professor**		
Course	**Research scientific methodology**		
Study Programme	**Marine Electronic Engineering and Information 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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Course description

Generic information		
Head of Course	**Dr.sc. Biserka Draščić Ban**	
Course	Selected Topics in Mathematics	
Study Programme	Marine Electronic Engineering and Information 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 basic concepts of probability theory, vector analysis, Laplace transforms and multiple integrals.

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 formulas
4. Describe random variables
5. Use and calculate numerical characteristics of random variables
6. Explain and apply the transformation of coordinates into different coordinate systems
7. Identify basic concepts of vector analysis
8. Express and correctly interpret the gradient, divergence and rotor
9. Use and calculate Laplace transforms
10. Master the methods of solving multiple integrals in various coordinate systems

1.4. Course Outline

The space of elementary events. Probability. Total probability and Bayesian formulas. Random variables. Numerical characteristics of random variables. Rectangular, cylindrical, spherical coordinate systems and coordinate transformations. Vector analysis: gradient, divergence, rotor. Laplace transforms. Multiple integrals: in rectangular, cylindrical and spherical coordinate systems

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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Regular attendance at classes and homework.

1.8. Assessment[1] of Learning Outcomes

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 1-5 (20%), 2nd written exam - learning outcomes 6-8 (25%), 3rd written exam - learning outcomes 9 -10 (25%)
- 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. Randomly, 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 P (X <5) = 0: 6915 holds. Calculate the probability P (-1 <X <6).
3. For the given scalar field f (x, y, z) = 3x2 y + y2 z3, and the vector s = i + j + 2k calculate:
   a) grad f;
   b) ∂f / ∂s;
   c) Δf
4. Find the area of the part of the plane between the circles x2 + y2 = 4 I -2x + x2 + y2 = 0
5. Find the Laplace transformation of the function f (x) = x e^{5x}

ORAL EXAM:

1. Total probability theorem
2. Scalar field gradient
3. Application of double integral

1.10. Main Reading

1. T. 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)
3. B. Apsen: Repetitorij iz više matematike 3, Tehnička knjiga Zagreb, 1965.
4. B. Apsen: Riješeni zadaci iz više matematike uz 3. dio repetitorija, Tehnička knjiga Zagreb, 1988.

1.11. Recommended Reading

1. P. Vranjković: Zbirka zadataka iz vjerojatnosti i statistike, Školska knjiga, Zagreb, 1992.
W. Feller: An Introduction to Probability Theory and its Applications, I,II, J. Wiley & Sons, New York, 1950, 1966

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.	Po potrebi	

B. Apsen: Repetitorij iz više matematike 3, Tehnička knjiga Zagreb, 1965.	2	
B. Apsen: Riješeni zadaci iz više matematike uz 3. dio repetitorija, Tehnička knjiga Zagreb, 1988.	2	
1.13. Quality Assurance		

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Course description

Generic information			
Head of Course	**dr.sc. Biserka Draščić Ban**		
Course	Statistics		
Study Programme	Marine Electronic Engineering and Information Technology		
Level	Graduate degree programme		
Type of Course	Elective		
Year of Study	first		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	5	
	Number of Hours (L+E+S)	2+2	

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The main course objective is to teach the students how to apply statistical methods to determine the natural laws of the observed traffic phenomena.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

1. To recognize the meaning and the task of statistics and the phases of statistical analysis
2. To recognize and analyze different kinds of data sets and their characteristics
3. To explain the terms of random variables and probability distributions
4. To differ the theoretical probability distributions, and connect them with empirical ones
5. To describe the sampling method and, by using the estimation methods and statistical testing on a random sample, make some conclusions about the population
6. To recognize the Chi-Square Test
7. To interpret the terms of correlation and regression

1.4. Course Outline

The meaning and the task of statistics. Graphical methods in data analysis. Relative numbers. Numerical data analysis. Random variables. Theoretical distribution functions. Chi-Square Test. Sampling method. Time series analysis. Correlation and regression.

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

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1.6. Comments	

1.7. Student Obligations

Taking classes regularly and doing homework assignments.

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation	0,5	Seminar paper		Experiment	
Written exam		Oral exam	1	Essay		Research	
Project		Continuous Assessment	1,5	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 is done by conducting three partial written tests and by final exam (oral exam).

Examples:

Written exam:

1) (outcome 2) In period from 2010. until 2017. a certain mass phenomenon has been investigated and the following data was collected:

Year	Y	
2010	5565	
2011	5334	
2012	4734	
2013	4690	
2014	4497	
2015	4356	
2016	4172	
2017	3359	

   a) Find the average number of occurences per year?
   b) Determine the curve of the linear trend (with the origin in the center of the time period) and by it calculate the number of occurences that is expected in 2020.

2) (outcome 5) A statistical feature X has mean 9,72 and standard deviation 1,4. A sample of 36 statistical units gave the mean 8,93 . Is the difference between means statistically significant with the risk of 5%?

Oral exam questions:

1) (outcome 2) Make an example for attributive, numerical and time series, and for every one of them name the statistical indicators that can be calculated.
2) (outcomes 3 and 4) Say what is the probability of a certain, and of an impossible event. Name a few continuous probability distribution and a few discrete ones, and for every of them write down the DF.
3) (outcome 6) How (meaning by which statistical test) can we determine the correspondence of some empirical PD with a certain theoretical PD? Describe the procedure.
4) (outcome 7) Explain the meaning of the correlation and regression.

1.10. Main Reading

1. Z. Zenzerović, Statistički priručnik, Pomorski fakultet u Rijeci, Rijeka, 2004.

2. I. Šošić-V.Serdar, Uvod u statistiku, Školska knjiga, Zagreb, 2002.

1.11. Recommended Reading

1. Z. Zenzerović, Statističke metode u tehnologiji prometa, Fakultet za pomorstvo i saobraćaj, Rijeka, 1988.
2. T. Pogány-Z. Zenzerović, Statističke tablice s uputama za primjenu, Pomorski fakultet u Rijeci, Rijeka, 1993
3. J. Čaval, Statističke metode u privrednim i društvenim istraživanjima, Sveučilište u Rijeci, Rijeka, 1981.
4. I.Šošić, Zbirka zadataka iz statistike, Mikrorad, Ekonomski fakultet, Zagreb, 1998.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Z. Zenzerović, Statistički priručnik, Pomorski fakultet u Rijeci, Rijeka,	9	80
I. Šošić-V.Serdar, Uvod u statistiku, Školska knjiga, Zagreb, 2002.	5	80

1.13. Quality Assurance

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3.2. Course description

Generic information		
Head of Course		
Course	MASTER'S THESIS	
Study Programme	Marine Electronic Engineering and Information Technology	
Type of Course	Mandatory	
Year of Study	2rd	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload	30
	Number of Hours (L+E+S)	

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The objective of the course is to enable students to independently apply the theoretical and practical knowledge acquired during their studies in the treatment of a selected professional or scientific topic. Students are encouraged to critically analyse domestic and foreign literature, correctly apply research methodology, and structurally compose written work in accordance with academic standards and faculty regulations. Special attention is given to developing the ability to interpret and evaluate relevant data, theoretical approaches, and practical examples. Through the process of consultations with a mentor and a final defence, students acquire competencies to present the results and conclusions of their research before a professional committee, thereby demonstrating academic maturity and the ability to solve complex problems.

1.2. Prerequisites for Course Registration

The student enrols in the course Master's Thesis by registering for the sixth (summer) semester of the undergraduate study program.

1.3. Expected Learning Outcomes

It is expected that the student will be able to:

1. Analyse relevant domestic and foreign literature and identify key insights, viewpoints, and facts related to the research topic.
2. Apply research methodology in the planning, processing, and interpretation of collected data.
3. Synthesize data from various sources and compose a coherent master's thesis text that includes illustrations (tables, graphs, diagrams) in accordance with research methodology.
4. Evaluate research results and formulate conclusions that reflect an understanding of the problem and the ability for critical thinking.
5. Present and defend the main results and conclusions of the master's thesis before a mentor and professional committee.

1.4. Course Outline

The master's thesis is an independent professional or scientific treatment of a selected topic. By completing it, the student demonstrates possession of the necessary competencies and learning outcomes, as well as the ability to apply theoretical and practical knowledge acquired during the studies. In the process of defending the master's thesis, the student must demonstrate mastery of relevant scientific and professional knowledge related to the chosen topic. The thesis is written and defended in Croatian, though, exceptionally, it may also be written and defended in English. The oral defence is conducted before the mentor and a Committee for the Defence and Evaluation of the master's thesis.

1.5. Modes of Instruction	☐ Lectures	☒ Practical work
	☐ Seminars and workshops	☐ Multimedia and Network

	☐ Exercises ☐ E-learning ☐ Field work	☐ Laboratory ☒ Mentorship ☒ Other (research and collaboration with industry professionals, analysis and processing of practical examples and data, and so forth)
1.6. Comments		

1.7. Student Obligations

The student, in agreement with the mentor, must choose the topic of the master's thesis and write it according to the instructions found on the faculty website:
https://www.pfri.uniri.hr/web/hr/dokumenti/Upute.za.izradu.diplomskoga.rada.PFRI.26.3.2024.pdf

As assistance for the student, a template for preparing the master's thesis is also available on the faculty pages:
https://www.pfri.uniri.hr/web/hr/dokumenti/Predlozak_za_diplomski_rad_08.07.2024.docx

The paper must be grammatically, orthographically, and stylistically correct.

After the first consultative meeting between the student and mentor, the student consults the assigned literature, studies the subject matter, consults their own collected sources, and thoroughly develops the content of the thesis.

Once the mentor approves and accepts the master's thesis, the student submits the final version to the student office.
The master's thesis is written in accordance with the Regulations on the Master's Thesis:
https://www.pfri.uniri.hr/web/hr/dokumenti/pravni_akti/Pravilnik.o.diplomskom.radu.na.sveucilisnom.diplomskom.studiju.pdf

1.8. Assessment[1] of Learning Outcomes

Course attendance		Class participation		Seminar paper		Experiment	
Written exam		Oral exam		Essay		Research	10
Project		Continuous Assessment		Presentation		Practical work	
Portfolio		Mentorship work	5	Master's thesis in written form	10	Oral defence of the master's thesis	5

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

Verification of the achievement of learning outcomes is conducted before the mentor and a professional Committee composed of three members, including the mentor. An external associate can be a member of the Committee if the thesis topic requires additional specific knowledge and competencies. The student must defend the thesis with an oral presentation and by answering questions. The Committee evaluates the quality and coverage of the work, clarity and precision of the presentation, the ability to answer professional questions, and the level of mastery of the chosen topic. During the defence, a report is kept in which data about the work, questions posed, and the candidate's success grade are recorded.
The originality of the master's thesis is checked using an appropriate IT system, and the mentor, based on the analysis, compiles a report on the conducted check. A positive opinion from the mentor and confirmation of the originality of the work are prerequisites for accepting the work and organizing the defence.

[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.

1.10. Mandatory literature (at the time of study program proposal submission)

1. Mandatory literature from the course for which the master's thesis is registered and written
2. Additional literature in agreement with the course instructor – mentor
3. Instructions for writing the master's thesis, editors: Prof. Dr. I. Kolanović, Associate Prof. Dr. A. Perić Hadžić, Associate Prof. Dr. I. Jurdana, Assistant Prof. Dr. M. Jardas, University of Rijeka, Faculty of Maritime Studies, Rijeka, 2024 – available at https://www.pfri.uniri.hr/web/hr/dokumenti/Upute.za.izradu.diplomskoga.rada.PFRI.26.3.2024.pdf

1.11. Recommended Reading (at the time of study program proposal submission)

1. Mandatory literature from the course for which the master's thesis is registered and written
2. Additional literature in agreement with the course instructor – mentor

1.12. Number of Main Reading Examples

Title	*Reading examples*	*Number of students*

1.13. Quality Assurance

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 student surveys are carried out once per semester. Additionally, pass rate results are analyzed annually, and appropriate measures are taken based on the findings.