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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		

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1.7. Student Obligations

Regular attendance at classes and homework.

1.8. Assessment[1] of Learning Outcomes

Course attendanc	2	Class participation		Seminar paper		Experiment	
Written exam		Oral exam	1,5	Essay		Research	
Project		Continuous Assessment	2,5	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 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.

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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

[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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Generic information		
Head of Course	Ines Kolanović, full professor	
Course	Scientific research 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
	Number of Hours (L+E+S)	30 + 0 + 15

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The aim of this course is that students after completing the course will be able to apply basic knowledge about the technology and methodology of scientific and professional research in writing student theses at graduate level.

1.2. Prerequisites for Course Registration

1.3. Expected Learning Outcomes

After passing the exam in this course, students will be able to:
1. correctly explain and interpret the basic terms: science, technology and methodology of scientific research
2. systematically analyze and explain the classification of science in the Republic of Croatia
3. recognize and single out the basic characteristics of certain types of scientific, scientific and professional works
4. explain and apply the rules of scientific research methodology in writing student papers
5. explain and apply the rules of scientific research technology in writing student papers

1.4. Course Outline

About science, scientific activity and research: theory of science, features of modern science, Croatian qualification 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 work in the system of higher education in graduate and postgraduate studies. The concept and features of scientific methods. Scientific research methodology. Technology of scientific research: observation of a scientific problem, setting a hypothesis, selection and analysis of a topic (title), making a research plan, compiling a working bibliography, collecting and studying literature and scientific information, solving a problem, formulating research results, applying research results. Writing a text and technical processing of a scientific and professional work: documentary basis of the manuscript, citation of literature, referencing in the text, presentation of illustrations.

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

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1.6. Comments	

1.7. Student Obligations

Students are obliged to: attend at least 70% of classes, 1 colluquia, seminar paper, final exam

1.8. Assessment[1] of Learning Outcomes

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

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

The final grade on the course is the sum of points earned by the student during classes (70% of the grade) and points earned in the final exam (30% of the grade) according to the Regulations on Studies of the University of Rijeka and the Regulations on studying at the Faculty of Maritime Studies in Rijeka.

Continuous assessment:
• 1 colloquia - it is necessary to achieve a minimum of 50% of the total number of points
• seminar paper - t is necessary to present the acquired knowledge and the application of the methodology and technology of scientific research

Final exam:
At the final exam, the integrity of theoretical knowledge in the field of Methodology of scientific research work is checked (minimum 50% of points)

Examples of evaluating learning outcomes in relation to set learning outcomes are:
1. Define the terms science, technique, technology and methodology of scientific research. (LO1)
2. Explain the classification of science in the Republic of Croatia. (LO2)
3. On a concrete example, single out the basic features of scientific works. (LO3)
4. Present the features 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 graduate level. (LO5)

1.10. Main Reading

1. 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.
2. Kolanović, I.: Teaching material published on Merlin

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.

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1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Kolanović, I.: Teaching material published on Merlin	Unlimited (web)	
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.	6	13

1.13. Quality Assurance

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

[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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Generic information		
Head of Course	Assoc. Prof. Irena Jurdana, PhD	
Course	Information Processing and Transmission	
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 course objective is to enable students to acquire knowledge on signal processing techniques, understand the concepts of information theory and the problem of transmitting information through the communication channel, and acquire knowledge on information encoding techniques and communication networks.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

1. Define mathematical models of signals and apply techniques for their processing.
2. Interpret Shannon's model of the communication system.
3. Understand and define the concept of entropy and its properties.
4. Understand, define, and distinguish fundamental concepts of information encoding, and distinguish types of codes.
5. Understand and define graphical code representations, and define and compute the parameters of efficient information encoding.
6. Understand the procedures of entropy information encoding (Huffman coding, arithmetic coding, and dictionary-based encoding techniques) and apply them to determine the corresponding codewords.
7. Understand and interpret the mathematical model of the communication network.
8. Compare and distinguish the reliability and availability of the communication network.

1.4. Course Outline

Types and mathematical models of signals. Noise: definition, types, influence, noise sources. Mathematical tools for signal analysis and processing.
Information theory. Definition and Shannon's mathematical model of the communication system. Definitions of the message, message transmission, and information content. Information content and Shannon's definition of entropy. Entropy properties. Discrete information sources. Definition of information measures for the amount of information in a communication system.
Types of information encoding, definitions, and properties of codes. Fixed-length and variable-length coding. Code efficiency. Graphical code representation. Shannon-Fano coding. Entropy information encoding methods – Huffman coding, arithmetic coding, and dictionary-based encoding methods (LZW coding). Decoding procedures.

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Communication networks: model, architecture, information transmission technologies. Reliability and availability of communication network: definitions, mathematical models, applications.

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 (lectures and exercises), midterm exams with numerical tasks, and 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							

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

The assessment of acquired learning outcomes is carried out according to the regulations on studies at the University of Rijeka and the regulations on studies at the Faculty of Maritime Studies in Rijeka as follows:

- through continuous assessment of knowledge during classes, 70% of the acquired learning outcomes are evaluated through the 1st midterm exam – learning outcomes 1-3 (35%), the 2nd midterm exam – learning outcomes 4-8 (35%); the student must achieve a minimum of 50% of points at each midterm exam,
- at the final exam, 30% of the acquired learning outcomes are evaluated (1-8), whereby the student must achieve a minimum of 50% of points to pass the final exam.

Examples of evaluation of learning outcomes with respect to the set learning outcomes are:

1. For the time-continuous signal $y_c(t)=\text{sinc}(2t)$ and the sampling period T = 1/4, graphically show the sampled signal y[n] and its spectrum.
2. Define and describe the fundamental parts of Shannon's communication system model.
3. The following random variables are given: X with set of values $S(X) = \{x_1, x_2, x_3\}$ and probability distribution $P_X = (0.6, 0.2, 0.2)$, and Y with set of values $S(Y) = \{y_1, y_2, y_3\}$ and probability distribution $P_Y = (0.35, 0.35, 0.3)$. Which variable has higher entropy?
4. Is there an instantaneous code (a=5, b=2, f) with codeword lengths {1, 3, 2, 3, 3}?
5. The following is given: the source with symbols $A = \{x_1, x_2, x_3, x_4, x_5\}$, symbol probabilities: $P = \{P(x_1)=0.37, P(x_2)=0.17, P(x_3)=0.16, P(x_4)=0.15, P(x_5)=0.15\}$, and code symbols B = {0, 1}. Using the Shannon-Fano algorithm, graphically show the code tree, determine the codewords and their lengths, and calculate the average codeword length, source entropy, and code efficiency.
6. The following is given: the source with symbols $A = \{x_1, x_2, x_3, x_4\}$ and symbol probabilities $P(x_1)=0.4$, $P(x_2)=0.2$, $P(x_3)=0.3$, $P(x_4)=0.1$. Using arithmetic coding, encode the message: $x_2x_1x_3x_2$.
7. Show and explain the mathematical model of the communication network.
8. Define and explain the parameters of comparing the reliability and availability of the communication network.

1.10. Main Reading

- Course material available on the e-learning system – Merlin (https://moodle.srce.hr)
- Pandžić, I. S. et al.: Uvod u teoriju informacije i kodiranje, Element, Zagreb, 2007.
- Ilić, Ž. et al.: Teorija informacije i kodiranje – zbirka zadataka, Element, Zagreb, 2014.

1.11. Recommended Reading

- Pauše, Ž.: Uvod u teoriju informacije, Školska knjiga, Zagreb, 1989.
- Duck, M.; Read R.: Communication and Computer Networks, Pearson Education Limited, 2003.
- Bažant, A. et al.: Telekomunikacije – tehnologija i tržište, Element, Zagreb, 2007.
- Bažant, A. et al.: Osnovne arhitekture mreža, Element, Zagreb, 2014.
- Lathi, B. P.: Linear Systems and Signals, Oxford University Press, 2004.
- Lathi, B. P.; Green R. A.: Essentials of Digital Signal Processing, Cambridge University Press, 2014

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Course material available on the e-learning system – Merlin (https://moodle.srce.hr)	-	30
Pandžić, I. S. et al.: Uvod u teoriju informacije i kodiranje, Element, Zagreb, 2007.	2	30
Ilić, Ž. et al.: Teorija informacije i kodiranje – zbirka zadataka, Element, Zagreb, 2014.	6	30

1.13. Quality Assurance

The quality of the study is continuously monitored in accordance with the ISO 9001 system implemented at the Faculty of Maritime Studies in Rijeka. An analysis of exams is made annually, and once a semester, a survey is conducted among students.

[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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Generic information			
Head of Course	dr.sc. Nikola Tomac		
Course	Robotics		
Study Programme	ELECTRONIC AND INFORMATION TECHNOLOGIES IN MARITIME		
Level	2.		
Type of Course	electoral		
Year of Study	5		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		5
	Number of Hours (L+E+S)		3+1+0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The objective of this course is to provide the student with relevant knowledge of robotics and systems prescribed by STCW and IMO Model Courses for the service of an electrical engineering officer.

1.2. Prerequisites for Course Registration

1.3. Expected Learning Outcomes

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

1. Explain the principles of robot operation.
2. Describe the driving characteristics of the robot.
3. Conduct robot testing.
4. List and explain the maintenance of the robot
5. Understand robot programming
6. Explain the types and characteristics of the robot.
7. Explain the construction and characteristics of robot elements.
8. Explain the position and orientation of the rigid body.
9. Understand the kinematics and inverse kinematics of the robot.
10. Explain trajectory planning and interpolation methods.
11. Explain the hierarchical management of robots.
12. Explain the algorithms for managing the coordinates of sequential robot systems (position, speed, torque, and force.
13. Describe artificial intelligence robots.
14. Understand robotic vision.
15. Explain the basic characteristics of flexible production systems.

1.4. Course Outline

The basics of robotics. Robot Propulsion Systems. Robot kinematics. Robot programming. Robot accessories. Marine robots.

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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 attendance at classes, regular midterm exams, final exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	1,5	Class participation		Seminar paper		Experiment	
Written exam		Oral exam	0,9	Essay		Research	
Project		Continuous Assessment	1,6	Presentation		Practical work	
Portfolio							

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

Learning outcomes are evaluated through regular class attendance and activity (10%), continuous exams (60%) and final examination (30%). During the class, the student can collect a maximum of 70% of the grade points as follows:
A) Successfully pass 2 oral midterms within the prescribed deadlines. Each passed midterm carries a minimum of 15% and a maximum of 30% of marks and can be taken 3 times. A student who has not achieved all the required learning outcomes cannot take the midterm exam. The next colloquium cannot be accessed unless the previous colloquium is passed. The colloquiums include the following:
1st Colloquium Transformers and Fundamentals of Electromagnetism
2nd Colloquium Asynchronous and DC Machines (Learning Outcomes 1-5)
B) Active attendance (lectures and exercises). Each class absence accounts for 1% of the grade point. Students who have passed both exams can apply for the oral final exam (learning outcomes 1-5) and earn a minimum of 15% and a maximum of 30% of the marks.

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

1. *Explain the principles of robot operation.*
2. *Describe the driving characteristics of the robot.*
3. *Conduct robot testing.*
4. *List and explain the maintenance of the robot*
5. *Understand robot programming*
6. *Explain trajectory planning and interpolation methods.*
7. *Explain the hierarchical management of robots.*
8. *Explain the algorithms for managing the coordinates of sequential robot systems (position, speed, torque and force.*
9. *Describe artificial intelligence robots.27. Explain the properties and applications of magnetic materials.*

1.10. Main Reading

N. Tomac: Robotika, Pomorski fakultet u Rijeci, 2012. web izdanje

1.11. Recommended Reading

1. R.J. Schilling (1990): Fundamentals of Robotics - Analysis and Control, Prentice-Hall, Englewood Cliffs, New Jersey.
2. Y. Koren (1983): Computer Control of Manufacturing Systems, McGraw-Hill, New York.
3. T. Surina, M. Crnekovic (1990): Industrijski roboti, Skolska knjiga, Zagreb.
   Z. Kovacic, S. Bogdan, V. Krajci (2002): Osnove robotike, Graphis, Zagreb

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
N. Tomac: Robotika, Pomorski fakultet u Rijeci, 2012. web izdanje		

1.13. Quality Assurance

In accordance with ISO 9001 at the Faculty level.

[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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Generic information		
Head of Course	Božidar Kovačić	
Course	Operating 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)	2+2

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The aim of the course is the acquisition of basic knowledge of operating systems and processes within operating systems, the acquisition of knowledge of basic concepts of the operating system - process, process synchronization mechanisms, data management, memory management and the acquisition of knowledge and skills for advanced operating systems.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

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

1. Explain the basic tasks of operating systems in relation to the structure of operating systems.
2. Interpret program execution by applying processes and threads and link processes and threads to execution states.
3. Explain the mechanisms of mutual exclusion of processes and threads, and apply the appropriate mechanism of mutual exclusion in solving the problem of harmonization of joint work of processes and threads.
4. Identify memory management strategies and select the appropriate memory management strategy for a specific problem task.
5. Explain the types of file systems and select the appropriate file system according to the given system specifications.
6. Connect the operating system components and hardware used to control the I / O units.
7. Identify security mechanisms in operating systems and justify the application of basic and additional security functions for a specific operating system

1.4. Course Outline

Introduction to operating systems: development of operating systems, basic tasks of operating systems, structure of operating systems.
Interaction (connection) of operating system and hardware, process management: process competitiveness, synchronization, downtime, processor management.
Memory management: paging, segmentation, placement strategies, memory protection.
Resource allocation, data management: working with files and directories.
Input-output device management: device driver, hardware device controller, interrupt processing.

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The role of security and protection in operating systems: security mechanisms, implementation of protection in the operation of processes and threads.		
1.5. Modes of Instruction	☒ Lectures ☐ Seminars and workshops ☒ Exercises ☒ E-learning ☐ Field work	☐ Practical work ☐ Multimedia and Network ☒ Laboratory ☐ Mentorship ☐ Other _____
1.6. Comments		
1.7. Student Obligations		
1st and 2nd knowledge test (theory), 1st knowledge test of exercises, final exam		

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper		Experiment	
Written exam	1	Oral exam		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 takes place 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 knowledge test- learning outcomes 1-3 (20%), 2nd knowledge test - learning outcomes 4-7 (20%), 1st knowledge test form exercises - learning outcomes 1-7 (30%); the student must realize a minimum of 50% of points for each knowledge test.
• 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:
1. In the written exam, the student lists the types of operating systems, sketches parts and connections of operating systems with an explanation of the basic tasks of the operating system (1).
2. In the written exam, the student applies a program consisting of several processes and threads with an explanation of the results of the program and comments on the result of the program (2.).
3. The student in the homework designs a program that correctly coordinates the given system of multiple processes and threads by applying appropriate mechanisms of mutual exclusion (3).
4. The student solves the problem task in which the memory management strategy is given in the written exam (4.).
5. The student in the written or oral exam selects the file system and sketches the description of the file location on the disk (5).
6. The student on the written exam identifies the activity of the operating system and hardware during the execution of processing with input-output units (6).
7. The student on a written exam identifies security and protection mechanisms for a given operating system (7).

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1.10. Main Reading

1. Tanenbaum A., Modern Operating systems, Pearson, 2014.
2. Silberschatz, A., P.B. Galvin, G. Gagne, Operating System Concepts, 9th edition, John Wiley&Sons, New York, 2012.
3. Operacijski sustavi. Budin, L., Golub, M., Jakobović, D., Jelenković L. Element, Zagreb, 2010

1.11. Recommended Reading

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Teaching material for e-course available on the e-learning system - Merlin		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 exams is made annually, and once a semester a survey is conducted among students.

[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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Generic information		
Head of Course	Dario Ogrizović, PhD	
Course	E-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

E-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 applies to smart and social commerce, e-learning, e-services, e-government, social cooperation, shared economics, 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 basics of e-business related to system types, models, methods, mechanisms, management programs and benefits.
2. Describe the methods and models for selling goods, services and information using computer networks from business to individual customers.
3. List and distinguish between electronic and mobile commerce, their content and implementations.
4. Describe social networks and applications for social commerce and social enterprise systems, advertising, CRM and entertainment.
5. Describe connected smart commerce, internet of things and smart applications.
6. Describe consumer behaviour on the Internet, marketing and advertising in a web environment.
7. List security issues and their solutions in e-business.
8. Differentiate and systematize types of e-payments, mobile payments and digital currencies.
9. Indicate the ethical, legal, social and business environments in which e-business operates.

1.4. Course Outline

Theoretical foundations of e-business

Methods and models for the sale of goods, services and information using computer networks

Content and implementations of electronic and mobile commerce

Social networks, applications for social commerce and social enterprise systems, advertising, CRM and entertainment

Connected smart commerce, internet of things and smart applications

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Consumer behaviour on the Internet, marketing and advertising in a web environment

Security issues and their solutions in e-business

Types of e-payments, mobile payments and digital currencies in e-business

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

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

1.8. Assessment[1] of Learning Outcomes

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

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

The process of evaluation of the acquired learning outcomes takes place during continuous assessments (through 2 midterm examinations - total 70%) and at the final part of the exam (30%).

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

1. Explain the theoretical basics of e-business that relate to system types, models, methods, mechanisms, management programs and benefits.
2. Describe the methods and models for selling goods, services and information using computer networks.
3. List the electronic and mobile commerce, their content and implementations.
4. Describe social networks and applications for social commerce and social enterprise systems, advertising, CRM and entertainment.
5. Describe connected smart commerce, internet of things and smart applications.
6. Describe consumer behaviour on the Internet, marketing and advertising in a web environment.
7. List security issues and their e-commerce solutions.
8. Sort and organize e-commerce, mobile payments and digital currency e-business types.
9. List the ethical, legal, social and business environments in which e-business operates.

1.10. Main Reading

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

1.11. Recommended Reading

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

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Turban, E., et al. Electronic commerce 2018: A managerial and social networks perspective. Springer, 2017.	10	40
Schneider, G., P. Electronic Commerce, Gengage Learning, 2017.	10	40
Jelassi, T., et al. Strategies for E-business: Creating Value Through Electronic and Mobile Commerce: Concepts and Cases. 3rd ed. Harlow, England: FT Prentice Hall, 2014.	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).

[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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Generic information			
Head of Course	Aleksandar Cuculić, Assistant professor		
Course	Marine electric motor drives		
Study Programme	Marine Electronic Engineering and Information Technology		
Level	Graduate		
Type of Course	Elective		
Year of Study	I		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		5
	Number of Hours (L+E+S)		2+2+0

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The aim of this course is to acquire knowledge in the field of marine electric motor drives in order to understand, analyse and select the electric drive with regard to the specifics and requirements of the marine environment.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

1. Analyse the operation of marine electric motor drives (EMD) in different operating conditions.
2. Evaluate the characteristics and performance of electric motor drives with regard to the specifics and requirements of marine devices and systems.
3. Understand the basic principles of control of DC, asynchronous, synchronous, brushless DC, reluctant, stepper and servo motors.
4. Explain the principles of scalar control, vector control and direct torque control of AC induction motor.
5. Understand the basics of electric motor drives dynamic modelling.
6. Define and understand the issue of electromagnetic compatibility in marine electric drives.
7. Be able to apply appropriate power electronics circuits and sensors in electric motor drives.
8. Know the ways and methods of testing and maintenance of ship's electric motor drives.

1.4. Course Outline

Operating conditions of marine electric motor drives (EMD). Electrical and mechanical parameters of EMD. Control of DC, asynchronous, synchronous, brushless DC, reluctant, stepper and servo motors. Scalar control. Vector control. Direct torque and flow control. Dynamic EMD modelling. Electromagnetic compatibility in marine EMD. Application of power electronics in marine EMD. Sensors in EMD. EMD testing

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

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1.7. Student Obligations

Regular follow-up of classes (lectures and exercises), continuous assessment, and passing the 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	0,5	Continuous Assessment	1	Presentation		Practical work	
Portfolio							

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

The 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:

- 60% of the acquired learning outcomes through the continuous assessment 1st mid-term exam – through learning outcomes 1-4 (30%), 2nd mid-term exam - through learning outcomes 5-8 (30%); the student must have completed at least 50% of points in each mid-term exam,
- 10% of the acquired learning outcomes through independent task (project), where the student must realize a minimum of 50% of points,
- 30% of the acquired learning outcomes (1-8) are evaluated in the final part of the exam, with a minimum of 50% credit for passing the final exam.

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

1. Define the operating conditions of the electric motor drive.
2. What specific conditions must be met by the electric motor drive of the steering gear on board?
3. Describe how to control a stepper motor using a H-bridge.
4. State the advantages of direct torque control over vector control.
5. What electrical parameters do you need to consider when creating a dynamic synchronous motor model?
6. What electrical disturbances can be caused by PWM inverters.
7. Which sensors are used to obtain feedback on the rotor angle (position) in vector control?
8. How will you examine whether the propulsion electric motor drive in the ship's dynamic positioning system meets the specified conditions?

1.10. Main Reading

1. Teaching material on the Merlin e-learning system (https://moodle.srce.hr)
2. Hughes, Austin, and Bill Drury. Electric motors and drives: fundamentals, types and applications. Newnes, 2019.

[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

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Teaching materials on the Merlin e-learning system	Available on Web	30
Hughes, Austin, and Bill Drury. Electric motors and drives: fundamentals, types and applications. Newnes, 2019.	10	30

1.13. Quality Assurance

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

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Generic information			
Head of Course	Assoc Prof Ana Perić Hadžić, Assit. Prof. Dražen Žgaljić		
Course	PROJECT MANAGEMENT		
Study Programme	Marine Electronic Engineering and Information Technology		
Type of Course	Elective		
Year of Study	1st	Graduate degree programme	
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

The course aims to explain the importance of projects and international projects and the role of project management in the development of business systems. The emphasis is on strategic preparation, evaluation, initiation, and development of project management models at different management levels in order for students to be able to manage projects in the conditions of modern development of the economy.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

After passing the exam in this course, students will be able to:
1. correctly interpret the basic theoretical and practical concepts of project management in the development of business systems,
2. distinguish project management processes (strategic preparation, initiation, implementation, control).
3. analyze different stakeholders
4. apply skills and competencies that contribute to more effective implementation and help solve complex organizational and other problems related to project management.
5. correctly define the terms related to the structure of EU-funded projects
6. design, analyze and formulate their own idea and make a project proposal.

1.4. Course Outline

Theoretical-Methodological determination of project management (defining project, project management, Project life cycle, Projects section-stakeholder), Processes of project management (project planning, organization, management, control). Strategic aspects of project management, project management of company development (development policy, investment policy, evaluation of investment projects). Management of international projects. Organization and programmes of the EU (focusing on programmes that finance the development of Transport), planning of EU projects, logical matrix (log frame), measuring the achievement of objectives, management of work packages and project results, consortium agreements and protection Intellectual property, communication and project management team, exploitation, dissemination and sustainability of EU projects, quality planning, quality assurance and control, risk management. Business case: Harbour Business Plan, the justification for the concession in the field of maritime domain, the EU project.

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

1.7. Student Obligations

The student must be present for at least 70% of the total hours in lectures and tutorials and have passed continuous assessments and written project to be admitted to 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 of the student's success in the course is the sum of the percentage of success achieved by the student during classes (70% of the grade) and the percentage of success achieved in the final exam (30% of the grade) according to the rules of the University of Rijeka and the Faculty of Maritime Studies in Rijeka.
Continuous assessment of knowledge:
- it is necessary to achieve at least 50% correct answers from continuous assessments
- project - it is necessary to show the acquired knowledge and application of project methodology for the selected example
Final exam:
- at the final exam it is necessary to achieve at least 50% correct answers

Examples of evaluating learning outcomes in relation to set learning outcomes are:
1. Draw the project life cycle and mark the basic stages in 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 are and explain their role in the project
4. On the given example, use the critical path method to show the sequence of project activities, print the critical path of project activities, calculate the total duration of the project and Gantt chart show the sequence of project activities
5. Explain the role of EU structural funds and programs in financing projects related to sustainable transport development
6. Formulate a project proposal individually or in a team that includes the project description, relevance of the project application, implementation capacities of applicants and partners (if you have a partner), project efficiency and feasibility, project budget, project sustainability.

1.10. Main Reading

1. Authorized lectures on the e-learning platform MERLIN (online materials)

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1.11. Recommended Reading

1. European Funds for Croatian Projects, A Handbook of financial cooperation and European Union, Supported Programmes in Croatia, Središnji državni ured za razvojnu strategiju i koordinaciju fondova Europske Unije, Zagreb, 2009
2. Aid Delivery Methods, Volume 1. Project Cycle Management Guidelines, European Comission, Brusseles, 2004
3. Project Management Institute, A Guide to the Project management Body of Knowledge (PMBOK Guide), Fourth Edition, 2008.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
1. Authorized lectures on the e-learning platform MERLIN (online materials)	50	50

1.13. Quality Assurance

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

[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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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	5
	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, theoretical basics and virtualization as the basis for the emergence of cloud computing are explained. Basic service models, implementations and major cloud computing service providers are presented.

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

1. Explain the theoretical basics of cloud computing related to the foundations, etymology and properties of computing clouds
2. Present virtualization as the basis for the emergence of cloud computing and the type of virtualizations
3. List and distinguish between service models and cloud computing implementations
4. Describe and compare the major cloud computing service providers using historical view, global network of data centres and CDN hubs
5. Distinguish and systematize the types and purpose of available public and private cloud computing services
6. Implement computer services
7. Implement network services
8. Implement storage services

1.4. Course Outline

Theoretical basics of cloud computing. Foundations, etymology and properties of computing clouds. Virtualization. Cloud computing service models. Cloud computing implementation models. The major cloud computing service providers. Global network of data centres and CDN hubs. Type and purpose of available cloud computing services. Application of the most important cloud services: Computer services, network services and storage services.

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

1.7. Student Obligations

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

1.8. Assessment[1] of Learning Outcomes

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

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 2 midterm examinations - total 70%) and at the final part of the exam (30%).

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

1. Explain the foundations, etymology and properties of cloud computing
2. List and explain the types of virtualization as the basis for the emergence of cloud computing
3. List and sort cloud computing service models and cloud computing implementation models
4. Compare and describe the major cloud computing service providers
5. Classify and systematize the types and purpose of available public and private cloud computing services
6. Implement computer services
7. Implement network services
8. Implement storage services

1.10. Main Reading

4. Erl, T.: Cloud Computing: Concepts, Technology & Architecture, The Prentice Hall Service Technology Series, 2013.
5. Chopra, R.: Cloud Computing: An Introduction, Mercury Learning & Information, 2017.
6. 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 scientific papers from journals:

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	20
Chopra, R.: Cloud Computing: An Introduction, Mercury Learning & Information, 2017.	5	20
Kavis, M.J.: Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS), Wiley, 2014.	5	20
Rafaels, R.: Cloud Computing: From Beginning to End, CreateSpace Independent Publishing Platform, 2015.	5	20

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).

[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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Generic information			
Head of Course	Dr. sc. Sanjin Valčić		
Course	Application of mathematical tools in electrical engineering		
Study Programme	Marine Electronic Engineering and Information Technology		
Level	Graduate degree		
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)		2+2+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

1. Understand, set and calculate various line and surface integrals of scalar and vector fields.
2. Apply Stokes' and divergence theorem in the theory of electromagnetism, i.e. in Maxwell' s equations.
3. Find general and singular solutions of various ordinary first and second order differential equations.
4. Apply ordinary differential equations in the modeling of electrical RLC circuits.
5. Understand, interpret, and apply the properties of the Laplace transform to time dependent signals.
6. Apply the Laplace transform to solving differential equations and use the Laplace transform in the analysis of electrical RLC circuits.
7. Define and explain the orthogonality of trigonometric functions and expand periodic functions in form of trigonometric Fourier series.
8. Apply the Fourier transform in signal analysis theory, i.e., determine the amplitude and phase spectrum of a signal.

1.4. Course Outline

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 transform. 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

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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 class attendance (lectures and exercises), midterms with numerical assignments, and oral examination.

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 Regulations on Studies at the Faculty of Maritime Studies in Rijeka as follows:

- *through continuous assessment during the course the 70% of the acquired learning outcomes are evaluated: through 1st midterm - learning outcomes 1-4 (35%), 2nd midterm - learning outcomes 5-8 (35%); the student must have completed at least 50% of points in each midterm,*
- *at the final part of the exam 30% of the acquired learning outcomes (1-8) are evaluated, with the student having to pass a minimum of 50% of points for passing the final exam.*

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. Solve the differential equation y'-y / x = x^2.
4. 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.
5. Calculate the Laplace transform of the function g (t) = t^2u (t-2).
6. 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.
7. Expand the periodic function f (x) = x, given at the interval [-π, π], in a form of a trigonometric Fourier series.
8. 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

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

1.11. Recommended Reading

- https://www.wolframalpha.com/about/
- https://www.geogebra.org/

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Teaching material on the e-learning system Merlin	-	30
Brnetić, I., Županović, V.: Matematika 3 – višestruki integrali, Element, Zagreb, 2009.	3	30
Elezović, N.: Matematika 2 – diferencijalne jednadžbe, Element, Zagreb, 2010.	3	30
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 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.

[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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Generic information			
Head of Course	Marko Gulić		
Course	Object oriented programming		
Study Programme	Marine Electronic Engineering and Information Technology		
Level	Graduate degree programme		
Type of Course	Core		
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 knowledge and skills for solving problems using object-oriented programming as well as training for the development of more complex programs with a graphical user interface.

1.2. Prerequisites for Course Registration

1.3. Expected Learning Outcomes

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

1. Explain the concept of class and object
2. Correctly interpret the notion of inheritance, interface, and polymorphism
3. Develop a computer program in which simple numerical algorithms will be implemented
4. Develop a computer program in which object-oriented programming will be properly applied using adequate problem-solving methods
5. Develop a computer program that reads and writes to a file
6. Design and develop a computer program with a graphical interface

1.4. Course Outline

Fundamentals of object-oriented programming. Simple numerical algorithms. Class definition (attributes, methods, constructors). Inheritance, interfaces, and polymorphism. Fields and lists. Write and read files. Using collection classes, iterators, and other components from a shared library. Development of applications with a graphical user interface

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	Teaching is carried out by combining classroom work and individual work in the computer lab. Students will be instructed to use the distance learning system when enrolling in the course. A detailed schedule of lectures and exercises will be published in the implementation plan.

1.7. Student Obligations

- Regularly attend classes (lectures and exercises) and take short tests at the beginning of each exercise
- Write 1st and 2nd intermediate exam (colloquium)
- Create and present a simple project task
- Pass the final (oral) exam if the criteria for admission are met.

1.8. Assessment[2] of Learning Outcomes

Course attendance	1	Class participation	0,5	Seminar paper	Experim ent	
Written exam		Oral exam	1.5	Essay	Researc	
Project	0,5	Continuous Assessment	1.5	Presentation	Practical	
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:

- 70% of the acquired learning outcomes are evaluated through continuous knowledge assessment during the teaching process: through the 1st intermediate exam (colloquium) - learning outcomes 3-4 (20%), 2nd intermediate exam (colloquium) - learning outcomes 5-6 (20%), project – learning outcomes 3-6 (20%), weekly short tests before exercises - learning outcomes 1-3 (10%); a student must have completed a minimum of 50% points in each intermediate exam (colloquium)
- 30% of the acquired learning outcomes (1-3) are evaluated at the final (oral) part of the exam, with a minimum of 50% of available points necessary for passing the final exam.

Examples of evaluating learning outcomes respecting set learning outcomes are:

1. Explain the concept of an object
2. Explain the inheritance of two classes
3. Create a program that loads 10 integers and then stores them in the Numbers Class, which also contains a method for calculating the arithmetic mean of the numbers entered.
4. Create a program that creates two classes. Superclass Employee contains salary data = 50000 as a real number. The Developer subclass contains the additional data bonus = 20000 as an integer.
5. Create a program that enrolls new students in an already created student.txt file and has the ability to read data about an individual student.
6. Design and develop a calculator program (simple mathematical operations - addition, subtraction, multiplication, division, remainder) with a graphical user interface

[2] 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

- Allen B. Downey (2011.), Think Java (How to Think Like a Computer Scientist), Needham, Massachusetts, https://greenteapress.com/thinkapjava/thinkapjava.pdf
- E-course teaching materials available on the Merlin e-learning system (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)	available for free	15
E-course teaching materials available on the Merlin e-learning system	available for free	15

1.13. Quality Assurance

The quality of study is continuously observed under the ISO 9001 system and following European standards and guidelines for quality assurance implemented at the Faculty of Maritime Studies, University of Rijeka. An analysis of the exams is given annually, and a survey among students is conducted by the semester.

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Generic information		
Head of Course	Ph.D. Jasmin Ćelić, assistant professor	
Course	Internet of Things	
Study Programme	Marine Electronic Engineering and Information Technology	
Type of Course	Compulsory course	
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

Acquiring knowledge about the principles of operation and design of smart devices, technologies for their networking, application development, security issues and principles of data processing within IoT networks. Enabling students to network smart devices, implement different platforms and intelligent environments and work on developing solutions for different areas of application of IoT technology.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

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

1. Identify the basic concepts and features of the Internet of Things
2. Choose the appropriate Internet of Things architecture
3. Distinguish approaches in the implementation of IoT solutions
4. Distinguish 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, models and ways of communication, 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 areas of application. The Internet of Things in industry and shipping.

1.5. Modes of Instruction

☒ Lectures	☒ Practical work
☐ Seminars and workshops	☐ Multimedia and Network
☒ Exercises	☒ Laboratory
☐ E-learning	☐ Mentorship
☐ Field work	☐ Other _____

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1.6. Comments	

1.7. Student Obligations

1st colloquium, 2nd colloquium, final exam.

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper		Experiment	
Written exam	1	Oral exam	0.5	Essay		Research	
Project		Continuous Assessment	1	Presentation		Practical work	0.5
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 Regulations on Studies at the Faculty of Maritime Studies in Rijeka as follows:

- 70% of acquired learning outcomes are evaluated through continuous testing of knowledge during classes:
  through the 1st colloquium - learning outcomes 1.-3. (30%), 2nd colloquium - learning outcomes 4.-6. (30%); while a student after each colloquium must realize a minimum of 50% of points;
- at the final part of the exam, 40% of the acquired learning outcomes are evaluated (1-6), whereby the student must realize a minimum of 50% of points to pass the final exam;
- final ECTS grade, is defined on the basis of the achieved total% of knowledge, skills and competencies and numerical grade after the final / remedial exam as follows:
  - grade excellent (5) corresponds to grade A in the ECTS scale and a success rate of 90 to 100%,
  - a grade of very good (4) corresponds to a grade of B on the ECTS scale and a success rate of 75 to 89.9%,
  - grade good (3) corresponds to grade C in the ECTS scale and a success rate of 60 to 74.9%,
  - a grade of sufficient (2) corresponds to a grade of D on the ECTS scale and a success rate of 50 to 59.9%,
  - the grade insufficient (1) corresponds to the grade F in the ECTS scale and the success rate from 0 to 49.9%.

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

1. List the technologies that enabled the development of the Internet of Things? (IU # 1)
2. What is I2C and for what purpose is it used? (IU # 2)
3. What is the difference between Cloud and EDGE IoT solutions? (IU # 3)
4. What are the limitations of the IEEE 802.15.4 standard? (IU # 4)
5. What security threats are identified as the most significant in IoT solutions? (IU # 5)
6. What classes of smart IoT objects are defined in RFC7228? (IU # 6)

1.10. Main Reading

- Cirani, S., Ferrari, G., Picone, M., Veltri, L. (2019.). Internet of Things: Architectures, Protocols and Standards, 1st edition, Wiley, Hoboken, NJ, USA
- Ćelić, J. (2021.). Internet of Things, authorized lectures, Faculty of Maritime Studies, University of Rijeka, Rijeka, Croatia

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

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 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.

[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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Generic information			
Head of Course	Sanjin Valčić, Ph.D.; Zoran Mrak, Ph.D.		
Course	Application of maritime radiocommunication systems		
Study Programme	Marine Electronic Engineering and Information Technology		
Level	Graduate degree		
Type of Course	Mandatory		
Year of Study	1.	II. semester	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		5
	Number of Hours (L+E+S)		2+0+2

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

1. Explain the basic features of VHF Data Exchange System, GSM and HF Data radiocommunication systems in maritime communications.
2. Understand, differentiate and analyze the ways of multiple access to channels and the specifics of signal modulation in maritime digital terrestrial communication systems.
3. Define and understand the working principle of UHF and SHF internal ship communications.
4. Argue the possibilities of applying 5G technologies in coastal navigation areas.
5. Evaluate the parameters of satellite connection and analyze the structure of satellite communication systems used onboard vessels.
6. Recognize and understand the basic characteristics of satellite very small aperture terminals (VSAT), as well as the calculation of the communication link (uplink and downlink).
7. Explain and analyze the basic features and specifics of maritime SSAS and LRIT systems.
8. Identify the challenges of global coverage of satellite communications systems.

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 class attendance (lectures and seminars), taking midterms, submitting project assignment and taking the 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	1	Continuous Assessment	1	Presentation		Practical work	
Portfolio							

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

The 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:

- *through continuous assessment during the course the 70% of the acquired learning outcomes are evaluated: through 1st midterm - learning outcomes 1-4 (20%), 2nd midterm - learning outcomes 5-8 (20%); the student must have completed at least 50% of points in each midterm, and project task (30%),*
- *at the final part of the exam 30% of the acquired learning outcomes (1-8) are evaluated, with the student having to pass a minimum of 50% of points for passing the final exam.*

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

1. Explain the difference between VDE, ASM and AIS data exchange in VDES systems.
2. State the difference between SOTDMA and CSTDMA multiple access.
3. Explain the infrastructure of modern UHF systems in ship's internal communications.
4. Explain the potential applications of 5G technology in maritime communications.
5. Calculate the received signal power at the receiver of the INMARSAT's earth station Burum, if the satellite transmits 46 dB of EIRP.
6. Argue the basic advantages of using maritime satellite very small aperture terminals (VSAT).
7. Analyze in detail and explain the features and specifics of the LRIT system.
8. Is it possible and with which communication system to establish a reliable connection for the Internet Protocol in Antarctica? Explain your answer.

1.10. Main Reading

- Teaching material on the e-learning system Merlin (https://moodle.srce.hr)
- Recommendation ITU-R M.1174-4: Technical characteristics of equipment used for on-board vessel communications in the bands between 450 and 470 MHz, online publication
- Recommendation ITU-R M.1798-1: Characteristics of HF radio equipment for the exchange of digital data and electronic mail in the maritime mobile service, online publication
- Recommendation ITU-R M.2092-0: Technical characteristics for a VHF data exchange system in the VHF maritime mobile band, online publication

- LRIT Technical documentation Part I: MSC.1/Circ.1259/Rev.5, online publication
- LRIT Technical documentation Part II: MSC.1/Circ.1294/Rev.3, online publication
- David Tse, Pramod Viswanath (2005.), Fundamentals of Wireless Communication, Cambridge University Press, https://web.stanford.edu/~dntse/wireless_book.html

1.11. Recommended Reading

- Recommendation ITU-R M.2135-0: Technical characteristics of autonomous maritime radio devices operating in the frequency band 156-162.05 MHz
- 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)

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Teaching material on the e-learning system Merlin	-	30
Recommendation ITU-R M.1174-4: Technical characteristics of equipment used for on-board vessel communications in the bands between 450 and 470 MHz, online publication	-	30
Recommendation ITU-R M.1798-1: Characteristics of HF radio equipment for the exchange of digital data and electronic mail in the maritime mobile service, online publication	-	30
Recommendation ITU-R M.2092-0: Technical characteristics for a VHF data exchange system in the VHF maritime mobile band, online publication	-	30
LRIT Technical documentation Part I: MSC.1/Circ.1259/Rev.5, online publication	-	30
LRIT Technical documentation Part II: MSC.1/Circ.1294/Rev.3, online publication	-	30
David Tse, Pramod Viswanath (2005.), Fundamentals of Wireless Communication, Cambridge University Press, https://web.stanford.edu/~dntse/wireless_book.html	-	30

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.

[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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Generic information		
Head of Course	Ph.D. Jasmin Ćelić, assistant professor; Ph.D. Marko Valčić, associate professor	
Course	Decision Support Systems	
Study Programme	Marine Electronic Engineering and Information Technology	
Type of Course	Elective course	
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 aim of the course is to acquire knowledge in the field of development of the decision-making systems that include computer processing and data analysis, data modeling, detection and accumulation of knowledge, and application of the decision-making process.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

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

1. Discuss the decision-making process and analyze the basic elements and structure of different decision-making support systems.
2. Discuss methods and tools to build certain components of the decision support system.
3. Connect different warehouses and sources of data with the analytical components of the decision support system.
4. Discuss the problem of the preparation and processing of input data and on the basis of the same offer appropriate solutions.
5. In accordance with the set criteria, select and apply the appropriate methods for modeling with data in at least one program system (eg MATLAB, Python, R, etc.).
6. Declare mathematical and computerized (program) characteristics of selected methods from theoretical and application aspect.
7. Present the results and the possibilities of developed models in the context of decision-making, and examine their reliability.
8. Compare and discuss different approaches to addressing decision-making issues.

1.4. Course Outline

The decision-making process. Basic elements and architecture of the decision support system. The process of building a decision support system. Methods and tools for building a decision support system. Analytical Information Systems. Bases and other data warehouses. Dimensional modeling. Systems for multivariate analytical data processing. Visualization of results. Knowledge detection procedures in data sets. Program systems and program support. Loading data. Preparation and processing of data. Methods and Techniques of Data Analysis: Computer Statistics, Operational Research, Quantitative Methods, Machine Learning,

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Computer Intelligence, Optimization. Linear and nonlinear regression. Classification. Linear and nonlinear programming. Presentation of discovered knowledge and decision-making based on developed models.		
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	The final exam can be held in written and / or oral form.	

1.7. Student Obligations

project, 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	1	Continuous Assessment	1	Presentation		Practical work	
Portfolio							

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

The 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:

- Through the continued verification of knowledge within the mentoring work, and the independent work of the student on the project task, 70% of the acquired learning outcomes are valued:
  - Independent and mentoring work related to the overcoming of the selected program system and the implementation of selected methods for the development of certain component systems with the program code discussion - learning outcomes 3.-5. (35%),
  - Preparation of project assignment in the form of seminar work, presentation and public defense of project assignment, issues and discussion - learning outcomes 6-8. (35%),
    Note: Of the total number of points related to project task activities, the student must realize at least 50% of the points;
- 30% of the acquired learning outcomes (1-8) are valued on the final part of the exam, where the student for the passage on the final exam must realize at least 50% of the points;
- final ECTS grade, is defined on the basis of the achieved total% of knowledge, skills and competencies and numerical grade after the final / remedial exam as follows:
  - grade excellent (5) corresponds to grade A in the ECTS scale and a success rate of 90 to 100%,
  - a grade of very good (4) corresponds to a grade of B on the ECTS scale and a success rate of 75 to 89.9%,
  - grade good (3) corresponds to grade C in the ECTS scale and a success rate of 60 to 74.9%,
  - a grade of sufficient (2) corresponds to a grade of D on the ECTS scale and a success rate of 50 to 59.9%,
  - the grade insufficient (1) corresponds to the grade F in the ECTS scale and the success rate from 0 to 49.9%.

Examples of Evaluation of Learning Outcomes Compared to the set Learning Outcomes are:

Example of project assignment:

In the Matlab or Python program system, develop a system component to make a diagnostic decision in the context of whether the patient has benign or malignant breast cancer. The necessary input and target data can be found at:

https://www.kaggle.com/uciml/breast-cancer-wisconsin-data or na

https://archive.ics.uci.edu/ml/datasets/breast+cancer+wisconsin+(diagnostic).

Within the project task it is necessary to make the following:

- realize data collection from Internet sources directly from the program code, ie without the use of an Internet browser, and preview of the .csv, .xls or .xlsx format (LO 1.3.3)
- make program to address cell problems in which undefined values (NAN), as well as missing data problems (LO 1.3.4)
- make a division of the available data set to appropriate training and test subgroups, and create at least three classification models based on the available data using standard methods of machine learning (logistic regression, decision tree, K-NN, etc.) (LO 1.3.5)
- present the theoretical substrate of selected methods, and link mathematical expressions with program code (LO 1.3.6)
- analyze and interpret the possibilities of developed classification models using ROC curves and values in confusion matrix (LO 1.3.7)
- apply developed classification models on new data, discuss the results obtained, and on the basis of them to provide recommendations to select the most favorable method from the set of used methods (LO 1.3.8)

Example of questions from the final (oral) exam:

1. Describe and discuss the decision-making process. (LO 1.3.1.)

2. Justify the possibilities and restrictions on the application of linear and nonlinear programming in the context of the optimal decision. How does the mathematical nature of the function of the target and different possible restrictions affect the selection of the above methods? (LO 1.3.2)

1.10. Main Reading

- Valčić, M., Panić, I. (2020). Sustavi za podršku odlučivanju. Autorizirana predavanja. Sveučilište u Rijeci, Pomorski fakultet, Rijeka, Hrvatska. Dostupno na: https://moodle.srce.hr (Merlin)
- Sharda, R., Delen, D., Turban, E. (2020). Analytics, Data Science, & Artificial Intelligence: Systems for Decision Support, 11th Ed. Pearson Education, Hoboken, NJ, USA.

1.11. Recommended Reading

- Shmueli, G., Bruce, P.C., Gedeck, P., Patel, N.R. (2020). Data Mining for Business Analytics: Concepts, Techniques and Applications in Python. John Wiley & Sons, Hoboken, NJ, USA.
- Pasqual, D.G. (2015). Artificial Intelligence Tools: Decision Support Systems in Condition Monitoring and Diagnosis. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
- Messac, A. (2015). Optimization in Practice with MATLAB: For Engineering Students and Professionals. Cambridge University Press, New York, NY, USA.
- The MathWorks, (2020). Statistics and Machine Learning Toolbox: User's Guide. The MathWorks, Inc. Available online: https://uk.mathworks.com/help/stats/index.html
- Beale, M.H., Hagan, M.T., Demuth, H.B. (2020). Deep Learning Toolbox: User's Guide. The MathWorks, Inc. Available online: https://uk.mathworks.com/help/deeplearning/index.html

- The MathWorks, (2020). Optimization Toolbox: User's Guide. The MathWorks, Inc. Available online: https://uk.mathworks.com/help/optim/index.html

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Valčić, M., Panić, I. (2020). Sustavi za podršku odlučivanju. Autorizirana predavanja. Sveučilište u Rijeci, Pomorski fakultet, Rijeka, Hrvatska. Dostupno na: https://moodle.srce.hr (Merlin)	Web (e-kolegij na sustavu Merlin)	15
Sharda, R., Delen, D., Turban, E. (2020). Analytics, Data Science, & Artificial Intelligence: Systems for Decision Support, 11th Ed. Pearson Education, Hoboken, NJ, USA.	2	15

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.

[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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Generic information			
Head of Course	**Marko Gulić**		
Course	**Algorithms and data structures**		
Study Programme	**Marine Electronic Engineering and Information Technology**		
Level	Graduate degree programme		
Type of Course	Core		
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 knowledge of the most widely used algorithms (search and sort) and data structures (linked list, circular linked list, row, stack, edited binary tree) and advanced programming techniques (recursion, dynamic programming). The objective of the course is to train students to develop more complex and sophisticated programs.

1.2. Prerequisites for Course Registration

1.3. Expected Learning Outcomes

After passing the exam, students will be able to do the following:
1. Describe the use of different data structures and algorithms
2. Evaluate the complexity of the algorithms
3. Develop a computer program in which the appropriate sorting algorithm will be implemented
4. Develop a computer program in which the appropriate search algorithm will be implemented
5. Recognize the application of an appropriate data structure to solve a specific problem and develop a computer program
6. Develop a computer program using the required advanced programming technique

1.4. Course Outline

Sorting algorithms. Search Algorithms. An introduction to pointers. Dynamic memory allocation. Pointers and dynamic arrays. Pointers and linked lists. Doubly linked lists. Circular List, Multiple Linked Lists. Stack and Queue. Trees. Binary trees. Recursion. Dynamic programming. Selected algorithms.

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

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1.6. Comments	Teaching is carried out by combining classroom work and individual work in the computer lab. Students will be instructed to use the e-learning system when enrolling in the course. A detailed schedule of lectures and exercises will be published in the implementation plan.

1.7. Student Obligations

- Regularly attend classes (lectures and exercises) and take short tests at the beginning of each exercise
- Write 1st and 2nd intermediate exam (colloquium)
- Pass the final (oral) exam if the criteria for admission are met.

1.8. Assessment[3] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper	Experim ent	
Written exam		Oral exam	1.5	Essay	Researc	
Project		Continuous Assessment	1.5	Presentation	Practical	
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:

- 70% of the acquired learning outcomes are evaluated through continuous knowledge assessment during the teaching process: through the 1st intermediate exam (colloquium) - learning outcomes 3-4 (30%), 2nd intermediate exam (colloquium) - learning outcomes 5-6 (30%), weekly short tests before exercises - learning outcomes 1-6 (10%); a student must have completed a minimum of 50% points in each intermediate exam (colloquium)
- 30% of the acquired learning outcomes (1-4, 6) are evaluated at the final (oral) part of the exam, with a minimum of 50% of available points necessary for passing the final exam.

Examples of evaluating learning outcomes respecting set learning outcomes are:

1. In the example given, describe how the selection sort algorithm works
2. Explain the time complexity of the insertion sort algorithm
3. Create a program that loads a series of integers from the field.txt file and sorts that string using selection sort
4. Create a binary search program for the sorted array of integer data contained in the sort.txt file
5. Choose to apply the appropriate data structure for the given programming problem and implement it programmatically.
6. Design and write a recursive function to calculate the factorial of a given number

1.10. Main Reading

- Julijan Šribar, Boris Motik: Demistificirani C++, Dobro upoznajte protivnika da biste njime ovladali, Element, Zagreb, 2001.
- E-course teaching materials available on the Merlin e-learning system (https://moodle.srce.hr)

[3] 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

- Stanley B. Lippman, Josée Lajoie, Barbara E. Moo: C++ Primer, 5th Edition, Addison-Wesley Professional, 2013
- Adam Drozdek: Data Structures and Algorithms in C++, Course Technology, 2000.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Julijan Šribar, Boris Motik: Demistificirani C++	2	25
E-course teaching materials available on the Merlin e-learning system	-	25

1.13. Quality Assurance

The quality of study is continuously observed under the ISO 9001 system and following European standards and guidelines for quality assurance implemented at the Faculty of Maritime Studies, University of Rijeka. An analysis of the exams is given annually, and a survey among students is conducted by the semester.

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Generic information			
Head of Course	Associate proffesor Biserka Draščić Ban, PhD		
Course	Statistics		
Study Programme	Marine Electronic Engineering and Information Technology		
Level	Undergraduate 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 differe 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.

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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

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							

1.9. 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%?

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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

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

6. 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

[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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Generic information			
Head of Course	Doc. dr. sc. Jasminka Bonato		
Course	Reliability and safety of technical systems		
Study Programme	Electronic and Information Technology in Navigation		
Level	graduate		
Type of Course	obligatory		
Year of Study	1.		
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		5
	Number of Hours (L+E+S)		30+15+0 (2+1+0)

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

To present and approximate the basic ideas of reliability theory; determination of component (system) reliability; mathematical modeling of the reliability of technical systems.

1.2. Prerequisites for Course Registration

Completed course;“Applied Mathematics“

1.3. Expected Learning Outcomes

1. Describe the basic magnitudes of reliability theory.
2. Analyze different configurations of technical systems.
3. Application in solving the problems in the theory of reliability and availability of various configurations of technical systems.
4. Describe the possibilities of application of the theory of reliability in technology and technology.
5. Analyze scientific articles dealing with methods of safety of technical systems

1.4. Course Outline

Baseline concepts relevant to the field of reliability of technical systems. Component reliability (fault density, fault frequency. Reliability, mean failure time). Component reproducibility (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 parallel-serial and serial-parallel configuration systems. Reliability of the "k of m" configuration system. Reliability of non-renewable systems with interdependent components. Reliability of standby system. Reliability of a renewable parallel configuration system.
Reliability of a back-up renewable system. Availability of a renewable one-component system. Availability of a renewable parallel configuration system. Availability of a back-up renewable system. Reliable design of technical systems.FMEA. Design and security of technical systems.

1.5. Modes of Instruction

☒ Lectures	☐ Practical work
☐ Seminars and workshops	☐ Multimedia and Network
☒ Exercises	☐ Laboratory
☒ E-learning	☐ Mentorship
☐ Field work	☒ Homework

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1.6. Comments	

1.7. Student Obligations

Regular attendance at classes, passing exams that qualify students for the final or remedial exam, depending on their achievement in the written parts of the exam.

1.8. Assessment[4] of Learning Outcomes

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

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

70% during class (attendance records + continuous assessment + homework) and final exam 30%.

1.10. Main Reading

1. Notes from lectures and exercises
2. A. Kraš, J. Bonato, B.Draščić Ban, Reliability and Availability of digital systems, Faculty of Maritime Studies , Rijeka, 2017.
3. J. Bonato, Reliability and safety of technical systems, Textbook, e-edition, Faculty of Maritime Studies , Rijeka, 2019.
4. V.Mikuličič, Z.Šimić: „Reliability, Availability and Risk Models in the Power System: Part 1 Analytical Methods for Reliability and Availability Calculation“, Kigen, Zagreb, May, 2008.
5. N. Elezović: Fourier order and integral Laplace's Transformation, School Boo, Zagreb

1.11. Recommended Reading

1. Charles E. Ebeling. Reliability and Maintainability Engineering Waveland Pr Inc; 2 Har/Cdr edition (December 8, 2009)
2. B.S.Dhillon: Reliability, Quality and Safety for Engineers, *CRC PRESS*, Florida, 2005.
3. D.J. Smith: Reliability, Maintainability and Risk, *Elselvier,* United Kingdom, 2005.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
A. Kraš, J. Bonato, B.Draščić Ban, Reliability and Availability of digital systems, Faculty of Maritime Studies , Rijeka, 2017.	5	20
N. Elezović: Fourier order and integral Laplace's Transformation, School Boo, Zagreb	1	

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.

[4] 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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Generic information			
Head of Course	Božidar Kovačić		
Course	Business Information 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)		2+1

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The aim of the course is to get acquainted with the concept and operation of business information systems. Students are introduced to the basic methodologies of building information systems to the extent that they can identify problems and propose concepts for building information systems. Students will model business processes using business process analysis and modeling applications to be able to integrate functionally

1.2. Prerequisites for Course Registration

None

1.3. Expected Learning Outcomes

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

1. Explain the types and divisions of business information systems
2. Explain the stages of construction and methods of development of business information systems
3. Design and graphically present a specific process model and incorporate other elements of the process model: product, elements of organization (hierarchy), entities, etc.
4. Comment on the principles of information security in business information systems
5. Explain the organizational structure of the enterprise resource management system (ERP)
6. Create a prototype of a business information system

1.4. Course Outline

1. Introduction to the program, basic concepts of business information system
2. Information systems: structure, tasks, functions and features
3. The meaning and functioning of IS in business system management
4. Information systems for decision support: decision making, concept, goals, models, group support
5. Information system and business system: vertical and horizontal levels, ways of support and data integration
6. Stages of information system development, information system process and data modeling, information systems security.
7. Application of commercial applications for analysis and modeling of business processes

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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

1st and 2nd knowledge test (theory), 1st knowledge test of exercises, final exam

1.8. Assessment[1] of Learning Outcomes

Course attendance	2	Class participation		Seminar paper		Experiment	
Written exam	1	Oral exam		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 takes place 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:

1. 70% of acquired learning outcomes are evaluated through continuous assessment during classes through the 1st knowledge test - learning outcomes 1-4 (20%), 2nd knowledge test - learning outcomes 5-6 (20%), 1st knowledge test from exercises - learning outcomes 1-4, 6 (30%); the student must realize a minimum of 50% of points for each knowledge test.
2. At the final part of the exam, 30% of the acquired learning outcomes are evaluated (1-6), whereby the student must realize a minimum of 50% of points in order to pass the final exam.

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

1. At the written exam, the student states the types of business information systems with an explanation of the basic tasks of information systems (1).
2. In the written exam, the student breaks down the development of the information system into phases, and explains the methods of developing business information systems (2).
3. The student in the written exam designs graphic representations of a specific process model: product, elements of organization (hierarchies), entities, etc. (3)
4. The student on the written exam identifies the mechanisms of security and protection of the business information system (4).
5. At the written exam, the student argues the meaning and functioning of IS in business system management (5).
6. In the written exam, the student justifies the role of the decision support information system with explanations of the decision-making process, decision-making goals and decision-making models (5).
7. A student in homework designs, designs and builds a prototype of a business information model. (3.6)

1.10. Main Reading

4. M. Pavlić: Informacijski sustavi, Školska knjiga, Zagreb, 2011.

1.11. Recommended Reading

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

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1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Informacijski sustavi	4	25

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 exams is made annually, and once a semester a survey is conducted among students.

[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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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	Semester	3rd
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.

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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 (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 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:

9. Define ship operational and information technologies.
10. Define shipboard critical systems and assets.
11. Explain maritime cyber security regulations and standards.
12. Explain working principles of basic attack techniques.
13. Explain working principles of the firewall.
14. Explain working principles of the anti-virus protection.
15. Explain working principles of the data cryptography.
16. Explain working principles of the VPN.
17. Explain working principles of the cyber security testing.
18. 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).

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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., Kamahara, J., Rooks, M., Yano, Y. (2019). Maritime Cyber Risk Management: An Experimental Ship Assessment. Journal of Navigation	1	13

1.4. Quality Assurance

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.

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Generic information			
Head of Course	Prof. Irena Jurdana, PhD		
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

Acquire knowledge on the basic features of fiber optic communication networks and systems. Ability to independently perform measurement of the fundamental transmission parameters of fiber optic transmission systems, use of basic measurement instruments, and basic maintenance of fiber optic systems. Ability to independently plan and design fiber optic networks.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

1. Describe and understand the physical phenomena of light propagation
2. Analyse the types of optic fibers and cables
3. Understand the attenuation and dispersion effects
4. Indicate passive and active optical components
5. Analyse the types and application of fiber optic transmission systems
6. Describe methods and instrumentation for measurements on fiber optic systems
7. Compare and distinguish the reliability and availability of the fiber optic network
8. Describe the types and use of optical sensors

1.4. Course Outline

History of optical communication. Introduction in physical definition and principal laws of optics. Optical transmission systems – elements, production, parameters. Fibers and cables types, production and application. Application of fiber optics in telecommunications. Planning and constructing optical cable transmission systems. Measurement of optical parameters, definition and test methods for the relevant parameters of optical systems, measurement equipment. Availability and reliability of optical network. Mathematical availability models of network. Trends in optical network domain: WDM, DWDM, PON, FTTx. Optical sensors. Submarine optical network systems.

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

Regular attendance to lectures, to 1st and 2nd mid-term exam, presentation of exercises in the practical work session, 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							

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

The process of evaluating acquired learning outcomes is based on the regulation on University of Rijeka Studies and the regulation on Studying at the Faculty of Maritime Studies in Rijeka as follows:

• Through continuous assessment of knowledge during the course, 70% of the learning outcomes gained through the 1st mid-term exam - learning outcomes 1-4 (25%), 2nd mid-term exam - learning outcomes 5-8 (25%) are valued, including presentation of the practical task - learning outcomes 1-8 (10% in each mid-term exam); the student must achieve at least 50% points for each mid-term exam.

• 30% of the learning outcomes (1-8) are evaluated in the final part of the exam (oral), with the student passing the final exam at least 50% of the points.

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

1. Define and understand the physical phenomena of light propagation
2. Analyse the types of optic fibers and cables
3. Identify and interpret different attenuation and dispersion impacts
4. Indicate passive and active optical components
5. Analyse the types and application of fiber optic transmission systems
6. Describe and explain methods and instrumentation for measurements on fiber optic systems and show measurement results in graphic and numeric form
7. Understand the methods of mathematical modeling of fiber optic networks
8. Explain the use of optical sensors.

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. Reading material available on e – learning system - 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. Reading material available on e – learning system - Merlin (https://moodle.srce.hr)

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
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, Element, Zagreb, 2007.	1	20
Bažant, A. i dr.: Osnovne arhitekture mreža, Element, Zagreb, 2014.	1	20
Reading material available on e – learning system - Merlin (https://moodle.srce.hr)	-	20

1.13. Quality Assurance

The quality of the study is constantly monitored in accordance with the ISO 9001 system implemented at the Faculty of Maritime Studies in Rijeka. An analysis of exams is made annually, and once in semester is conducted by anonymous student evaluation of teaching.

[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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Generic information			
Head of Course	Prof. dr. sc. Vinko Tomas		
Course	New Technologies in Diagnostics and Control Systems		
Study Programme	Marine Electronic Engineering and Information Technology		
Level	Graduate degree programme		
Type of Course	Core		
Year of Study	2nd	3rd	
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

This course is intended to provide the students with knowledge in design and implementation of new technologies and techniques in diagnostics and automatic process control and also its application on ships.

1.2. Prerequisites for Course Registration

-

1.3. Expected Learning Outcomes

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

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

1.4. Course Outline

Introductions in diagnostics and automatic process control with fault tolerance. Features of diagnostic systems. Organization of the diagnostic process. Techniques of structural and functional diagnostics. Diagnostics in computer control systems. Techniques of fault tolerance in diagnostic system, redundancy management, redundancy in diagnostic system (hardware, information, software and time). Diagnostic system evaluation methods. Influence of diagnostics on reliability and safety of controllers of marine electrical machines and devices. New techniques in sensor signal processing. Examples of the application of new technologies on ship systems and processes, and more widely in maritime affairs.

1.5. Modes of Instruction

☒ Lectures	☒ Practical work
☐ Seminars and workshops	☐ Multimedia and Network
☒ Exercises	☒ Laboratory
☐ E-learning	☐ Mentorship
☐ Field work	☐ Other _____

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1.6. Comments	

1.7. Student Obligations

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							

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

The procedure for evaluating the acquired learning outcomes takes place 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 colloquium - learning outcomes 1-4 (25%), 2nd colloquium - learning outcomes 5-8 (25%), presentation of the research task (seminar) - learning outcomes 1-8 (20%); the student must achieve a minimum of 50% of points for each colloquium, while the presentation of the research task is evaluated on the basis of elaborated assessment criteria;
- at the final part of the exam, 30% of the acquired learning outcomes are evaluated (1-8), whereby a student must pass a minimum of 50% of points in order to pass the final exam.

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

1. State and explain the characteristics of diagnostic systems
2. Draw and explain for different means the scheme of organization of the diagnostic process
3. In the technique of structural diagnostics when ATE and when BITE concept is applied in computer control system
4. Explain the application of functional diagnostics for a real-time control system
5. Explain for the system shown in the figure the error handling in a redundant pair
6. Calculate diagnostics (probability of correct diagnostics in a distributed diagnostic system)
7. Reliability of a redundant system with cold and hot reserve as a function of error coverage (Cd)
8. List the techniques for analyzing the condition of the ship's propulsion systems, when it is applied and for which condition

1.10. Main Reading

1. V. Tomas, New technologies in diagnostics and management, authorized lectures (textbook in preparation), Faculty of Maritime Studies, University of Rijeka, academic 2020/2021.
2. Teaching material for e-course exercises available on the e-learning system - Merlin

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.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
V. Tomas, New technologies in diagnostics and management, authorized lectures, Faculty of Maritime Studies in Rijeka, 2019, available on the e-learning system - Merlin	e- learning/Merlin	25

Teaching materials for exercises, e-course available on the e-learning system - Merlin	e- learning/Merlin	25

1.13. Quality Assurance

Quality assurance is based on Faculty ISO 9001 system. Yearly analyze is produced based on quantitative student examination data, and qualitative based on student survey derived at the end of each 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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Generic information			
Head of Course	prof. dr. sc. Vinko Tomas and prof. dr. sc. Marko Valčić		
Course	Automatic Control of Marine Vessels		
Study Programme	Marine Electronic Engineering and Information Technology		
Level	Graduate degree programme		
Type of Course	Elective		
Year of Study	2nd	3rd	
Estimated Student Workload and Methods of Instruction	ECTS coefficient of Student Workload		5
	Number of Hours (L+E+S)		30+30+0 (2+2+0)

1. GENERAL COURSE DESCRIPTION

1.1. Course Objectives

The aim of the course is to acquire knowledge of the principles and techniques in the guidance, navigation and control of marine vessels with special emphasis on marine autopilots, dynamic positioning systems and propulsion control systems.

1.2. Prerequisites for Course Registration

None.

1.3. Expected Learning Outcomes (LO)

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

1 Discuss the notation characteristic of the area of vessel guidance and control and interpret the application of individual reference frames and vessel motion in six degrees of freedom.
2 Derive a model of kinematics and dynamics of vessels in the horizontal plane, and explain how and why these models are used in the guidance and control of vessels.
3 State and explain in detail the models of environmental loads and discuss how certain external disturbances are treated in vessel control systems.
4 Describe the structure of the system for dynamic positioning and interpret the meaning and purpose of individual parts of the system.
5 Discuss the applications of estimators in marine control systems (adaptive autopilots, dynamic positioning), with special reference to the Kalman filter (possibilities, applications, advantages, disadvantages).
6 Explain the feedback loop of a multivariable controller with feedforward control, with special reference to applications in adaptive autopilots and in dynamic positioning systems.
7 Compare and discuss different approaches in solving the problem of thrust allocation.
8 Analyse and explain concepts for propulsion control.

1.4. Course Outline

Definitions, basic features and principles of guidance, navigation and control of marine vehicles. Structure of ship control systems (autopilots, dynamic positioning). Notation and reference frames. Modelling of surface vessels (kinematics, dynamics). Environmental load models (wind, waves, sea currents). Models of thruster units (ship propeller without and in nozzle, azimuth thrusters). Thrust allocation. Propulsion control. Advanced methods of guidance and control of marine vessels (optimal, adaptive, unmanned remote control). Adaptive autopilots. Dynamic positioning systems. Integrated navigation systems. Autonomous navigation and autonomous maritime systems and facilities. Development trends and perspectives.

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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	The final exam can be held in written and/or oral form.	

1.7. Student Obligations

1st midterm exam, 2nd midterm exam, 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							

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

The procedure for evaluating the acquired learning outcomes takes place according to the Regulations on Studies of the University of Rijeka and the Regulations on Studying at the Faculty of Maritime Studies in Rijeka as follows:

- 70 % of acquired learning outcomes are evaluated through continuous testing of knowledge during classes:
  - Through the 1st midterm exam - learning outcomes 1-4 (35 %),
  - Through the 2nd midterm exam - learning outcomes 5-8 (35 %),

  where the student must realize a minimum of 50 % of points for each colloquium;
- at the final part of the exam, 30 % of the acquired learning outcomes are evaluated (1-8), whereby the student must realize a minimum of 50 % of points to pass the final exam;
- final ECTS grade is defined on the basis of the achieved total % of knowledge, skills and competencies and numerical grade after the final/remedial exam as follows:
  - grade excellent (5) corresponds to grade A in the ECTS scale and a success rate of 90 to 100 %,
  - a grade of very good (4) corresponds to a grade of B on the ECTS scale and a success rate of 75 to 89.9 %
  - grade good (3) corresponds to grade C on the ECTS scale and a success rate of 60 to 74.9 %,
  - a grade of sufficient (2) corresponds to a grade of D on the ECTS scale and a success rate of 50 to 59.9 %,
  - the grade insufficient(1) corresponds to the grade F in the ECTS scale and the success rate from 0 to 49.9 %

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

1 Tabulate all six degrees of freedom; indicate the type of motion, the name of the degree in Croatian and English, forces and moments, linear and angular velocities, position and orientation. (LO 1.3.1)

2 Make a sketch for the analysis of the dynamics of the vessel in the horizontal plane. Clearly indicate the position and orientation of the craft, characteristic coordinate systems, characteristic angles and force vectors, and briefly describe all physical quantities of interest. (LO 1.3.2)

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 $\{b\}$ is in CG. The basic dimensions are Loa = 100 m, B = 40 m, H = 10 m and T = 4 m. The density of sea water is ρ_{sea} = 1025 kg/m^3, and of air ρ_{air} = 1.23 kg/m^3. The gyro- compass shows the current heading ψ = 70°, and the anemometer gives 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 $C_X(\gamma_{wind}) = -0.6\cos(\gamma_{wind})$, $C_Y(\gamma_{wind}) = 0.8\sin(\gamma_{wind})$, and $C_N(\gamma_{wind}) = 0.1\sin(2\gamma_{wind})$.
a) Sketch the position of the MOB in relation to $\{n\}$ and plot all characteristic angles and vectors.
b) Express the angle γ_{wind} in terms of β_{wind} and ψ, and calculate it.
c) Calculate the wind load vector $\boldsymbol{\tau}_{wind} = [X_{wind}, Y_{wind}, N_{wind}]^T$ and the resultant wind force. (LO 1.3.3)

4 Sketch the part of the structure of the classical system for dynamic positioning that relates to the thrust allocation. Clearly indicate what enters and what exits each block. (LO 1.3.4)

5 What does estimation refer to in dynamic positioning systems? Describe in detail and discuss the two basic applications of the Kalman filter in vessel control systems. (LO 1.3.5)

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6 DP system control logic:
a) Sketch the control feedback loop of a non-linear multi-variable PID controller with wind feedforward control
b) Clarify the individual blocks, inputs and outputs of each block
c) Define the control vector $\boldsymbol{\tau}_c$, express it by the control law of management and explain it
d) What is wind feed-forward control and what is it used for in a DP system? (LO 1.3.6)
7 Thrust allocation:
a) Explain the thrust allocation process, in particular for a fixed pitch propeller (FPP), and in particular for a variable pitch propeller (CPP)
b) Determine the configuration matrix **B** in the case of three azimuth 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 offer a solution using a pseudo-inverse matrix. (LO 1.3.7)
8 Propulsion control:
a) State the basic characteristics (quantities, terms, units) of the propeller in the nozzle with fixed pitch in open water conditions
b) Sketch 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, with special reference to the operational profile of DP vessels. (LO 1.3.8)

1.10. Main Reading

Valčić, M., Tomas, V. (2020). *Guidance and Control of Marine Vehicles*. Lecture Notes, Faculty of Maritime Studies Rijeka, University of Rijeka, Rijeka, Croatia.
Fossen, T.I. (2011). *Handbook of Marine Craft Hydrodynamics and Motion Control*. John Wiley & Sons Ltd, Chichester, UK.

1.11. Recommended Reading

1. 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
2. Valčić, M. (2020). *Optimization of thruster allocation for dynamically positioned marine vessels*. PhD Thesis. University of Rijeka, Faculty of Engineering, Rijeka.
3. Valčić, M. (2015). *Inteligentna estimacija u sustavima za dinamičko pozicioniranje plovnih objekata*. Doktorska disertacija. Sveučilište u Rijeci, Pomorski fakultet u Rijeci, Rijeka.
4. Mandžuka, S. (2009). *Automatsko upravljanje plovnim objektima*. Sveučilište u Rijeci, Pomorski fakultet u Rijeci, Rijeka.

1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
Valčić, M., Tomas, V. (2020). *Guidance and Control of Marine Vehicles*. Lecture Notes, Faculty of Maritime Studies Rijeka, University of Rijeka, Rijeka, Croatia.	e- learning/Merlin	10
Fossen, T.I. (2011). *Handbook of Marine Craft Hydrodynamics and Motion Control*. John Wiley & Sons Ltd, Chichester, UK.	2	10

1.13. Quality Assurance

Quality assurance is based on Faculty ISO 9001 system. Yearly analyze is produced based on quantitative student examination data, and qualitative based on student survey derived at the end of each semester.

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Generic information			
Head of Course	Miroslav Bistrović		
Course	Testing of ships electrical appliances		
Study Programme	Marine Electronic Engineering and Information Technology		
Level	Graduate		
Type of Course	Electoral		
Year of Study	5		
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

Objectives of the course are to gain fundamental insight and knowledge to test marine electrical appliances.

1.2. Prerequisites for Course Registration

/

1.3. Expected Learning Outcomes

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

1. Describe the basic features of the marine electrical appliance test area.
2. Explain the evaluation and technical and economic aspects of testing marine electrical appliances.
3. Analyze and explain the operation and control modes used during ships electrical testing devices.
4. Explain the conduct of technological testing processes, technical documentation and regulations based on registry requirements.
5. Apply standard testing techniques for marine electrical appliances.
6. To qualify for certification tests at the manufacturer's testing station, in the shipyard during the handover of the ship and during operation.
7. Know how to test the qualities of electrical insulation, grounding, mechanical protection, heating, vibration, idle generators, standalone and parallel operation and tuning protection.
8. Develop the ability to analyze, the ability to learn through team and individual work, and the ability to manage information and present it.

1.4. Course Outline

Introduction to testing ship electrical devices. Safety precautions when testing marine electrical appliances. Presentation and use of technical documentation. General overview and analysis of testing of electrical equipment at the manufacturer's station, during the construction, handover and operation of the ship. Checking the automatic functions of the primary and auxiliary ship systems and the ship's power plant. Regulations, rules and requirements of registers for testing marine electrical devices, systems and their components. Maintenance and record-keeping of spare parts of ship electrical appliances.

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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

1.8. Assessment[1] of Learning Outcomes

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

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

Assessment by conducting two midterm examinations during the class and the final exam
Examples of evaluating learning outcomes with set learning outcomes are:
1) What is a certificate, and what is a document?
2) What information does the test report contain?
3) Clarify the concept of technical specification certificates.
4) The functions of the quality control service include, what?
5) State the standard test environment conditions at the manufacturer's test station.
6) Which ship systems and remote control systems must be subjected to surveillance registry control during their production, testing at the shipyard, on the test navigation and during the handover of ship?
7) What is meant by testing electronics and their components for electromagnetic resistance?
8) Through what is viewed efficacy of product testing at the manufacturer's station viewed?
9) Explain the term polarization index.
10) Explain the definition of probability - penetration of insulation of the test device.
11) The change in cable breakthrough voltage as a function of cable duration is an inverted exponential model. Write the model equation and explain the abbreviations.
12) What standard conditions must the electrical equipment designed for the ship meet?

1.10. Main Reading

- Croatian Register of Shipping, Rules for the Technical Supervision of Naval Ships.
- IEC International Standard.

The program is consistent with the programs of the reference universities:
Gdynia Maritime Academy: Diagnostics Measurement at Electrical Power Systems

1.11. Recommended Reading

- F.Avčin, P. Jereb, Testing of electrical machines.
- W. Nurnberg, Testing Electrical Machines.

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1.12. Number of Main Reading Examples

Title	*Number of examples*	*Number of students*
	Web	22

1.13. Quality Assurance

The method of monitoring the quality of the program is governed by mechanisms which are developed and applied at the institution level (in accordance with ISO 9001 at the Faculty of Maritime Studies.).