

Autumn Semester 2025			
Semester	Course Code	Course Name ENG	ECTS
1	VA2005	Business English	3
1	ME0832	Business Management	6
1	IN4030	Introduction to Programming using Python	9
1	IN4034	Mathematical Foundations for Software Engineering	3
1	IN1013	Internet and Web Basics	6
1	IN4031	API Foundations	3
3	IN4035	Automata Computability and Complexity	6
3	IN4039	Development Process and Tooling Foundations	3
3	IN0679	System and Object-Oriented Programming	6
3	IN1000	Algorithms and Data Structures	3
3	IN4040	Java Development Fundamentals	3
3	IN4038	Computer Networks Architecture and Operating Systems	6
3	VA0402	Spanish	3
3	VA0401	German	3
5	IN1012	Critical Thinking	3
5		Optimization Theory and Large Systems Synergetics	6
5	MA0316		3
7	IN0682	Systems Theory and System Analysis	6
7	IN1004	Information Security, Protection and Cryptography	6
7		Software Engineering and Technologies of Information Systems Design	6
7	IN0648		6
	IN0621	Artificial Intelligence	6

Spring Semester 2026			
Semester	Course Code	Course Name ENG	ECTS
2	HU0237	Environment, Labour and Civil Protection	3
2	HU4008	Business Management: Labour Law	3
2	SD3302	Basics of Project Management	3
2	SD3301	Research Methodology	3
2	IN4034	Mathematical Foundations for Software Engineering	6
2	IN1000	Algorithms and Data Structures	6
2	IN0693	IT Software Project Management	3
4	VA0402	Spanish	3
4	VA0401	German	3
4	IN0698	Advanced Software Development	6
4	IN4038	Computer Networks Architecture and Operating Systems	6
4	IN0698	Advanced Software Development	6
4	SD3402	Course projects II	6
4	IN0682	Systems Theory and System Analysis	3
6			

RNU study course Introduction to Programming using Python

Study program	Information Systems
Amount	9 ECTS=240 ac.hours
Author	Jeļena Čaiko
Preliminary knowledge, Related study courses	
Aim	To supply students with an understanding of the software development basics, and algorithms and make them skillful in Python programming language. To give them understanding and skills in structured and object-oriented programming.
Planned learning outcomes	
Knowledge	1. Explain algorithms design and programming basic principles. 2. Understanding of the main blocks of computer programs. 3. Understanding basic programming constructs: branching, looping, functions, and exception handling. 4. Explains the reasoning behind and basics of the object-oriented approach.
Skills	1. The ability to construct and program algorithms according to the specification in Python language. 2. The ability to construct programs using functions. 3. The ability to apply object-oriented analysis and create programs using defined object-oriented programming hierarchies of objects. 4. Knows how to work with basic data-types like lists, and dictionaries.
Competencies	1. Show the ability to select a programming solution to solve the problem. 2. Show the ability to perform the basic analysis of the complexity of the algorithms to select the best-suited solution.
Literature and other sources of information:	
	1. Paul Barry (2016) Head-First Python, O'Reilly, p.364.

Compulsory reading	- Eric Matthes (2015) Python crash course: a hands-on, project-based introduction to programming, p.514. - Fundamentals of Python programming. 2019. (http://cs.appstate.edu/~rmp/cs5245/pythonbook.pdf)
Recommended	- David Beazley, (2013) Python Cookbook: Recipes for Mastering Python 3 (3rd Edition) - Zed W. Shaw (2017) Learn Python 3 the Hard Way, Addison-Wesley, p.297. - Luciano Ramalho (2015) Fluent Python: Clear, Concise, and Effective Programming (1st Edition) O'Reilly, p.766 - Mark Lutz (2013) Programming Python: Powerful Object-Oriented Programming (5ed). O'Reilly, pp.1600

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Orientation & Introduction Introduction to computers Introduction to programming languages Intro to the Python Using GoogleCollab First program Numeric data types (including FP peculiarities) Variables Indentation Naming conventions	6	3
1	Environment setup Installing Anaconda/Python Working with environments Installing & Working with VSCode Installing and working with JupyterNoteBooks	4	2
2	Expressions and simple datatypes Comments (single-line / multi-line) Basic arithmetics Division Operator precedence Complex arithmetic Binary number manipulation	4	2
2	Branching, Strings, Lists & Loops Conditional statements If, if-else, if-elif, ternary operator Basic string manipulation	6	3

	Formatting strings Special characters		
3	Branching, Strings, Lists & Loops cont'd Loops, break, continue	6	3
3	Data Structures Tuples Lists Sets	6	3
4	Data Structures cont'd Dictionaries Shallow Copy Some operations on lists, dicts	6	3
4	Functions Defining, calling Arguments, default values, scope Returning values Scope & nested functions	4	2
5	Functions cont'd Lambda functions Recursive functions	4	2
6	Data input / output & exceptions Reading user input Files reading/writing Exceptions & program flow	4	2
7	Modules and packages Modules Packages Built-in modules	6	3
8	Debugging pdb Module Commands for debugging	6	3
9	Regular expressions Creating and evaluating Patterns Grouping Searching	6	3
10	Numpy library Installation Basic objects Measuring execution time Useful functions Basic operations with numpy	4	2
11	Introduction to Object-Oriented Programming Class definition/constructor Class methods Overloading	4	2

	Inheritance		
12	Basics of Object-Oriented Programming Intro to OOP design Is-A, Has-A Objects hierarchies Intro to OOP design patterns	4	2
13	Introduction to Test-Driven development. Unit testing Functional testing Short introduction to refactoring	4	2
14	Selected coding problems & practice	4	2
15	Selected coding problems & practice	4	2
16	Projects presentations & exam	4	2
	Total:	96 ac.h	48 ac.h

Description of students' self-studies organization and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	36/48/60	Knowledge, Skills and Competencies: Students studied the core concepts behind Python programming language, the basics of functional programming, OOP.
2. Familiarization with VSCode IDE, development environment setup, main features of Python, its data-types and expressions. Understanding of branching operators and data structures.	36/48/60	Knowledge, Skills and Competencies: Students understand and are able to setup full development environment for Python development and are able to read and explain programming code.
3. Familiarization with functional programming, exceptions mechanisms and their handling, debugging,	36/48/60	Knowledge, Skills, and Competencies: Students understand and can apply techniques beyond ordinary data structures to create

NumPy, and regular expressions.		software according to specifications.
4. Practical Exercises	36/48/60	Knowledge, Skills, and Competencies: Students will be able to create programs according to a specification.
Total:	144/192/240	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected;

	4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Algorithms and Data Structures

Study programme	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Jelena Čaiko
Preliminary knowledge, Related study courses	Basic Python Programming skills
Aim	The purpose of mastering the discipline of choice: the formation and consolidation of knowledge and skills in the use of fundamental algorithms and data structures. This course covers concepts of various data structures like stack, queue, list, tree and graph. Additionally, the course includes idea of sorting and searching.
Planned learning outcomes	
Knowledge	
	1. data structures used to represent typical information objects; 2. basic algorithms and characteristics of their complexity for typical tasks, often encountered and become "classic" in the field of computer science and programming;
Skills	
	1. develop algorithms using the general schemes, methods and techniques for constructing algorithms outlined in the course, choosing suitable data structures for representation information objects; 2. prove the correctness of the compiled algorithm and evaluate the main characteristics of its complexity; 3. experimentally (using a computer) to investigate the effectiveness of the algorithm and program;
Competencies	
	1. skills in the implementation of algorithms and used data structures by means of high-level programming languages;
Literature and other sources of information:	
• Compulsory reading	1.Introduction to algorithms: fourth edition, Cormen, Thomas H.,ISBN-9780262367509, Publisher The MIT Press, Year 2022. 2. John Canning, Alan Broder,Robert Lafore, Data Structures & Algorithms in Python, 1st edition, Published by Addison-Wesley, October 4th 2022. 3.Maurya, Rahul, Data Structures and Algorithms Made Easy with Java: Learn Data Structure using Java in 7 Days: Data Structures and Algorithmic Puzzles for Beginners to Professional, 2020

Recommended	1. John Canning, Alan Broder, Robert Lafore, Data Structures & Algorithms in Python, 1st edition, Published by Addison-Wesley Professional (October 4th 2022) 2. MB Gorzalczany, Evolution of SOMs' Structure and Learning Algorithm: From Visualization of High-Dimensional Data to Clustering of Complex Data, Series: Algorithms 2020-apr 28 vol. 13 iss. 5, 2020 3. Lancia, Giuseppe; Dalpasso, Marcello, A Fast Data Structure for the Representation of Sets of Integers Series: Algorithms 2019-may 01 vol. 12 iss. 5, 2019
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Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to object oriented programming through stacks, queues and linked lists. Basic Data Structures: Arrays, Strings, Stacks, Queues. Asymptotic analysis (Big-O notation)	8	4
2	Dictionaries: skip-lists, hashing, analysis of collision resolution techniques Trees, traversals, binary search trees, optimal and average BST's trees and red-black trees	8	4
3	Tries and pattern matching. Priority queues and binary heaps	8	4
4	Sorting: merge, quick, radix, selection, heap	8	4
5	Introduction to Graphs, Breadth first search and connected components	8	4
6	Depth first search in directed and undirected graphs and strongly connected components	8	4
7	Spanning trees: Prim's and Kruskal's algorithm, union-find datastructure.	8	4
8	Dijkstra's algorithm for shortest path. shortest path tree. Shortest and longest paths in directed acyclic graphs	8	4
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
Stack operations Queue Operations	48/64/80	Knowledge, Skills and Competencies: Write a program to perform PUSH,

		POP, PEEP & CHANGE operations on Stack. Write a program to implement insertion & deletion in a queue
Circular Queue Operations Sorting and searching	48/64/80	Knowledge, Skills and Competencies: Write a program to implement insertion & deletion in a circular queue. Write a program to perform - Selection sort - To sort the given number using bubble sort - Merge sort - Quick sort - Sequential and binary search
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Home works (Self-study work)	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory)	

4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Internet and Web Basics

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Jurijs Šamšins
Preliminary knowledge, Related study courses	Preliminary Knowledge: Before enrolling in this course, students should have: Basic understanding of computers and how to use them: Students should be familiar with how to use a computer, including installing software, managing files, and using an internet browser. Familiarity with the internet: Students should be comfortable using the internet, including browsing websites, using search engines, and understanding basic internet terminology. Basic understanding of programming or scripting languages (such as Python, JavaScript, etc.) would be advantageous but not strictly necessary. Related Study Courses: Advanced Web Development, Cybersecurity Basics Algorithms and Data Structures
Aim	The aim of the "Internet and Web Basics" course is to equip students with a foundational understanding of the functioning and structure of the internet, along with the knowledge of how to design, build, and maintain websites using fundamental web technologies.
Planned learning outcomes	
Knowledge	1. Understanding of Internet Fundamentals: Students will understand how the internet works, including its structure, protocols, and primary services. They will also learn about the domain name system (DNS), internet protocol (IP), and the role of Internet Service Providers (ISPs). 2. Basic Web Technologies: Students will learn the basics of web page creation using HTML (Hypertext Markup Language), how to style these pages with CSS (Cascading Style Sheets), and how to make them interactive using JavaScript. 3. Web Design Principles: Students will gain knowledge about essential web design principles, including usability, accessibility, and responsive design, which ensures web pages render well on a variety of devices and window or screen sizes.

	4.Web Servers and Databases: Students will understand the role of web servers in delivering web content and the basics of databases in storing data for web applications. They will also learn about server-side scripting with an introduction to PHP. 5.Web Security: Students will be introduced to fundamental web security concepts, common web vulnerabilities, and best practices for secure web development. 6.Emerging Web Technologies: Students will gain exposure to the latest trends and technologies in web development, such as AJAX, single-page applications, and web API.
Skills	1.Web Development Skills: Students will learn how to build a basic web page using HTML, style it with CSS, and add interactivity using JavaScript. These are the fundamental skills required for any web development work. 2.Server Interaction: Students will gain skills in setting up a basic web server and interacting with it using HTTP methods. They will also learn how to connect a webpage to a database using server-side scripting, likely with PHP. 3.Responsive Web Design: Students will be able to create web pages that are responsive, meaning they adapt and render well on various devices and screen sizes. This skill is increasingly important as web traffic from mobile devices continues to grow. 4.Web Security Basics: Students will learn to identify common security vulnerabilities in web applications and understand best practices to mitigate these risks. 5.Debugging and Troubleshooting: Students will develop the ability to debug and troubleshoot issues in their web code, an essential skill for any developer. 6. Critical Evaluation of Web Technologies: Students will be able to evaluate and adapt to emerging web technologies, an important skill in the rapidly evolving field of web development.
Competencies	1.Web Development Competency: The ability to apply knowledge of HTML, CSS, JavaScript, and basic server-side scripting to create, style, and add interactivity to web pages. 2.3Problem-Solving Competency: The ability to diagnose and solve problems related to web development, such as debugging code, troubleshooting server issues, or identifying and resolving security vulnerabilities.

	.Adaptability Competency: The capacity to keep up-to-date with and adapt to emerging technologies and trends in the rapidly evolving field of web development. 4.Communication Competency: The ability to effectively communicate technical information, both verbally and in writing. This includes writing clear and maintainable code, documenting work, and explaining technical concepts to non-technical stakeholders. 5.Collaborative Competency: The ability to work effectively in a team, coordinating with others to achieve common goals. This includes understanding the importance of collaboration tools like version control systems in web development. 6.Ethical Competency: An understanding of the ethical considerations in web development, such as respecting user privacy, ensuring accessibility, and acknowledging and mitigating the impact of biases in web design and content. 7.Analytical Competency: The ability to analyze web performance, identify bottlenecks or issues, and propose solutions to improve efficiency and user experience.
Literature and other sources of information:	
Compulsory reading	1. JavaScript: The Definitive Guide: Master the World's Most-Used Programming Language" by David Flanagan (7th Edition, 2020). 2. Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics" by Jennifer Robbins, 5th Edition, 2018. 3. Web Development with Node and Express: Leveraging the JavaScript Stack" by Ethan Brown, 2nd Edition, 2020 4. Mozilla Developer Network (MDN) 5. Web Docs 6. W3Schools.
Recommended	1. You Don't Know JS Yet: Get Started" by Kyle Simpson, 2nd Edition, 2020. 2. Front-End Development Projects with Vue.js" by Guilherme Roma, 2021. 3. Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB" by Azat Mardan, 2nd Edition, 2018. Online resources like: freeCodeCamp, Codecademy, Stack Overflow, and the official documentation for HTML, CSS, and JavaScript are valuable for further learning and problem-solving.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to the Internet Overview of the Internet and its evolution	4	2
2	Understanding IP addresses and DNS Introduction to Internet protocols (HTTP, HTTPS, FTP, SMTP, etc.) Internet services and applications	4	2
3	Introduction to Web Technologies Understanding the World Wide Web	4	2
4	Basics of HTML (HyperText Markup Language) Basics of CSS (Cascading Style Sheets) Introduction to JavaScript	4	2
5	Web Design and Usability Principles of web design	4	2
6	Understanding usability and user experience Accessibility considerations in web design	4	2
7	Web Servers and Hosting Introduction to web servers (Apache, Nginx, etc.)	4	2
8	Domain names and web hosting Basics of server-side scripting with PHP	4	2
9	Databases and Web Applications Introduction to databases (MySQL, PostgreSQL, etc.)	4	2
10	Basics of SQL for web applications Building simple web applications using PHP and MySQL	4	2
11	Introduction to Web Security Understanding web vulnerabilities (Cross-Site Scripting, SQL Injection, etc.)	4	2
12	Basics of secure web development Introduction to HTTPS and SSL certificates	4	2
13	Emerging Web Technologies Introduction to responsive web design and mobile web development	4	2
14	Overview of web APIs and web services Introduction to AJAX and single-page applications	4	2
15	Revision and Exam Preparation Review of key course concepts	4	2
16	Exam preparation and sample questions	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organization and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
Reading and Understanding Course Material:	24/32/40	Knowledge, Skills, and Competencies: This includes going through the course textbooks and other recommended reading materials. Students should aim to understand the fundamental concepts and theories related to the internet and web technologies.
Hands-on Practice:	24/32/40	Knowledge, Skills, and Competencies: Students should aim to get as much practical experience as possible. This could involve building simple web pages using HTML, CSS, and JavaScript, setting up a basic web server, or creating a simple web application using PHP and MySQL.
Additional Research:	24/32/40	Knowledge, Skills, and Competencies: Students are encouraged to research and keep up-to-date with the latest trends and technologies in the field of web development. This could involve reading research papers, technical reports, and news articles, and participating in relevant online forums and communities.
Preparation for Exams:	24/32/40	Knowledge, Skills, and Competencies: Before exams, students should review the course material, solve sample exam papers, and ensure they understand the key concepts and skills that will be assessed.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1.Mid-term Exam	+	+	+	30
2.Final Exam	+	+	+	40
3.Assignments and Projects	+	+	+	20
4.Participation and Attendance	+	+	+	10

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical

	application of the acquired knowledge are stated
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course API Foundations

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Jurijs Čižovs
Preliminary knowledge, Related study courses	Introduction to Programming using Python,
Aim	To supply students with a thorough understanding of API design, development, and management, emphasizing the critical role APIs play in modern software development and digital communication. Students will learn to create, deploy, and secure APIs, fostering a skill set that is essential for developing integrated and scalable software solutions.
Planned learning outcomes	
Knowledge	1. Gain a solid understanding of different API architectures like RESTful, SOAP, and GraphQL, and how they facilitate communication between software applications. 2. Understand the fundamental principles of API security including authentication, authorization, and various security protocols to ensure data integrity and security.
Skills	1. The ability to design, develop, and deploy APIs that are scalable, secure, and easily maintainable, following industry-standard best practices. 2. The ability to use various tools and techniques to test APIs for functionality, performance, and security, as well as debugging common API issues.
Competencies	1. Show the ability to identify and solve challenges encountered during API development, leveraging a solid understanding of API architectures and security principles. 2. Show the ability to work effectively in teams, manage version control, and document APIs thoroughly to ensure seamless collaborative development environments.
Literature and other sources of information:	

Compulsory reading	"Designing APIs with Swagger and OpenAPI" by Josh Ponelat and Marsh Gardiner (2020). "API Security in Action" by Neil Madden (2020). "GraphQL in Action" by Samer Buna (2020). "API Security in Action" by Neil Madden (2020). "OAuth 2.0: Getting Started in Web-API Security" by Matthias Biehl (2017)
Recommended	"Microservices Patterns: With examples in Java" by Chris Richardson (2018). "Pro RESTful APIs: Design, Build and Integrate with REST, JSON, XML and JAX-RS" by Sanjay Patni (2017).

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to APIs: - Definition and Significance - Types of APIs (REST, SOAP, GraphQL, etc.)	2	1
2	Understanding HTTP and Web APIs: - HTTP Methods, Status Codes, and Headers - Web APIs and Endpoints	2	1
3	RESTful APIs: - Principles of REST - Designing RESTful Endpoints	2	1
4	Data Formats: JSON, XML, and others	2	1
5	API Authentication & Authorization: Basic Auth, OAuth, JWT	2	1
5	API Documentation: Importance and Tools like Swagger, Postman	2	1
7	Versioning in APIs: Strategies and Best Practices	2	1
8	Rate Limiting and Throttling: Techniques and Importance	2	1
9	Error Handling in APIs: Common Practices	2	1
10	API Security: Common Threats and Mitigation Strategies	2	1
11	API Testing: Tools and Techniques	2	1

12	API Deployment: Cloud Platforms, Containers, and Orchestration	2	1
13	GraphQL: Differences between REST and GraphQL, Basics of GraphQL	2	1
14	Microservices and APIs: Microservices Architecture and Communication	2	1
15	API Analytics and Monitoring: Tools and Metrics	2	1
16	API Gateways: Functionality and Benefits	2	1
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	12/16/20	Knowledge, Skills and Competencies: Students studied the core concepts behind API foundations through a thorough examination of assigned readings and resources. Students will acquire the ability to critically assess various API design approaches and methodologies.
2. Project-Based Learning	12/16/20	Knowledge, Skills and Competencies: Through hands-on project work, students will apply the theoretical knowledge acquired to practical scenarios, honing their skills in API design, development, and troubleshooting. They will gain competencies in project management, teamwork, and effective communication as they work through project milestones, potentially in team settings.
3. Case Studies Analysis.	12/16/20	Knowledge, Skills and Competencies: Analyzing real-world case studies will equip students with a deeper

		understanding of the practical implications of API design choices. They will develop skills in critical analysis and evaluation, identifying what works well and what doesn't in real-world API implementations. Competencies in applying these insights to their own API projects will be fostered.
4. Practical Exercises	12/16/20	Knowledge, Skills and Competencies: Engaging in practical exercises will reinforce students' technical skills in API design, development, testing, and debugging. They will acquire a robust understanding of how theoretical concepts are applied in practical settings. Competencies in problem-solving, debugging, and continuous improvement will be honed through iterative practice and feedback.
Total:	48/64/80	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems;

	7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Development Process and Tooling Foundations

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Andrejs Bondarenko
Preliminary knowledge, Related study courses	Introduction to Programming using Python
Aim	To supply students with an understanding of the software development advanced topics, giving them a taste of what practices and tools are included in the modern advanced software development process.
Planned learning outcomes	
Knowledge	1. Understanding of the practices used in modern software development. 2. Understanding of the tooling available to modern software developers.
Skills	1. The ability to apply modern practices in software development. 2. The ability to set up and utilize modern tooling utilized by the software development teams.
Competencies	1. Show the ability to select best practices and tools and apply them to the software development process. 2. Show the ability to implement best practices and run the software development process.
Literature and other sources of information:	
• Compulsory reading	1. Clean Code in Python: Develop maintainable and efficient code, 2nd Edition, Mariano Anaya, 2020. 2. Clean Code, Robert C. Martin, Prentice Hall, 2008.
• Recommended	1. The Art of Clean Code, Christian Mayer, 2022.

Study course content and schedule of contact hours

Week	Topic	Academic hours
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		full-time intramural	part-time intramural
1	Introduction and orientation Naming conventions	2	1
2	Functions Small Do one thing One level of abstraction per function Switch statement Functions Side effects DRY	2	1
3	Comments & Formatting	2	1
4	Objects & Abstractions Data abstractions Data/object anti-simmetry The law of Demeter Data transfer objects	2	1
5	Error handling	2	1
5	Boundaries	2	1
7	Unit tests	2	1
8	Classes	2	1
9	Systems Emergence	2	1
10	Concurrency	2	1
11	Version control systems Git	2	1
12	Basics of Object-Oriented Programming Intro to OOP design Is-A, Has-A Objects hierarchies Intro to OOP design patterns	2	1
13	Test-Driven development. Unit testing Functional testing Short introduction to refactoring	2	1
14	JUnits testing framework	2	1
15	Code smells and heuristics	2	1
16	Selected coding problems/practice & exam	2	1
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	12/16/20	Knowledge, Skills and Competencies: Students studied the core concepts behind Python programming language, functional programming, OOP.
2. Familiarization with Test-Driven Development and Unit and Functional Testing.	12/16/20	Knowledge, Skills and Competencies: Students understand and are able to apply the principles and practices of Test-Driven Development and are skilled in implementing Unit and Functional Testing techniques to ensure code quality and maintainability in software development projects. They are competent in using testing frameworks and tools and can integrate testing into their software development process.
3. Familiarization with OOP principles, design patterns and refactoring.	12/16/20	Knowledge, Skills and Competencies: Students understand and are able to apply Object-Oriented Programming principles and design patterns to develop maintainable and scalable software systems. They are competent in refactoring techniques and can identify and fix code smells using heuristics and testing frameworks.
4. Practical Exercises	12/16/20	Knowledge, Skills and Competencies: Students will be able to create programs according to a specification.
Total:	48/64/80	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course System and Object-Oriented Programming

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Alexander Mrochko
Preliminary knowledge, Related study courses	Algorithms and Data Structures, Introduction to programming using Python, IT Software project management, Internet and Web Basics (Internet/DNS/HTTPS/HTML/CSS)
Aim	The aim of the "System and Object-Oriented Programming" course is to equip students with the necessary skills and knowledge to develop software applications effectively and efficiently. This course is typically designed to cover a broad set of skills, focusing on both high-level object-oriented programming and lower-level system programming concepts. The course provides a foundation for a wide range of career paths in software development, from application development to embedded systems. The skills learned can also serve as a base for more advanced study in areas like software engineering, computer systems, data science, and artificial intelligence.
Planned learning outcomes	
Knowledge	1. Object-Oriented Programming (OOP): understand how to use classes and objects, inheritance, encapsulation, polymorphism, and abstraction. These concepts are essential for designing and developing software in an object-oriented way, which can increase code reusability and maintainability. 2. System Programming: gain a foundational understanding of system-level programming and how software interacts with hardware and the operating system. Topics may include processes and threads, memory management, system calls, file systems, and possibly interprocess communication and synchronization. 3. Programming Languages: could become proficient in one or more programming languages commonly used in system and object-oriented programming, such as C++, Java, or Python. 4. Data Structures and Algorithms: learn how to implement and use common data structures, such as arrays, linked lists, stacks, queues, trees, and graphs. Additionally, understand how to design and analyze algorithms, which are procedures or formulas for solving problems.

	5. Software Development Practices: The course should cover best practices for writing high-quality, maintainable code. This may include understanding design patterns, testing and debugging techniques, and the use of version control systems like Git. 6. Software Design and Architecture: learn about software design principles and architectural patterns, which can help you design more robust and scalable systems. 7. Understanding of Databases: Some courses might include basics of relational (SQL) and NoSQL databases. This is a crucial skill for any programmer, as most applications need to store and retrieve data. 8. Concurrency and Multithreading: An understanding of concurrency, multithreading, and parallel computing might also be part of the curriculum. These are advanced topics that are important for developing high-performance and real-time systems.
Skills	1.Coding Skills: You'll learn how to write clean, efficient code in one or more programming languages. This will typically involve both high-level, object-oriented programming and lower-level system programming. 2. Object-Oriented Programming: This includes skills like defining classes and creating objects, understanding and implementing inheritance and polymorphism, and using encapsulation and abstraction effectively. 3.System Programming Skills: You'll learn how to write code that interacts with the operating system and the underlying hardware. This can involve understanding system calls, process management, multithreading, memory management, and more. 4.Algorithmic Thinking: You'll learn to design and implement efficient algorithms for solving problems. This includes understanding how to choose the best data structures and algorithms for a particular task and understanding the time and space complexity of your solutions. 5.Debugging and Testing Skills: You'll learn how to find and fix problems in your code, and how to write tests to ensure your code is working correctly. This is an essential skill for producing reliable, high-quality software. 6.Software Design Skills: You'll learn how to design software systems using object-oriented principles and design patterns. This involves understanding how to organize code into classes and modules, how to define interfaces between different parts of a system, and how to create reusable and maintainable code. 7.Version Control Skills: You'll learn how to use version control systems like Git to manage and track changes to your code, and to collaborate with others. 8.Problem-Solving Skills: Programming involves a lot of problem-solving, and through this course, you'll develop your ability to think logically and creatively to solve complex problems.

	9. Project Management: You may also develop skills in managing software projects, from planning and scheduling to coordinating a team's work.
Competencies	1. Proficiency in Programming Languages: You should be competent in at least one object-oriented language like Java, C++, or Python, and understand system-level programming possibly using C or similar languages. 2. Object-Oriented Programming Competence: You will be able to create complex applications using OOP concepts such as classes and objects, inheritance, encapsulation, abstraction, and polymorphism. 3. System-Level Programming: You should gain the competence to create programs that can interact directly with the operating system, understand system calls, memory management, and possibly concurrency and multithreading. 4. Problem-Solving Competence: You will be able to use algorithmic thinking to solve complex problems efficiently and accurately. 5. Data Structures and Algorithms: You will be competent in implementing and using common data structures and understanding how different algorithms work and when to use them. 6. Debugging and Testing: You should be competent in identifying, diagnosing, and correcting code errors (debugging), as well as developing appropriate tests to ensure program functionality. 7. Software Design Competence: You should be able to design software systems that are robust and scalable using design principles and patterns. 8. Version Control: You will be proficient in using version control systems such as Git to manage changes in source code over time, a critical skill in modern software development. 9. Database Skills: Depending on the course, you may gain proficiency in using SQL and NoSQL databases, an essential competency for any software developer. 10. Communication Skills: Through collaborative projects, you will likely improve your ability to communicate effectively about technical issues, both in writing and verbally.
Literature and other sources of information:	
Compulsory reading	1. Freeman, Eric, Robson, Elisabeth, Head First Design Patterns: A Brain-Friendly Guide: Building Extensible and Maintainable Object-Oriented Software Paperback – 5 Jan. 2021. 2. S. Stewards, C++ Programming Language Object Oriented Programming 2022 Paperback – 1 January 2022. 3. Mauricio Aniche, Simple Object Oriented Design A guide to creating clean, maintainable code MEAP began April 2023, Publication in Spring 2024 (estimated, ISBN 9781633437999 , 225 pages.
Recommended	1. Matthias Noback, Object Design Style Guide: Powerful Techniques for Creating Flexible, Readable, and Maintainable

	Object-Oriented Code in Any Oo Language, from Python to PHP Paperback – 6 April 2020. 2.Object Oriented Programming Using Bluej 5th Edition (2022) 3. Fundamental Approaches to Software Engineering 25th International Conference, FASE 2022, Held as Part of the European Joint Conferences on Theory and Practice of Software, ETAPS 2022, Munich, Germany, April 2–7, 2022, Proceedings.
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Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	System Programming. Basic Concepts of Operating Systems	4	2
2	Process Management	4	2
3	Memory Management	4	2
4	File Systems	4	2
5	I/O Systems	4	2
6	System Programming Tools	4	2
7	Object-Oriented Programming (OOP). Basics of OOP	4	2
8	Classes and Objects	4	2
9	Constructors and Destructors Definition and Purpose Overloading and Overriding	4	2
10	Inheritance and Polymorphism Types of Inheritance Overriding and Overloading Methods Abstract Classes and Interfaces	4	2
11	Exception Handling: Try, Catch, Finally Blocks Creating Custom Exceptions	4	2
12	File I/O and Serialization: Reading and Writing to Files Object Serialization and Deserialization	4	2
13	OOP in C++ Basics of C++ programming Classes and objects in C++ Inheritance and polymorphism in C++	4	2
14	OOP in Java	4	2

	Basics of Java programming Classes and objects in Java Inheritance and polymorphism in Java		
15	System Programming in Java File I/O and serialization in Java Networking and threads in Java Java's garbage collection mechanism	4	2
16	Course Review and Exam Preparation	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organization and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
Reading Material	24/32/40	Knowledge, Skills, and Competencies: Students will be assigned weekly reading from the textbook and other resources. These readings will provide theoretical background and context for the programming skills and concepts that will be taught.
Coding Practice	24/32/40	Knowledge, Skills, and Competencies: Students are expected to spend a significant amount of time coding outside of class hours. This may be practicing exercises provided by the instructor, working on personal projects, or using online resources to learn and practice.
Online Learning Platforms	24/32/40	Knowledge, Skills, and Competencies: online resources like Codecademy, LeetCode, or HackerRank to supplement classroom learning.
Peer Learning	24/32/40	Knowledge, Skills, and Competencies: Students may form study groups to learn and solve problems collaboratively. This is beneficial for understanding different perspectives and approaches.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
Assignments	+	+	+	30
Midterm Examination:	+	+	+	30
Final Examination:	+	+	+	40

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations;

	2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.
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RNU study course Computer Networks Architecture and Operating Systems

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Rostislavs Kopitovs
Preliminary knowledge, Related study courses	
Aim	Provide students with an understanding of computer networks and operating systems. Give understanding of network architectures, protocols, and key operating system components. The course also addresses emerging trends in these fields, preparing students for the evolving IT landscape.
Planned learning outcomes	
Knowledge	1. Understand the fundamental principles of computer networks, including network architecture, protocols, and transmission methods. 2. Gain knowledge about operating systems, focusing on process, thread and memory management, I/O systems, and file systems.
Skills	1. Ability to analyze and configure network systems, including proper setup of network devices and implementation of security protocols. 2. Proficiency in operating system tasks such as managing processes, optimizing memory usage, handling file systems, and troubleshooting common OS-related issues.
Competencies	1. Show the ability in designing, implementing, and securing computer networks. Which encompasses an understanding of protocols, layers, and models; proficiency in configuring network devices and media; knowledge in data transmission principles; the ability to implement network security measures; and staying abreast with contemporary networking trends. 2. Proficiency in understanding, managing, and optimizing operating system tasks and resources. This involves a grasp of OS types and architectures; effective management of processes, threads, and memory; proficiency in file system handling and I/O optimization; ensuring robust OS security protocols;

	and keeping updated on the latest OS trends and innovations.
Literature and other sources of information:	
Compulsory reading	- Computer Networks by Andrew S. Tanenbaum and David J. Wetherall (2016). - Operating Systems: Principles and Practice by Thomas Anderson and Michael Dahlin (2014).
Recommended	- Computer Networking: A Top-Down Approach by James Kurose and Keith Ross (2017). - Modern Operating Systems by Andrew S. Tanenbaum and Herbert Bos (2015). - Network Security Essentials: Applications and Standards by William Stallings (2017). - Linux Kernel Development by Robert Love (2018). - TCP/IP Illustrated, Volume 1: The Protocols by Kevin R. Fall and W. Richard Stevens (2018).

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to Computer Networks and Operating Systems Overview of computer networks, operating systems, and their roles in computing.	4	2
2	Networking Basics Understanding protocols, layers, and models (TCP/IP, OSI model).	4	2
3	Network Devices and Media Discussion about network devices like routers, switches, hubs, and media like cables, wireless, fiber optics.	4	2
4	Data Transmission Concepts of data transmission including bandwidth, latency, error detection and correction.	4	2
5	Physical Layer and Data Link Layer Detailed discussion about the roles and functionalities of the physical and data link layers.	4	2
6	Network Layer	4	2

	Understanding network layer functions, IP addressing, routing algorithms.		
7	Transport Layer Detailed study on transport layer protocols (TCP, UDP), port numbers, reliability.	4	2
8	Application Layer Introduction to application layer protocols (HTTP, FTP, SMTP, DNS).	4	2
9	Introduction to Operating Systems Overview, types, and architecture of operating systems.	4	2
10	Process Management Process concepts, scheduling, inter-process communication.	4	2
11	Thread Management Introduction to threads, thread-level parallelism, multithreading models.	4	2
12	Memory Management Physical and virtual memory, paging, segmentation, memory allocation.	4	2
13	File Systems File system interface and implementation, directory structure, protection.	4	2
14	I/O Systems Overview of I/O systems, I/O hardware, application I/O interface.	4	2
15	Security and Protection Operating system security, network security, firewalls, intrusion detection systems.	4	2
16	Current Trends and Future Directions Latest trends in computer networks and operating systems, including cloud computing, IoT, edge computing, network function virtualization (NFV), software-defined networking (SDN), etc.	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes

1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills and Competences: Students studied the core concepts behind Networking and Operating Systems.
2. Exploring TCP/IP Protocols: Investigate the structure and functions of TCP/IP protocols in computer networks.	24/32/40	Knowledge, Skills, and Competences: Students will delve into the intricacies of TCP/IP protocols, gaining an understanding of their fundamental role in data transmission across computer networks, and developing skills in analyzing and troubleshooting network issues.
3. Understanding Operating Systems Components.	24/32/40	Knowledge, Skills, and Competences: This topic equips students with a comprehensive understanding of the various components of modern operating systems, such as memory management, process scheduling, and file systems, enhancing their ability to work effectively with diverse OS environments.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competences: Through hands-on exercises, students will apply theoretical knowledge in real-world scenarios, enhancing their practical skills in network configuration, operating system management, and problem-solving in a controlled environment.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Terminal & OS

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Dmitrijs Skorodihins
Preliminary knowledge, Related study courses	
Aim	To supply students with an understanding of various operating systems' architecture and features, and proficiency in terminal usage and shell scripting. The course seeks to foster the skills needed to independently troubleshoot, manage, and operate across multiple operating system environments.
Planned learning outcomes	
Knowledge	1. Understanding of the architecture, features, and terminal environments of Linux, Windows, and MacOS operating systems. 2. Understanding of terminal operations, including command-line interfaces, process management, and shell scripting.
Skills	1. The Ability to proficiently operate and troubleshoot across multiple operating systems using terminal commands and scripting. 2. Skill to apply theoretical knowledge to solve real-world problems, such as system configuration, file management, and process control.
Competencies	1. Versatility in managing and operating different operating systems, adeptness in cross-platform terminal usage, and shell scripting. 2. Proficiency in independently handling tasks in OS and terminal environments, and troubleshooting system issues.
Literature and other sources of information:	
• Compulsory reading	1. Linux Basics for Hackers: Getting Started with Networking, Scripting, and Security in Kali" by OccupyTheWeb, No Starch Press (2018). 2. "Linux Command Line and Shell Scripting Bible, 4th Edition" by Richard Blum and Christine Bresnahan, Wiley (2020).

	3. "Windows 11 For Dummies, 1st Edition" by Andy Rathbone, For Dummies (2021). 4. "Learn Windows PowerShell in a Month of Lunches, 3rd Edition" by Don Jones and Jeffrey Hicks, Manning Publications (2016). 5. "macOS Catalina: The Missing Manual: The Book That Should Have Been in the Box" by David Pogue, O'Reilly Media (2019).
Recommended	1. "Mastering macOS Programming" by Stuart Grimshaw, Packt Publishing (2017). 2. "The Linux Command Line, 2nd Edition: A Complete Introduction" by William Shotts, No Starch Press (2019).

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to Operating Systems and Terminal: Concept of operating systems, the user interface - CLI vs GUI, what is a Terminal.	2	1
2	Understanding the System Shell: Introduction to the shell, its role in the OS, different types of shell (bash, sh, csh, ksh, zsh, etc.)	2	1
3	Basic Terminal Commands - Part 1: Navigating the file system, creating, moving, copying, and deleting files and directories.	2	1
4	Basic Terminal Commands - Part 2: Viewing and modifying file content, using editors like vi/vim, nano, etc.	2	1
5	File Permissions and Process Management: Understanding file permissions, process creation, and management.	2	1
5	Advanced Terminal Commands and Shell Scripting - Part 1: Pipes, redirections, background processes, and introduction to shell scripting.	2	1
7	Advanced Terminal Commands and Shell Scripting - Part 2: Writing and executing basic shell scripts, shell variables, arrays, and loops.	2	1
8	Review and Hands-on session: Review of concepts and hands-on lab session to implement what has been learned.	2	1
9	Introduction to Linux OS: Understanding the Linux OS, its history, distributions, and importance.	2	1

10	Linux Terminal and Commands: Working with the Linux terminal, essential commands, and utilities.	2	1
11	Introduction to Windows OS: Understanding the Windows OS, its architecture, and features.	2	1
12	Windows Command Prompt and PowerShell: Working with Windows command prompt, understanding PowerShell, essential commands, and scripting.	2	1
13	Introduction to MacOS: Understanding the MacOS, its architecture, and features.	2	1
14	MacOS Terminal and Commands: Working with the MacOS terminal, essential commands, and utilities.	2	1
15	Cross-Platform Terminal Tools: Introduction to cross-platform terminal tools like Git Bash, Cygwin, and WSL (Windows Subsystem for Linux).	2	1
16	Review, Recap, and Final Assessment: A comprehensive review of all concepts, addressing any lingering questions, and a final assessment to test the students' understanding.	2	1
Total:		32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning.	12/16/20	Knowledge, Skills and Competencies: Students studied the core concepts behind Terminal, basics of file systems and some specifics behind Linux, Windows and MacOS operating systems.
2. Familiarization with Terminal.	12/16/20	Knowledge, Skills and Competencies: Students will gain a deep understanding of terminal environments, command-line interfaces, and shell scripting. Students will get ability to navigate, modify, and manage the file system, run commands, and write shell

		scripts and will become proficient in terminal usage, process management, and shell scripting across multiple operating systems.
3. Familiarization with specifics of Linux, Windows and MacOS operation systems and their terminals.	12/16/20	Knowledge, Skills and Competencies: Students will get understanding of the architecture, features, and terminal environments of Linux, Windows, and MacOS. Will be able to operate, troubleshoot, and become versatile in operating and managing different operating systems.
4. Practical Exercises	12/16/20	Knowledge, Skills and Competencies: Students will acquire practical knowledge of operating systems, terminal usage, and through hands-on exercises. Will get ability to apply theoretical knowledge to solve real-world problems, and troubleshoot OS and terminal issues.
Total:	48/64/80	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems;

	7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Critical Thinking

Study programme	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Jelena Čaiko
Preliminary knowledge, Related study courses	For the successful study of the course, knowledge is required in the amount of school training in history, literature, physics, chemistry.
Aim	This course will introduce you to critical thinking, informal logic, and a small amount of formal logic. Its purpose is to provide students with the basic tools of analytical reasoning, which will give them a distinctive edge in a wide variety of careers and courses of study. The emphasis here is on learning how to think effectively.
Planned learning outcomes	
Knowledge	
	1. Know the theory and practice of deductive reasoning, the technique of analyzing enthymemes. 2. Know the main features of a scientific theory. Understanding of scientific methods, ability to use them as needed.
Skills	
	1. The ability to think about the phenomena of the surrounding world in interconnection, integrity and development, to identify problems and propose solutions based on a systematic approach. 2. The ability to critically analyze information, form one's own opinion and argue one's position on the universal problems of being and topical problems of modern society. 3. The ability to think outside the box, independently develop thinking technologies, generate ideas and make decisions in conditions of uncertainty.
Competencies	
	1. The ability to critically analyze and evaluate modern scientific achievements, generate new ideas in solving research and practical problems, including in interdisciplinary areas.
Literature and other sources of information:	
Compulsory reading	1. Bowell, Tracy; Cowan, Robert; Kemp, Gary, Critical Thinking ; A Concise Guide, Series: Critical thinking Publisher: Taylor & Francis; Routledge, 2020, ISBN: 9780815371427 2. Moore, Brooke Noel; Parker, Richard, ISE Critical Thinking Series: Critical thinking Publisher: McGraw-Hill, 2020, ISBN: 9781260241020

	3. Richard Paul; Linda Elder, Critical Thinking: Tools for Taking Charge of Your Professional and Personal Life, The Foundation for Critical Thinking, 2020, ISBN: 9781538139530
• Recommended	1. Lenin Iyer, Critical Thinking and its Importance in Education, Conference: Cognitive, Psychological and Behavioural Perspectives in Education, July 2019. 2. Gilmanishina, Suriya ; Smirnov, Sergei ; Ibatova, Aygul ; Berechikidze, Iza, The assessment of critical thinking skills of gifted children before and after taking a critical thinking development course, Series: Thinking Skills and Creativity 2020-dec, Publisher: Elsevier BV, 2020 3. Liyanage, Indika; Walker, Tony; Shokouhi, Hossein, Are we thinking critically about critical thinking? Uncovering uncertainties in internationalised higher education, Series: Thinking Skills and Creativity 2021-mar vol. 39, 2021

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction and Meaning Analysis	4	2
2	Argument Analysis	4	2
3	Basic Sentential Logic	4	2
4	Venn Diagrams	4	2
5	Fallacies	4	2
6	Scientific Reasoning	4	2
7	Strategic Reasoning and Creativity	4	2
8	Irrational Techniques of Persuasion Critiquing the Media	4	2
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
Evaluating Reasoning	24/32/40	Knowledge, Skills and Competencies: Knowing why information was created is a key to evaluation. Understanding the reason or

		purpose of the information, if the information has clear intentions, or if the information is fact.
Scientific Reasoning	24/32/40	Knowledge, Skills and Competencies: working with models, and designing empirical approaches to test hypotheses
Total:	48/64/80	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Home works (Self-study work)	+	+	+v	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected;

	5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Automata Computability and Complexity

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Jurijs Čižovs
Preliminary knowledge, Related study courses	
Aim	Provide students with a comprehensive understanding of the theoretical foundations of computation, including formal languages, automata, and complexity theory. It seeks to develop the ability to analyze and design complex algorithms, and critically evaluate the inherent limitations and capabilities of computational systems.
Planned learning outcomes	
Knowledge	1. Understand the foundations of computation theory, including deterministic and non-deterministic finite automata, regular expressions, context-free grammars, Turing machines, decidability, and complexity theory. 2. Comprehend the concepts of computational complexity classes such as P, NP, NP-Completeness, and the relationships among them.
Skills	1. Ability to design and analyze deterministic and non-deterministic finite automata, context-free grammars, and Turing machines for given problems or language descriptions. 2. Proficiency in proving problems as NP-complete using standard techniques such as reduction from known NP-complete problems.
Competencies	1. Apply the theoretical foundations of computation and complexity to real-world problems, and make decisions about suitable algorithms or data structures based on their computational complexity. 2. Critically evaluate the limitations of computation, particularly in relation to decidability and complexity, and the impact of these limitations on problem-solving and algorithm design in computer science.
Literature and other sources of information:	

Compulsory reading	"Introduction to the Theory of Computation" 3rd Edition by Michael Sipser (2012) "Automata and Computability: Conceptual Approach" by Anuradha A. Puntambekar (2020).
Recommended	"Understanding Computation: From Simple Machines to Impossible Programs" by Tom Stuart (2013). "Introduction to Languages and the Theory of Computation", 3rd Edition, by John Martin, (2003). "Introduction to the Theory of Computation", 2nd Edition, by Michael Sipser (2006).

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to Automata Theory and Formal Languages An overview of automata theory, formal languages, and their historical context and applications.	4	2
2	Deterministic Finite Automata (DFA) An in-depth look at deterministic finite automata, their workings, and their role in computer science.	4	2
3	Non-Deterministic Finite Automata (NFA) Introduction to non-deterministic finite automata and their equivalence to deterministic finite automata.	4	2
4	Regular Expressions and Languages Understanding regular expressions, their properties, and their relation to finite automata.	4	2
5	Context-Free Grammars (CFG) and Languages Introduction to context-free grammars and languages, derivation trees, and ambiguity.	4	2
6	Pushdown Automata (PDA) Exploring pushdown automata, their representations, and their equivalence to context-free grammars.	4	2
7	Turing Machines (TM) An introduction to Turing machines, the Church-Turing thesis, and the universal Turing machine.	4	2
8	Variants of Turing Machines	4	2

	• Exploration of various TM models, including multi-tape and non-deterministic Turing machines.		
9	Introduction to Decidability • An introduction to the concept of decidability, the Halting problem, and the concept of reduction.	4	2
10	Undecidability and Intractability • Exploring more undecidable problems, and introducing the concept of intractability.	4	2
11	Introduction to Computational Complexity • An overview of computational complexity, time and space complexity measures.	4	2
12	Time Complexity and P, NP classes • Detailed study of P and NP classes, polynomial time algorithms, and NP problems.	4	2
13	NP-Completeness • Introduction to NP-Completeness, Cook-Levin theorem, and methods of proving NP-Completeness.	4	2
14	More on NP-Completeness and Hardness • Further discussion on NP-Completeness, exploring the concept of NP-Hard problems.	4	2
15	Space Complexity and PSPACE • Introduction to space complexity, PSPACE, and the relationships between time and space complexity classes.	4	2
16	Review and Further Topics • Review of key topics covered in the course, and an exploration of advanced topics, such as the hierarchy of complexity classes, randomized algorithms, and quantum computing.	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/	Planned learning outcomes
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	part-time intramural/ part-time extramural or distance studies	
1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills, and Competences: Students studied the core concepts behind Automata theory, computability, and complexity topics.
2. Familiarization with Automata Theory and its Applications.	24/32/40	Knowledge, Skills and Competencies: Students understand specific aspects of automata theory, including deterministic and non-deterministic finite automata, regular expressions, and context-free grammars.
3. Familiarization with Complexity and Computability Theory.	24/32/40	Knowledge, Skills, and Competencies: Students understand computational complexity, complexity classes such as P, NP, and NP-Completeness, and the relationships among them. Understand computability theory, with an emphasis on decidability and the Halting problem.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students will be able to design and analyze automata and algorithms, apply theoretical knowledge to real-world computational challenges.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
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Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Java Development Fundamentals

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Viktors Gopejenko
Preliminary knowledge, Related study courses	Algorithms and Data Structures
Aim	To supply students with an understanding of the Java Core ver. 19+ for software development.
Planned learning outcomes	
Knowledge	1. Understanding the J2SE 19 language specifics.
Skills	1. The ability to set up and utilize J2SE project. 2. The ability to develop algorithms using the J2SE v19 programming language.
Competencies	1. Show the ability to select suitable J2SE libraries and apply them to develop the software according to the specifications.
Literature and other sources of information:	
Compulsory reading	1. Core Java for the Impatient (3rd Edition), Cay S. Horstmann, 2022. 2. Effective Java (3rd edition), Joshua Bloch, 2018.
Recommended	1. JDK 19 Documentation [https://docs.oracle.com/en/java/javase/19/books.html]

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction and orientation Naming conventions Build tools / project setup	2	1
2	Fundamental Programming Structures	2	1

3	Object-Oriented Programming	2	1
4	Interfaces and Lambda Expressions	2	1
5	Inheritance and Reflection	2	1
6	Exceptions, Assertions, and Logging	2	1
7	Generic Programming	2	1
8	Collections	2	1
9	Streams	2	1
10	Processing Input and Output	2	1
11	Concurrent Programming	2	1
12	Annotations	2	1
13	The Date and Time API	2	1
14	Internationalization	2	1
15	Compiling and Scripting JUnit frameworks	2	1
16	The Java Platform Module System	2	1
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	12/16/20	Knowledge, Skills and Competences: Students studied the core concepts behind Java Core edition programming language.
2. Familiarization with basic J2SE constructs and Object-Oriented programming in Java, Collections, Streams, Input & Output.	12/16/20	Knowledge, Skills and Competencies: Students understand and are able to write, read and comprehend OOP code written in Java. Including usage and understanding of Collections, Streams and IO operations.
3. Familiarization with J2SE Annotations, Date&Time API, Logging and Exceptions, Handling and Concurrency.	12/16/20	Knowledge, Skills and Competencies: Students understand and can apply techniques beyond ordinary OOP, Collections, Streams and IO.

4. Practical Exercises	12/16/20	Knowledge, Skills and Competencies: Students will be able to create programs according to a specification.
Total:	48/64/80	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as

	considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Physics

Study programme	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Kristīne Hamruna
Preliminary knowledge, Related study courses	Mathematics
Aim	• studying basic physical phenomena and ideas; • mastering the fundamental concepts, laws, theories and physical research methods of classical and modern physics; • formation of the scientific worldview and modern physical thinking; • learning the specific methods and techniques for solving problems in various branches of physics; • introduction to modern scientific equipment and learning techniques for performing physical experiments
Planned learning outcomes	
Knowledge	
	1. To understand the practical problems of the specific physical content. 2. Independently know physical and technical problems, use model thinking.
Skills	
	1. formation of skills to distinguish the specific physical content of practical problems; 2. independently solve physical and technical problems, use model thinking.
Competencies	
	1. basic laws of physics; 2. for using the basic laws of physics in life, in practice and in future subjects; 3. knowledge of the concept of modern physics.
Literature and other sources of information:	
• Compulsory reading	1. Principles & Practice of Physics, 2nd edition, Published by Pearson (March 30th 2020) - Copyright © 2021, Eric Mazur 2. Physics for Scientists and Engineers: A Strategic Approach with Modern Physics, 5th edition, Published by Pearson (July 13th 2022) - Copyright © 2022, Randall D Knight California Polytechnic State University-San Luis Obispo 3. Conceptual Physics, 13th edition, Published by Pearson (February 5th 2021) - Copyright © 2022, Paul G Hewitt City College of San Francisco

Recommended	1. Quantum Physics for Beginners: From Wave Theory to Quantum Computing. Understanding How Everything Works by a Simplified Explanation of Quantum Physics and Mechanics Principles, by Carl J. Pratt 14 Mar 2021 2. Physics I For Dummies by Steven Holzner 29 Mar 2022 3. The Physics Book: Big Ideas Simply Explained by DK and Jim Al-Khalili 5 Mar 2020
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Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1-16	1. Nature and physical thinking. 2. Mathematical apparatus of physics. 3. Motion of a material point. Laws of mechanics. 4. Theory of relativity. 5. Movement of absolutely solid substances. 6. Mechanical properties of continuous beams. 7. Electromagnetic field theory. 8. Laws of constancy and integrals of motion. 9. Transition processes and fluctuations. 10. Wave processes. 11. Quantum effects and wave properties of particles. 12. Fundamentals of quantum mechanics. 13. Centrally symmetric field. 14. Atomic theory. 15. Molecules. 16. Core 17. Statistical physics and thermodynamics. 18. Transferred phenomena. 19. Phase transitions and phase equilibria. 20. Properties of quantum gas. 21. Theory of solids. 22. Fundamentals of physical and semiconductor electronics. 23. Nanomaterials, nanodevices and nanoelectronics. 24. Substance in extreme conditions. 25. Nuclear energy and thermonuclear energy. 26. Elementary particles and unified field theory. 27. The physical picture of the modern world.	64	32
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Calculating the 3-dimensional movement of a material point.	48/64/80	Knowledge, skills and competences: Provide understanding: Calculating the 3-dimensional motion of a material point.
2. Principles and applications of analog and digital signal processing.	48/64/80	Knowledge, skills and competencies: Principles and applications of analog and digital signal processing.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Home works (Self-study work)	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some

4 –almost satisfactory)	problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very, very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Applied Statistics

Study programme	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Kristīne Hamruna
Preliminary knowledge, Related study courses	Mathematical Foundations for Software Engineering
Aim	To improve students' knowledge of data collection, processing and analysis, to develop understanding of data acquisition and processing methods, an ability to display and process data using the information technology, to learn how to assess data reliability and received results, as well as to analyze the results and draw conclusions.
Planned learning outcomes:	
knowledge	1. Data mining, processing and analysis methods. 2. Forecasting, putting forward hypotheses and test methods, evaluation of reliability of the results.
skills	1. Apply statistical methods in engineering to design and improve information systems. 2. Improve the qualifications of data processing for solution of engineering and management tasks. 3. Development of skills in analyzing the collected data and using the results in decision-making.
competences	1. The ability to apply theoretical and practical knowledge and skills to effectively manage the design and development of information systems. 2. To choose the most appropriate methods to analyze the situation and evaluate the results. 3. To develop the competence of decision-making based on a preliminary analysis of the situation.

Literature and other sources of information:	
compulsory reading	- David W. Scott. Statistics. A Concise Mathematical Introduction for Students, Scientists, and Engineers. Wiley, 2020. - Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye. Probability & Statistics for Engineers & Scientists. 9-th Edition. Pearson Education Limited 2016. - Probability, Statistics and Random Processes. 2023 Online Courses. https://www.probabilitycourse.com.
recommended	- David M. Levine and David F. Stephan. STATISTICS & ANALYTICS. Addison-Wesley Professional; 4th edition, 2022. - Jim Frost. Introduction to Statistics. Statistics By Jim Publishing, 2020. - Michael Baron. PROBABILITY AND STATISTICS FOR COMPUTER SCIENTISTS. Chapman and Hall/CRC; 3rd edition, 2019. - William Navidi. Statistics for Engineers and Scientists. McGraw-Hill Education; 5th edition, 2019. - Richard J. Larsen, Morris L. Marx, An introduction to mathematical statistics and its applications. Sixth edition. Boston : Pearson, 2018.

Contents and schedule of the contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
	1-st Part Probability		
1.	Concept of statistics , goals, objectives, types, and methods of monitoring. The Role of Statistics in Engineering. The Engineering Method and Statistical Thinking.	2	1
1.	Combinatorics. Permutations and combinations.	2	1

2,3.	Introduction to Probability. Main definitions. Events and Their Probabilities. Classical method. Relative frequency method. Subjective method. Unions of Events and Addition Rules. Conditional Probability. Intersections of Events and Multiplication Rule. Total Probability Rule. Independence of events. Bayes' Theorem. Sequences of Independent Trials (Bernoulli Trials).	8	4
4,5.	Random Variables. Discrete Random Variables and Probability Distributions. Probability Distributions and Probability Mass Functions. Cumulative Distribution Functions. Mean and Variance of a Discrete Random Variable. Binomial Distribution. Geometric Distributions. Poisson Distribution.	8	4
6,7.	Random Variables. Continuous Random Variables and Probability Distributions. Probability Distributions and Probability Density Functions. Cumulative Distribution Functions. Mean and Variance of a Continuous Random Variable. Continuous Uniform Distribution. Normal Distribution. Exponential Distribution .	8	4
8.	Large Random Samples. The Law of Large Numbers. The Central Limit Theorem.	2	1

	2-nd Part Statistics		
8,9.	Descriptive statistics. Sampling method. Statistical tables and charts. General Concepts of Point Estimation. General Concepts of Interval Estimation.	6	3
10.	Concept of average values. Mode, median, and quartiles. Variance and standard deviation. Absolute and relative indicators of sample.	4	2
11	Hypothesis testing. Hypothesis and alternative. Type I and Type II errors: level of significance. General Procedure for Hypothesis Tests.	4	2
12.	Correlation and regression. Assessment of data correlation. Calculation of correlation and determination coefficient. Regression equation.	4	2
13.	Characteristics of time series. Growth rate. Average values.	2	1
	3-d Part. Random Processes		
13.	Stochastic Processes. Definitions and classifications. Basic characteristics.	2	1
14.	Markov processes and Markov chains. Markov chains. Matrix approach. Steady-state distribution.	4	2
15.	Counting processes. Binomial process. Poisson process.	4	2
16.	Simulation of stochastic processes.	4	2
Total on study year:		4 CP = 64 ac .h	4 CP = 32 ac. h.

Description of students' self-studies organisation and assignments:

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Events and Their Probabilities. Counting Techniques. Random Variables and Probability Distributions	24/32/40	The acquired knowledge, skills and competences
2. Data processing and explication	24/32/40	The acquired knowledge, skills and competences
3. Data correlation	24/32/40	The acquired knowledge, skills and competences
4. Simulation of stochastic processes.	24/32/40	The acquired knowledge, skills and competences
Total ac. hours:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1.	*	*	*	20
2.	*	*	*	20
3.	*	*	*	20
4.	*	*	*	20
Exam	*	*	*	20

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;

High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Relational DBMS Foundations

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Jurijs Šamšins
Preliminary knowledge, Related study courses	Introduction to Programming using Python
Aim	Equip students with a comprehensive understanding of database design, data modeling, normalization, and management, enabling them to efficiently handle and analyze data within a relational database management system (RDBMS). Through a blend of theoretical knowledge and practical application, students will learn to develop, optimize, and secure databases, gaining crucial skills that are imperative in modern-day data-driven decision-making in various industrial and commercial domains.
Planned learning outcomes	
Knowledge	1. Students will acquire an in-depth understanding of relational database principles, including data modeling, normalization, and functional dependencies, essential for designing efficient databases. 2. Students will learn about the various data integrity, security measures, and query optimization techniques, to ensure reliable and secure data storage and retrieval.
Skills	1. Students will develop the capability to design, create, and manage relational databases using SQL DML, DDL, DCL, and TCL statements, fostering a skill set that's fundamental for database administration and development. 2. Students will hone their ability to analyze and optimize queries, ensuring optimal performance and data retrieval efficiency within the database environment.
Competencies	1. Students will demonstrate the ability to undertake complex database projects from conception through to completion, showcasing their understanding of database design, and management principles. 2. Students will exhibit an effective collaborative work ethic in project settings, manifesting the ability to communicate and document database

	designs and solutions clearly, contributing significantly to team projects within industrial and commercial contexts.
Literature and other sources of information:	
Compulsory reading	"Database Design for Mere Mortals: A Hands-On Guide to Relational Database Design (4th Edition)" by Michael J. Hernandez (2020) "Learning SQL: Generate, Manipulate, and Retrieve Data" by Alan Beaulieu (2020) "SQL Performance Explained" by Markus Winand (2020) "SQL in 10 Minutes, Sams Teach Yourself (5th Edition)" by Ben Forta (2020) "Database Internals: A Deep Dive into How Distributed Data Systems Work" by Alex Petrov (2019)
Recommended	"Data-Intensive Applications with Azure: Build Large-Scale, Real-World Apps Using Azure Services" by Ben Fistein (2021).

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to Databases and DBMS: - Overview of Database Management Systems (DBMS) - Role and Importance of Databases in Modern Computing	2	1
2	Database Design Basics: - Introduction to Data Modelling - Conceptual, Logical, and Physical Database Design	2	1
3	Entity-Relationship Model (ER Model): - Entities, Relationships, and Attributes - ER Diagrams	2	1
4	Normalization: - Introduction to Normalization - Normal Forms (1NF, 2NF, 3NF)	2	1
5	Advanced Normalization: - BCNF and 4NF - Normalization and Database Design	2	1

5	Introduction to SQL: • Basics of SQL • Managing DBs	2	1
7	SQL Data Manipulation Language (DML): • Insert, Update, and Delete Operations • Select Queries	2	1
8	SQL Joins and Subqueries: • Understanding Joins • Subqueries and Nested Queries	2	1
9	SQL Functions and Aggregation: • Built-in Functions • Group By and Having Clauses	2	1
10	Indexes and Query Optimization: • Understanding Indexes • Basics of Query Optimization	2	1
11	Transactions and Concurrency Control: • ACID Properties • Transaction Management	2	1
12	Database Security and Authorization: • Security Concerns in Databases • SQL Grant and Revoke Commands (DCL)	2	1
13	Database Integrity: • Integrity Constraints • Ensuring Data Integrity	2	1
14	Backup, Recovery, and TCL Statements: • Backup and Recovery Concepts • Transaction Control Language (TCL)	2	1
15	Introduction to Stored Procedures and Triggers: • Basics of Stored Procedures • Understanding Triggers	2	1
16	Project Presentations and Review: • Students Presenting Their Database Projects • Review and Feedback	2	1
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	12/16/20	Knowledge, Skills and Competencies: By engaging with essential reading materials and sources, students deepen their theoretical understanding of

		relational database systems and their underlying principles. They develop the skill of critically analyzing literature and extracting relevant information, building competencies in self-directed learning and the integration of foundational knowledge into practical scenarios.
2. DB design	12/16/20	Knowledge, Skills and Competencies: Students will reinforce their understanding of database design principles, normalization, and data integrity. They will also enhance their skills in utilizing DBMS tools to create, modify, and optimize databases, fostering a competence in independently tackling database design challenges in real-world scenarios.
3. DBMS Tuning and Optimization	12/16/20	Knowledge, Skills and Competencies: Students will acquire knowledge on various DBMS performance tuning techniques, and develop skills in identifying, analyzing, and optimizing performance bottlenecks. This will foster a competence in ensuring database systems are optimized for performance, catering to industry and commerce needs effectively.
4. Practical Exercises	12/16/20	Knowledge, Skills and Competencies: Through hands-on exercises, students cement their knowledge of database operations, from designing to querying. They sharpen their skills in executing SQL DML, DDL, DCL, and TCL statements efficiently. This continuous practice fosters a competence in troubleshooting, optimizing, and effectively managing real-world database systems.
Total:	48/64/80	

Study work	Knowledge	Skills	Competences	% of
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				final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations;

	2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Advanced Software Development

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Andrejs Bondarenko
Preliminary knowledge, Related study courses	Algorithms and Data Structures
Aim	To supply students with an understanding of the software development advanced topics, giving them a taste of what practices and tools are included in the modern advanced software development process.
Planned learning outcomes	
Knowledge	1. Understanding of the main components of the multitier software architecture and what are the driving forces behind them. 2. Understanding of the practices used in modern software development. 3. Understanding of the tooling available to modern software developers.
Skills	1. The ability to design multitier applications. 2. The ability to apply modern practices in software development. 3. The ability to set up and utilize modern tooling utilized by the software development teams.
Competencies	1. Show the ability to select best practices and tools and apply them to the software development process. 2. Show the ability to implement best practices and run the software development process.
Literature and other sources of information:	
• Compulsory reading	1. Refactoring: Improving the Design of Existing Code, (2nd Edition), Martin Fowler, Addison-Wesley, 2018. 2. The Cleaner Coder, Robert C. Martin, 2011. 3. Systems Analysis and Design: An Object-Oriented Approach with UML 6th Edition, Alan Dennis, Barbara Wixom, David Tegarden, 2020.
• Recommended	1. Python 3 Object-Oriented Programming: Build robust and maintainable software with object-oriented design patterns in Python 3.8 (3rd Edition), Dusty Phillips, 2018.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Decorators	4	2
2	Objects with descriptors	4	2
3	OOP design patterns - Creational	4	2
4	OOP design patterns - Structural	4	2
5	OOP design patterns - Behavioural	4	2
5	SOA	4	2
7	Functional programming Introduction Generators, Iterators and Async programming	4	2
8	Functional programming Monads	4	2
9	Refactoring 1 Intro Principles Bad smells Building tests	4	2
10	Refactoring 2 First set of refactorings Encapsulations Moving features Organizing data	4	2
11	Refactoring 3 Simplifying conditional logic Refactoring APIs Dealing with inheritance	4	2
12	Clean code 1 Complexity vs productivity The 80/20 principle KISS Premature optimization	4	2
13	Clean code 2 State of flow Do one thing Less is more in a design Focus	4	2
14	Code review	4	2

15	Time management, Estimation, Pressure	4	2
16	Selected problems / practice & exam	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organization and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts behind Python programming language, functional programming, and OOP.
2. Familiarization with OOP principles and design patterns, and code refactoring.	24/32/40	Knowledge, Skills, and Competencies: Students will be able to apply Object-Oriented Programming principles and design patterns creatively and structurally, as well as refactor existing code to improve its quality, readability, and maintainability.
3. Familiarization with functional programming, asynchronous programming, and clean code practices.	24/32/40	Knowledge, Skills, and Competencies: Students will be able to demonstrate knowledge and practical skills in functional programming, asynchronous programming, and the use of monads and understand the importance of writing clean, maintainable, and efficient code through the application of refactoring principles and techniques.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students will be able to create programs according to a specification.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of
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				final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations;

	2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.
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RNU study course Mathematical and Numerical Methods

Study programme	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Inese Trusiņa
Preliminary knowledge, Related study courses	Mathematical analysis, Differential equations, Analytic geometry and higher algebra, Mathematical modeling
Aim	The purpose of the course is - to study the classical equations of mathematical physics; - to study the methods for solving partial differential equations; - to study the basic techniques for solving linear partial differential equations of the second order; - to study the methods of operational calculus and their application; - to study the numerical methods for solving partial differential equations.
Planned learning outcomes	
Knowledge	
	1. The methods of operational calculus, can find an image for a given original and find the original for a given image; 2. The methods of operational calculus, they are able to find solutions to differential 3. The methods of analysis of the equations or systems of differential equations that satisfy given initial conditions; 4. The methods of analysis of the basic classical equations of mathematical physics; 5. The methods of analysis of the classification of linear differential equations of the second order with partial derivatives; 6. The numerical methods for solving second-order partial differential equations
Skills	
	1. Apply the methods of independent determination of the equations type in the case of a function of two variables for linear second-order partial differential equations; 2. Apply the methods to solve homogeneous linear second-order partial differential equations with simple initial conditions and zero boundary conditions.
Competencies	

	1. Apply a mathematical and numerical methods for solving new, more complex problems that arise in the mathematical modelling of various phenomena and processes
Literature and other sources of information:	
Compulsory reading	- Advanced Engineering Mathematics and Analysis: Volume 1, Maher, Rami A., 2021, Nova Science Publishers, Inc, ISBN 978-168507435-7, pages 380. - An introduction to complex analysis and the Laplace transform, Eiderman, Vladimir, 2021, CRC Press, ISBN 978-100051111-6, 978-036740978-4, pages 384. - Advances in mathematical methods for electromagnetics, Kobayashi, Kazuya, Smith, Paul Denis, 2021, Institution of Engineering and Technology, ISBN 978-178561384-5, pages 724
Recommended	- An introduction to numerical methods and analysis, Epperson, James F., 2021, Wiley publisher, ISBN 978-111960475-4, 978-111960469-3, pages 650. - Numerical analysis – lecture notes, Yeates, A., Durham University, 2018, 87 pages. - Lecture notes on mathematical methods, Mihir Sen, Joseph M. Powers, 2012, Department of Aerospace and Mechanical Engineering University of Notre Dame, 502 pages

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Problems of mathematical methods. Function of complex variable. Vector analysis. Determinates and matrices. Infinite series.	6	2
2	Differential equations. Classification of linear equations of the second order with partial derivatives. Canonical form.	6	2
3	Hyperbolic partial differential equation. Wave equation for the three-dimensional case. Parabolic partial differential equation. Heat equation for the three-dimensional case. Elliptic partial differential equation. Metaharmonic equation. Elliptic equations with a source. Green's formula. Green's function method. Laplace equation. Poisson equation.	6	2
4	Special functions.	8	4

	Bessel function. Legendre function. Hypergeometric functions. Confluent hypergeometric functions. Sturm-Liouville theory - orthogonal functions. Legendre function. Associated Legendre function.		
5	Laplace transform and operational calculus. Fourier transform and properties. Fourier transforms on Euclidean space. Fourier transform of function space. Discrete Fourier transform. Fast Fourier transform.	6	2
6	Numerical methods. Approximation of functions. Correlation analysis. Regression equations.	6	2
7	Numerical methods. Numerical differentiation and integration. Numerical solution of systems of linear equations.	8	4
8	Numerical methods. Numerical solutions of ordinary differential equations. Numerical solutions of partial differential equations.	8	4
9	Matrices. Eigenvalues and eigenvectors.	2	2
10	Ordinary differential equations	2	2
11	Canonic forms. Hyperbolic, parabolic and elliptic partial differential equation.	2	2
12	Laplace transformation	2	2
13	Taylor series. Interpolation.	2	2
	Total:	64 ac. h	32 ac. h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
In context of heat conductivity equation: Fourier series and Fourier integral	24/32/40	Knowledge, Skills and Competencies
Elliptic equations with a source Green's formula, Green's function method.	24/32/40	Knowledge, Skills and Competencies
Sturm-Liouville theory Completeness of Eigenfunction	24/32/40	Knowledge, Skills and Competencies
Approximation. Eulers methods for initial value problems.	24/32/40	Knowledge, Skills and Competencies
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Home works (Self-study work)	+	+	+	20
2. Control tasks	+	+	+	30
3. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Information Security, Protection and Cryptography

Study programme	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Viktors Gopejenko
Preliminary knowledge, Related study courses	Mathematical Foundations for Software Engineering, Computer Networks Architecture and Operating Systems
Aim	- Learn main concepts related to computer network vulnerabilities, threats and security risks - Study security testing standards, methodologies and tools - Learn the approaches to risk assessment - Acquire skills in understanding the protection object and selection of a propriety of security controls - Study security standards, methodologies and tools - Get an insight into network protocols - Learn the approaches to penetration testing - To prepare students to act as a member and leader of the team to contribute positively to manage projects efficiently in the field of decision making business processes.
Planned learning outcomes	
● Knowledge	1. Fundamental concepts of information security, IT systems security and data protection. The ability to identify applicable security requirements base on security standards. 2. Understanding of computer systems related threats and protection controls.
● Skills	1. Ability to identify necessary and required protection level of applied security controls 2. Ability to develop security documentation and review security related processes. The ability to apply the theoretical and practical knowledge and skills for the security risk assessment
● Competencies	1. The ability to detect and analyse signs and consequences of security attacks as well as to provide valid response and work on corrective and preventive measures.
Literature and other sources of information:	
● Compulsory reading	1. William Stallings, Lawrie Brown. Computer Security Principles and Practice. – 4th ed. Pearson 2021

● Recommended	1. Paar, C.; Pelzl, J.: Understanding Cryptography: A Textbook for Students and Practitioners. Berlin, Heidelberg: Springer, 2009 2. V.Gopejenko Information Protection, Reliability and Cryptography. Basic of Information Security, Tutorial Work (2020). Riga, RNU, e-public, pp.17 3. Gopejenko, V. Bobrovskis, S. Robust security network association adjusted hybrid authentication schema (2014), 8th IEEE International Conference on Application of Information and Communication Technologies, AICT 2014 - Conference Proceedings. 014 Conference paper. DOI: 10.1109/ICAICT.2014.7035907 4. Levchenko, M. Gopeyenko, V. The modern approach to planning and implementation of enterprise data warehouse the International Conference on Application of Information and Communication Technologies, AICT2010 (2010) Conference paper. DOI: 10.1109/ICAICT.2010.5612011
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Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1.	Introduction to Information Security. Security Threats and Vulnerabilities	4	2
2.	Cryptographic Tool	4	2
3.	Symmetric Encryption and Message Confidentiality	4	2
4.	Public-Key Cryptography and Message Authentication	4	2
5.	User Authentication	4	2
6.	Access Control	4	2
7.	Database Security	4	2
8.	Malicious Software	4	2
9.	Denial-of-Service Attacks	4	2
10.	Intrusion Detection	4	2
11.	Firewalls and Intrusion Prevention Systems	4	2
12.	Buffer Overflow	4	2
13.	Software Security	4	2
14.	Operating System Security	4	2
15.	Internet Authentication Applications	4	2
16.	Exam	4	2
	Total:	64 ac.h.	32 ac.h.

Description of students' self-studies organization and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
Practice time 1 Cryptographic Tools	24/32/40	Knowledge: Students studied the problems of Information Security concepts (e.g. security threats, vulnerabilities, security risks, security controls). Suggest security controls that are required to protect personal data according to security controls classification.
Practice time 2 Tutorial Work Basic Concepts in Cryptography	48/64/80	Knowledge, Skills and Competencies: Modular Arithmetic, Symmetric Encryption/Decryption examples, The RSA Public-Key Encryption application Pollard's Rho Method to factorize $n=p \cdot q$
Practice time 3 Firewall Exercise	24/32/40	Knowledge, Skills and Competencies: FIREWALL Configuration

		Types of attacks are not able to be prevented through the firewall. How might prevent these attacks from taking place?
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Practice Time Assignments	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Optimization Theory and Large Systems Synergetics

Study programme	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Irina Gonsalesa-Ortisa
Preliminary knowledge, Related study courses	
Aim	To provide students with relevant knowledge and develop their competence to apply quantitative, mathematical methods to make optimal management decisions and develop adequate and effective management strategies in practical business.
Skills and abilities. Knowledge.	• Skills in practical setting and solving problems of linear programming in business, management and technology; • Skills of practical solutions of various types of transport tasks; • Skills of practical application of game theory and risk analysis when forecasting business situations; • Skills of practical application of the theory of case-processes in various business and management situations; • Skills of practical search of laws regressions; • Skills of practical analysis of time series, compilation of short-term and long-term forecasts; • Skills of practical application of game theory and risk analysis when forecasting business situations. • To analyze, systematize, synthesize and integrate information necessary for the operation of an enterprise. • To use modern technologies of information acquisition, processing and systematization. • To acquire new knowledge independently.
Competencies	Analysis of business and management problems. • The Mathematical modeling of optimization and forecasting problems. • The ability to apply the theoretical and practical knowledge and skills for the

	effective managing of an enterprise and its structural divisions. • The ability to plan and forecast the effective activity of an enterprise in accordance with the set aims, economic environment and labour market situation. • The ability to use information technologies for performing professional activities. • The ability to perform research with scientific value in the field of management.
Literature and other sources of information:	
Compulsory reading	Levy A. The Basics of Practical Optimization.- Society for Industrial and Applied, 2009.-167p. Gilliland. Business Forecasting: Practical Problems and Solutions.- Wiley, 2016.-417p. Hyndman R. Forecasting: Principles and Practice.- Otexts, 2014.-292p. Vanderbei R. Linear Programming. Foundations and Extensions.- Springer, 2010.-467p.
Recommended	Ord, K., Fildes R. Principles of Business Forecasting.- South-Western College Pub, 2019.-528p. Hanke D. Business forecasting.- Pearson, 2021.-510p. Stair R.M. and Reynolds G. Principles of Information Systems: A Managerial Approach (International Edition). Delmar Cengage Learning, 2021. - 635 p. Pierre D. A. Optimization theory with applications. Dover Publication, 2021. Microsoft Office 2019. Inside Out 1st Edition by Joe Habraken. Series: Inside Out. Publisher: Microsoft Press; 1 edition (December 10, 2019), - 1024 pages.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1.	Optimal solutions for management and economics. Description of economic and mathematical methods of optimization.	4	2
2.	Methods of linear programming. Practical examples.	4	2

3.	Integer linear programming. Practical examples.	4	2
4.	Transport problem. Organization of optimal supply. The transport problem of optimal transportation” Practical examples.	4	2
5.	Assignment Problem. A practical example.	4	2
6.	“Northwest corner method. Cycles.” The method of "the smallest element". Practical examples.	4	2
7	Planning a profitable business. Monte Carlo method in solving the linear programming problem	4	2
8.-9.	Sociometric matrixes. Sociometric modeling of the ranks of professional groups.	8	4
10	Optimization of the economy. A model of an expanding economy. Process intensity vector. Matrix of the business cycle. Coefficients of growth and profitability within the economic cycle. The conditions of economic equilibrium. The search for economic equilibrium.	4	2
11.-12.	Regression and correlation Pair regression. Multidimensional regression. Linear pair regression and correlation. Correlation coefficient, determination coefficient.	8	4
13.-14.	Time Series Analysis and Forecasting.	8	4
15.-16.	Performing practical tasks in application MS Excel.	8	4
Total:		64 ac.h.	32 ac.h.

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources and methodological materials learning	40/80/112	Acquired knowledge of: - the role of globalization in the development of management information systems;

		- the role of information systems in the process of enterprise management; - mathematical methods in economics; - working with MS Office applications; Testing form - test
2. Preparing for practical tasks. Solving the linear programming problems.	4/0/0	Knowledge, skills and competencies: - formulation and solutions of linear programming problems for business, management and economics; - mastering the technique of solving linear programming problems.
3. Preparing for practical tasks in the MS Excel. Transport problems solutions: organization of optimal supply.	4/0/0	Knowledge, skills and competences: - to formulate a linear programming problem for the transport problem of optimal transportation with minimal cost; - to apply relevant technique for solving transport problems using MS Excel, MathCAD; - finding the best solution with Solver.
4. Preparing for practical tasks in the MS Excel. Planning the technological cycle of the enterprise.	4/0/0	Skills and Competencies: - formulating the linear programming problem for the production problem of the optimal production plan with maximum income; - applying the relevant techniques for solving transport problems using MS Excel, MathCAD; - finding the best solution with Solver.
5. Preparing for practical tasks. Sociometric modeling of the ranks of professional groups.	4/0/0	Skills and Competencies: - application of the methodology of sociometric modeling of the ranks of professional groups using the programs MathCAD and MS Excel.
6. Preparing for practical tasks. The study of the Markov process of events. Solving the challenge of an expanding economy.	4/0/0	Skills and Competencies - application of the methodology for solving the problems of the expanding economy model using the MathCAD and MS Excel programs; - evaluation of business development prospects using the Markov process model.
7. Preparing for practical tasks. Regression and correlation analysis	4/0/0	Skills and Competencies: application of the acquired knowledge and the means of - pair regression; - multidimensional regression; - nonlinear pair regression and correlation.

8. Preparing for practical tasks. Time-set forecasting and trends research of real business.	8/0/0	Skills and Competencies: application of the acquired knowledge and the means of - time series conversion methods; - time series analysis: additive and multiplicative models; - spectral (FURIE) time series analysis; - forecasting methods; - assessment of the quality of forecasting; - short-time and long-time forecasting of business situations.
9. Preparing for practical tasks. Game theory models.	8/0/0	Skills and Competencies: application of the acquired knowledge and the means of - decision-making in conditions of uncertainty and risk; - decision-making in conditions of total uncertainty; - decision-making in conditions of risk; - decision-making with aid of decision tree; - practical experience in application of game theory and risk analysis of business situations.
10. Report writing. Theme 1: Inter-branch balance. Leontyev equation.	8/0/0	Knowledge, skills and competencies: students understand the structure of interbranch balance and present a methodology for it calculating.
11. Report writing. Theme 2: Economical equilibrium conditions.	8/0/0	Knowledge, skills and competencies: students know the conditions of economic equilibrium; are able to describe the types of market equilibrium; understand the mechanism to achieve market equilibrium. .
12. Tests for part-time students	0/48/48	The aim of tests for part time students is to assess their knowledge, skills and competences in the application of modern technologies of information acquisition, processing and systematisation, which is essential for the efficient operations of an enterprise. Practical work in MS Office applications.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
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1. Tests for full-time / part-time students	+	+	+	40
2. Exam	+	+	+	60

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 – almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete, the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Mathematical Modelling

Study programme	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Viktors Gopejenko
Preliminary knowledge, Related study courses	Mathematical Foundations for Software Engineering
Aim	The purpose of the course is • to give students an opportunity to obtain practice in the solution of the real world mathematic tasks • to teach to create models of systems and to work with them • to provide students with an opportunity to obtain practical skill in construction of the mathematical models in the tasks of the processes study in physics, electronics, economics, business, and life. To provide understanding and skills in the use of appropriate analytical methods and tools to effectively create, extract, maintain, recover and disseminate data and knowledge that is useful for business.
Planned learning outcomes	
Knowledge	
	1. know how to create mathematical models of the phenomenon and processes. 2. Understand the place of the mathematical packages in the modeling process of the real world objects
Skills	
	1. Solve the tasks of the systems behavior prediction 2. Apply received knowledge for the analysis, classification and generalization of the received information
Competencies	
	1. To analyse, systematize, synthesize and integrate obtained information
Literature and other sources of information:	
• Compulsory reading	1. Anwarud Din (2022) Optimal control theory of a novel International Journal of Modern Physics B Vol. 36, No. 32, 2250238 (2022) stochastic human norovirus model and vaccine development. https://doi.org/10.1142/S0217979222502381 2. Weiwei Zhang, Xinzhu Meng & Yulin Dong (2019) Periodic Solution and Ergodic Stationary Distribution of Stochastic SIRS Epidemic Systems with Nonlinear Perturbations Journal of Systems Science and

	Complexity volume 32, pages1104–1124 (2019) https://doi.org/10.1007/s11424-018-7348-9
● Recommended	1. J.R. Kalniņš, G. Hiļķeviča, E. Vītola. Matemātiskā modelēšana. Rīga: SIA „Drukātava”, 2008. 192 lpp 2. Juan Martin Garcia (2006) Theory and Practical Exercises of System Dynamics. Barcelona: Juan Martin Garcia, p.294. 3. Vensim Ventana Simulation Environment, DSS, Professional, PLE Plus, PLE. With Causal Tracing 4. Б Гулд Х. Тобочник Я. Компьютерное моделирование в физике. Тт. 1,2., М., Мир, 1990. 5. V.Gopejenko System Dynamics and Computer Experiments and Modelling Technologies, Research works (2020). Riga, RNU, e-public, pp.33 6. V.Gopejenko, Y.Kozmina. Simulation Model the Dynamics of the System Arising from Interaction of Tourism with the Local Environment. International Scientific Conference. International scientific conference INFORMATICS IN THE SCIENTIFIC KNOWLEDGE. Varna Free University. The Institute of Mathematics and Informatics Bulgarian Academy of Sciences. June 27-29, 2014, Varna, Bulgaria, pp.53-62 7. V. Gopejenko, Y. Kozmina (2012) Computer Simulation and System Dynamics in Educational Process (2012). International scientific conference: INFORMATICS IN THE SCIENTIFIC KNOWLEDGE June 27-29, 2012, Varna Free University, Varna, Bulgaria, pp.305-320 8. V.Gopejenko Mathematical Modeling, Study works (2020). Riga, RNU, e-public, pp.33 9. V.Gopejenko Mathematical Modeling, Practical exercises based on Vensim (2020). Riga, RNU, e-public, pp.51

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	System Dynamics Model Development with Vensim Software. System Dynamics, Classification of Systems, Generic Structures, Stock Flow Diagram, Overview of Vensim Interface and Building Block	4	2
2	Basis of mathematical modelling. Calculation after formulas.	4	2
3	Models based on ordinary differential equations	4	2
4	Oscillations. Simple harmonic oscillator	4	2
5	Oscillations in electrical circuits	4	2
6	Simulation of chaotic motion of the dynamic systems. Butterfly effect.	4	2
7	Modelling of the chaotic phenomena:	4	2

	Ordinary one-dimensional visualization Chaotic regime		
8	Mathematical models of stochastic processes	4	2
9	Random walk	4	2
10	Beam losses passing through substance	4	2
11	Calculation of integrals using Monte Carlo method	4	2
12	Waves and signals	4	2
13	Study beats	4	2
14	Simulation in business. Project Dynamics	4	2
15	Simulation in Social Area. A Catastrophe Study	4	2
16	Development of an Epidemic	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
Models based on ordinary differential equations. Study of the Newton thermal conductivity law	48/64/80	Knowledge, Skills and Competencies: give an understanding the studies of the processes and phenomena described by ordinary differential equations a
The Impact of the Business Plan	48/64/80	Knowledge, Skills and Competencies: to give students the knowledge to use a business plan to minimize risks at all business management; to be able to determine the endogenous factors that ca affect the growth of a business.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Home works (Self-study work)	+	+	+	50

2. Exam	+	+	+	50
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Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered;

	1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.
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RNU study course Computer Modelling and Computer Graphics

Study programme	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Juris Roberts Kalniņš
Preliminary knowledge, Related study courses	Mathematical Foundations for Software Engineering
Aim	The purpose of the course is to provide theoretical knowledge and practical skills in the basics of computer graphics and image processing; to teach student the main algorithms used in 2D and 3D computer graphics.
Planned learning outcomes	
Knowledge	
	To give theoretical knowledge about the fundamental concepts of 2D-3D Computer Graphics and modelling and raster graphics algorithms, representation and transformation of 2D/3D objects, image construction and image processing methods.
Skills	
	To develop practical skills for implementing the considered algorithms and methods in practice, using the programming environment offered in the training course.
Competencies	
	To develop the ability to independently and creatively use the acquired theoretical knowledge and practical skills to solve problems of computer graphics and image processing. Be able to create and convert two-dimensional (2D) and three-dimensional (3D) graphic objects in order to display the resulting image, object or animation on the screen of any device
Literature and other sources of information:	
Compulsory reading	- Computer Graphics from Scratch: A Programmer's Introduction to 3D Rendering. Paperback – May 13, 2021 by Gabriel Gambetta 248 pp. ISBN-13: 9781718500761 - Fei Wang, Chao Zhou, Yanlong Chen and Xindi Jing (2021) Construction of 3D GIS based on VR and Edge Computing. Journal of Physics: Conference Series, Volume 2138, International Conference on Artificial Intelligence and Big Data Applications (ICAIBD 2021) 24-25

	September 2021, Hubei, China J. Phys.: Conf. Ser. 2138 012027. DOI 10.1088/1742-6596/2138/1/012027.
Recommended	1. Computer Graphics Principles and Practice Third Edition JOHN F. Hughes Andries Van Dam, Morgan Mcguire, David F. Sklar, James D. Foley, Steven K. Feiner, Kurt Akeley 2014 Pearson Education, Inc. 2. Gopejenko, V., Gopejenko, A. (2018) Using applications and tools to visualize ab initio calculations performed in VASP, Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics) 10850 LNCS, pp. 489-496 (Scopus) DOI: 10.1007/978-3-319-95270-3_41 3. Gopejenko, V. Computer Graphics Algorithm and Computer Simulation Tutorial Work (2020). Riga, RNU, e-public, pp.14 4. Ravil I. Muhamedyev, Viktor I. Gopeyenko, Yevgenia A. Daineko, Alma T. Mansharipova, Elena L. Muhamedyeva. (2014) A method of Three-Dimensional Visualization of molecular processes of apoptosis. The 1st International Conference on Augmented and Virtual Reality (SALENTO AVR 2014, Lecce, Italy, September 17-20 2014), pp. 103-112. DOI: 10.1007/978-3-319-13969-2_8 5. Gopejenko, V. Mihailovs, I. (2015) Neurocomputer interface, the classification of the brain waves and virtual reality control 2015 9th IEEE International Conference on Application of Information and Communication Technologies - AICT2015, RUSSIA, Rostov-na-Donu, 14-16 October 2015, 4 pp. DOI: 10.1109/ICAICT.2015.7338595 6. Muhamedyev, R. Kiseleva, S. Gopejenko, V.I. Visualization of the renewable energy resources (2016) Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics) 2016 Book. DOI: 10.1007/978-3-319-40621-3_17 7. Темербеков С.Р. Компьютерная графика. Учебное пособие. – Рига, ИТС, 2002-184с.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Mathematical Foundations of Computer Graphics. Creation of 2 D objects. Basic Algorithms of Computer Graphics. Introduction Computer Graphics	4	2
2	2D Transformations- Translations, Scaling , Rotations, Matrix Notation. Composition of 2D Transformations	4	2
3	Coordinates System of Computer Graphics: World. Windows and Viewports Concepts.	4	2

	Transformation of Coordinates Clipping. Curve Fitting. B-spline interpolation.		
4	3D Computer Graphics. Types of 3D object models. 3D-coordinate systems. Basic 3D transformations. Composition of 3D Transformations	4	2
5	Spatial forms/Polygon mesh. Elements of mesh modelling. Presentation of spatial forms. Polygon mesh.	4	2
6	Methods of representation of Polygon mesh: - explicit description of the faces - description of the faces using the pointers in the list of the vertices explicit description of the edges Hidden Line Elimination. The ambiguity of perception. Solutions to the visibility problem in 3D computer graphics - Painter's algorithm - Z buffering A n algorithm based on the orientation of the vertices	4	2
7	Basic ray tracing Introduction to Raytracing and Rasterization Models to make pictures out of data	4	2
8	Basic ray tracing. Raytracing Algorithm: - Canvas to Viewport conversion - Tracing rays - The ray equation - The sphere equation - Ray meets sphere	4	2
9	Light. Light sources. Point lights Directional lights Ambient light Illumination of a single point Light. Diffuse reflection “matte” objects Modeling. Rendering with diffuse reflection Light. Specular reflection. Modeling specular reflection. Rendering with specular reflections	4	2
10	Light. Shadows Models. Reflection. Mirror reflection. Reflectiveness. Direction of Light Reflection. Light Reflection Range. Rendering with reflection Arbitrary camera position and orientation.. Rotation Matrix	4	2
11	Rasterization. Introduction. Lines. Draw Line. Interpolate function	4	2
12	Lines. Filled triangles. Sort the given points. Find the left and the right sides. Draw horizontal segments Shaded triangles. h-intensity of the color. Computing edge shading	4	2
13	Perspective projection. - The projection equations - 3D Cube Scene setup - 3D Cube a list of triangles - Models and instances	4	2

	- Models and Camera Transform		
14	Clipping. The Clipping Volume. Clipping the Scene Against a Plane. Defining the Clipping Planes. Clipping Triangles. Clipping in the Rendering Pipeline	4	2
15	Hidden surface removal - Rendering Solid Objects - Painter's Algorithm - Depth Buffering - Using 1/Z instead of Z - Back Face Culling - Classifying Triangles	4	2
16	Shading. Shading vs. Illumination. Flat Shading. Gouraud Shading. Phong Shading. Compare raytracer and rasterizer. Textures	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
Computer Graphics Algorithms.	48/64/80	Knowledge, Skills and Competencies: to give an understanding and capability to independently supplement the created programs to solve more complex practical problems of computer graphics and image processing; understanding the fundamental principles, advantages and limitations of computer graphics and image processing.
Ray Tracing and Rasterization	48/64/80	Knowledge, Skills and Competencies: to give students the knowledge the various computer graphics algorithms and image processing methods. capability create programs that implement the creation, transformation, visualization

		and processing of images of graphic objects.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Home works (Self-study work)	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part,

	however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course System Theory and System Analysis

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Juris Roberts Kalniņš
Preliminary knowledge, Related study courses	Critical Thinking, Introduction to programming using Python, Mathematical modelling
Aim	The aim of the "Systems Theory and System Analysis" course is to equip students with an understanding of the principles and methods used in systems theory and analysis. It seeks to foster an appreciation of how various components of a system interact with each other and contribute to the overall system's behavior and performance.
Planned learning outcomes	
Knowledge	1.Understanding of Systems Theory: Students will have a comprehensive understanding of systems theory, including the fundamental concepts, classification, and characteristics of systems. 2.Understanding of Systems Analysis: Students will understand the role of systems analysis, steps involved in it, and the various tools and techniques used. 3.Mathematical Modeling Skills: Students will be able to develop and interpret mathematical models used in systems analysis. They will understand how these models can be used to describe the behavior and performance of systems. 4.Understanding of System Dynamics: Students will understand the concept of system dynamics, including feedback loops, time delays, and oscillations in system behavior. 5.Systems Thinking: Students will understand the principles of systems thinking and will be able to apply these principles to problem-solving and decision-making. 6.Understanding of Complexity and Chaos Theory: Students will understand complexity and chaos theory and their implications on system behavior and predictability.
Skills	1.System Analysis Techniques: Students will have practical skills in using various system analysis techniques, such as linear and nonlinear programming, decision analysis, cost-benefit analysis, and risk analysis.

	2.Familiarity with Current Trends and Future Directions: Students will be familiar with the current trends and future directions in systems theory and systems analysis, particularly in the context of big data and artificial intelligence. 3.Application of Systems Theory and Analysis: Through case studies, students will understand the practical applications of systems theory and analysis across various disciplines.
Competencies	1.Critical Thinking: Students will be able to apply systems thinking in evaluating complex problems, making decisions, and formulating solutions. 2.Mathematical Proficiency: Students will be competent in developing and interpreting mathematical models for system analysis. 4.Analytical Skills: Students will have the ability to apply various system analysis techniques, such as linear and nonlinear programming, decision analysis, cost-benefit analysis, and risk analysis. 5.Problem Solving: Students will be able to apply the principles and methods of systems theory and system analysis to solve complex, real-world problems. 6.Understanding of System Dynamics: Students will be able to analyze system behavior in terms of dynamics, feedback loops, and time delays. 7.Interdisciplinary Application: Students will understand how systems theory and analysis can be applied in various disciplines and contexts, from engineering to business to social sciences. 8.Familiarity with Complexity and Chaos Theory: Students will be able to understand and explain the implications of complexity and chaos theory on system behavior and predictability. 9.Communication Skills: Students will be able to communicate complex systems theory concepts and analysis results effectively, both in written and oral form. 10 Continuous Learning: Students will be aware of current trends and future directions in systems theory and systems analysis, and have the ability to independently learn and adapt to new developments in the field.
Literature and other sources of information:	
Compulsory reading	1.A.V.Tyurin, A.Yu. Akhmerov, Systems theory and systems analysis in economics: Tutorial – Düsseldorf: LAP LAMBERT Academic Publishing GmbH & Co.KG., 2020. – 164 p. – ISBN 978-620-2-55443- 2.Dr. Bruce Powel Douglass, Dr. Christian von Holst, Agile Model-Based Systems Engineering Cookbook Improve system development by applying proven recipes for effective agile systems engineering, 2nd Edition.

	3. Joseph Valacich, Joey George, Jeffrey Hoffer, Modern Systems Analysis and Design Hardcover – Illustrated, 29 Jan. 2019.
Recommended	1. Basavanna shivanand s. Gornale, System analysis and design: : technology & applications paperback – 1 January 2020, ISBN 978-9389520385 2. Joseph S., Modern Systems Analysis and Design, Global Edition, Publisher Pearson 8th edition, ISBN-978-1292154145. 3. Alan Dennis, Barbara Wixom, David Tegarden, Systems Analysis and Design An Object-Oriented Approach with UML, 2020.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to Systems Theory	4	2
2	Fundamental Concepts and Characteristics of Systems	4	2
3	Classification of Systems	4	2
4	Components of Systems and Their Interrelationships	4	2
5	Emergent Properties and Hierarchy of Systems	4	2
6	Introduction to Systems Analysis The Role and Steps in Systems Analysis	4	2
7	Tools and Techniques Used in Systems Analysis Mathematical Modeling in Systems Analysis	4	2
8	Understanding and Developing Mathematical Models System Dynamics and Feedback Loops	4	2
9	Time Delays and Oscillations in System Behavior Principles of Systems Thinking	4	2
10	Application of Systems Thinking in Problem Solving and Decision Making	4	2
11	Complexity and Chaos Theory in Systems	4	2
12	Understanding Complex Adaptive Systems Chaos and Unpredictability in System Behavior	4	2

13	System Analysis Techniques: Linear and Nonlinear Programming	4	2
14	Decision Analysis in System Analysis Cost-Benefit Analysis and Risk Analysis in System Analysis	4	2
15	Case Studies in Systems Theory and Systems Analysis Current Trends and Future Directions in Systems	4	2
16	Theory and Systems Analysis The Role of Systems Theory and Analysis in the Age of Big Data and Artificial Intelligence.	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organization and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
Reading Assignments	24/32/40	Knowledge, Skills, and Competencies: Each week, students will be given reading assignments from the course textbook or other provided resources. These readings will supplement in-class lectures and provide a deeper understanding of the course content.
Online Resources	24/32/40	Knowledge, Skills, and Competencies: Students will also be directed to online resources such as educational websites, video lectures, and scholarly articles to expand their knowledge and understanding of the topics discussed.
Discussion Forums	24/32/40	Knowledge, Skills, and Competencies: Online discussion forums may be used to encourage peer-to-peer learning. Students will be expected to actively participate in these discussions, sharing their insights and responding to their classmates.

Problem-Solving Exercises	24/32/40	Knowledge, Skills, and Competencies: These exercises will allow students to apply theoretical knowledge to practical problems. They will be encouraged to work on these problems independently, developing their critical thinking and problem-solving skills.
Exams		Knowledge, Skills, and Competencies: There will be a midterm and a final exam to evaluate students' understanding of the course material. The exams will include a mix of multiple-choice questions, short-answer questions, and problem-solving exercises.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1.Mid-term Exam	+	+	+	30
2.Final Exam	+	+	+	40
3.Assignments and Projects	+	+	+	20
4.Participation and Attendance	+	+	+	10

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems;

	7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Professional Traineeship 1

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Andrejs Bondarenko
Preliminary knowledge, Related study courses	Compulsory study courses, Elective study courses, Professional specialization study courses, Study courses on research work, innovation work, project work and management
Aim	Provide students with practical experience in IT-related tasks such as software development, database management, network administration, cybersecurity, or project management. The main goals are to develop practical skills, expose students to the industry, apply theoretical knowledge, and enhance employability.
Planned learning outcomes	
Knowledge	
	1. Knowledge of networking and server technologies and their roles and functions. 2. Knowledge of backend development languages, frameworks, and tools.
Skills	
	1. Technical skills in analyzing and assessing IT infrastructure, backend development, and persistency layer technologies. 2. Practical skills in building frontend solutions and working with HTML/CSS/JavaScript and frontend frameworks.
Competencies	
	1. Critical thinking and problem-solving skills in proposing solutions to real-world IT problems. 2. Communication and collaboration skills in working with a team of IT professionals in the company providing the traineeship.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1-3	Study and analyze the IT infrastructure (both networking & servers) used in the company providing traineeship.	12	12
4-6	Study and assess technologies/frameworks used in frontend development (in the company providing traineeship).	12	12

7-9	Study and assess technologies used in the backend development in the company providing traineeship.	12	12
10-12	Study and asses technologies used in the persistency layer in the company providing traineeship.	12	12
13-16	Come up with conclusions of the analysis and proposals for improvement.	16	16
	Total:	64 ac.h	64 ac.h

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations;

	2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.
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RNU study course Professional Traineeship 2

Study program	Information Systems
Amount	12 ECTS = 320 ac.hours
Author	Andrejs Bondarenko
Preliminary knowledge, Related study courses	Compulsory study courses, Elective study courses, Professional specialization study courses, Study courses on research work, innovation work, project work and management
Aim	Provide students with practical experience in advanced IT infrastructure administration, DevOps techniques, software quality metrics, quality assurance processes, and software design patterns and architectures. The main goals are to develop practical skills, expose students to the industry's best practices, apply theoretical knowledge, and enhance employability.
Planned learning outcomes	
Knowledge	
	1. Knowledge of how to perform analyses and assessments of IT infrastructure administration processes and technologies. 2. Knowledge of how to perform analyses of software quality metrics and quality assurance processes. 3. Knowledge of software design patterns, architectural design processes, and types of architectures. 4. Knowledge of how to generate conclusions from analysis and make proposals for improvement.
Skills	
	1. Technical skills in analyzing and assessing IT infrastructure, its administration, and DevOps. 2. Practical skills in software quality metrics and QA process, as well as design patterns and architectural design patterns.
Competencies	
	1. Critical thinking and problem-solving skills in proposing solutions to real-world IT problems. 2. Communication and collaboration skills in working with a team of IT professionals in the company providing the traineeship. 3. Project management and organization skills.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural

1-2	Study and analyze advanced IT infrastructure administration process and technologies used in the company providing traineeship.	16	16
3-4	Study and assess the DevOps techniques used.	16	16
5-7	Study and assess software quality metrics used in the development process in the scope of the company providing traineeship.	24	24
8-10	Study and assess the quality assurance process and supporting technologies used in the company providing traineeship.	24	24
11-12	Study and assess software design patterns, architectural design process, and types of used architectures used in the company providing traineeship.	16	16
13-16	Draw conclusions from the analysis and proposals for improvement in the scope of the company providing traineeship.	32	32
	Total:	128 ac.h	128 ac.h

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding

	of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Qualification Traineeship

Study program	Information Systems
Amount	12 ECTS = 320 ac.hours
Author	Andrejs Bondarenko
Preliminary knowledge, Related study courses	Compulsory study courses, Elective study courses, Professional specialization study courses, Study courses on research work, innovation work, project work, and management
Aim	Provide students with practical experience in analyzing and assessing the entire lifecycle of an IT project, from project initiation to maintenance, and to develop their skills in proposing improvements and making informed decisions based on their analysis.
Planned learning outcomes	
Knowledge	
	1. Understanding of project initiation and planning processes. 2. Knowledge of software development methodologies. 3. Knowledge of software testing and deployment strategies. 4. Knowledge of project maintenance and support.
Skills	
	1. Ability to analyze and evaluate a project from initiation to maintenance. 2. Project management skills. 3. Communication skills for presenting analysis and recommendations.
Competencies	
	1. Ability to work independently and as part of a team. 2. Critical thinking and problem-solving skills. 3. Adaptability to changing project requirements and timelines.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1-2	Study and analyze project(s) initiation processes used in the company providing traineeship.	16	16
3-4	Study and analyze project(s) the planning processes used in the company providing traineeship.	16	16
5-6	Study and assess project(s) design processes used in the company providing traineeship.	16	16

7-10	Study and analyze project(s) development processes used in the company providing traineeship.	32	32
11-12	Study and analyze project(s) deployment strategy(-ies) used in the company providing traineeship.	16	16
13-14	Study and analyze project(s) maintenance processes used in the company providing traineeship.	16	16
15-16	Conduct overall software development process analysis, draw conclusions, and provide guidelines for improvements of the studied processes in the company providing traineeship.	16	16
	Total:	128 ac.h	128 ac.h

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as

	considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course IT Software Project Management

Study programme	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Jurijs Čižovs
Preliminary knowledge, Related study courses	Introduction to Software Engineering
Aim	The aims to provide an overview of the roles, responsibilities and management methods of the software project manager. The course intended to teach students how to develop approaches and styles of management for software projects. The discipline contains the theoretical foundations of software project management, describes modern methodologies, methods and tools for project management. Practical developments in project management carried out by students are aimed at acquiring the skills and abilities for detailed planning of software projects in an automated environment.
Planned learning outcomes	
Knowledge	
	1. Based on the system model, determine the main processes and project management functions for various management objects: project, program, project portfolio. 2. Draw up a diagram of a typical project life cycle. - Draw up a diagram of the life cycle of a software project.
Skills	
	1. Apply company-specific IT software project management methodologies 2. Planning and scheduling: the ability to create a project plan and schedule, and to track progress against those plans.
Competencies	1. Risk management: the ability to identify, assess, and mitigate risks that could impact the project's success. 2. Planning and organizing: the ability to develop clear and detailed plans for the project, and to effectively coordinate the efforts of team members to execute those plans. 3. Quality management: the ability to ensure that the project delivers a high-quality product that meets the needs of the end-users.
Literature and other sources of information:	
Compulsory reading	1. Koi-Akrofi, Godfred Yaw; Akrofi, Joyce Koi; Akwetey Matey, Henry, Understanding the Characteristics, Benefits and Challenges of Agile it Project Management: A Literature Based Perspective

	Series: International Journal of Software Engineering & Applications 2019-sep 30 vol. 10 iss. 5 2. Tameem Abdulbaset Abdulwahid ABDO Hezam, Software project development and management, August 2021 3. Uzma Omer, Shoaib Farooq, Rabia Tehseen, Software Project Management Education: A Systematic Review, September 2021 VFAST Transactions on Software Engineering 9(3):102-119
Recommended	1. Castro, Gabriela; Moreno, Ana M.; Peters, Lawrence, Agile and Software Project Management Antipatterns: Clarifying the Partnership, Series: IEEE Software, 2020. 2. Filippetto, Alessandro Souza; Lima, Robson; Barbosa, Jorge Luis A risk prediction model for software project management based on similarity analysis of context histories Series: Information and Software Technology 2021-mar vol. 131, 2021 3. Alessandro Filippetto, Robson Lima, and Jorge Barbosa, Átropos: towards a risk prediction model for software project management, Published Online: August 20, 2020 pp 296-314

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Software Project Basics	4	2
2	Tools and Techniques Estimation	4	2
3	Project Schedules Reviews	4	2
4	Software requirements	4	2
5	Design and Programming Software Testing	4	2
6	Using Project management effectively	4	2
7	Management and leadership	4	2
8	Managing an outsourced Project Process Improvement	4	2
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
Agile Project management	24/32/40	Knowledge, Skills and Competencies: Being able to estimate the resources required to perform an activity belonging to the software development process. To have strong decision-making skills. To use knowledge and strategic skills for the creation and management of projects, apply systematic solutions to complex problems, and design and manage the innovation in the organization. To demonstrate flexibility and professionalism when developing her work.
Classic Software Project management	24/32/40	Knowledge, Skills and Competencies: Being able to estimate the resources required to perform an activity belonging to the software development process. To have strong decision-making skills. To use knowledge and strategic skills for the creation and management of projects, apply systematic solutions to complex problems, and design and manage the innovation in the organization. To demonstrate flexibility and professionalism when developing her work.
Total:	48/64/80	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Home works (Self-study work)	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Advanced Software Architecture

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Jurijs Čižovs
Preliminary knowledge, Related study courses	Advanced Software Development
Aim	To supply students with a comprehensive understanding of various software architectures, clean architecture principles, layering schemes, and patterns, and enable them to design scalable and efficient systems while considering the tradeoffs between performance, complexity, maintainability, and extensibility.
Planned learning outcomes	
Knowledge	1. Understanding of the patterns and approaches used in modern software architecture. 2. Understanding of the different approaches to software system design.
Skills	1. The ability to apply architectural patterns in software architecture design and development. 2. The ability to apply architectural patterns in software architecture development.
Competencies	1. Show the ability to perform system analysis guided by the requirements. 2. Show the ability to perform system design guided by the requirements.
Literature and other sources of information:	
• Compulsory reading	1. Clean Architecture: Advanced and Effective Strategies Using Clean Architecture Principles; Elijan Lewis, 2020. 2. Clean Architecture: A Craftsman's Guide to Software Structure and Design, Martin, Robert Prentice Hall, 2017. 3. System Design Interview 2nd ed.; Alex Yu, 2020.
• Recommended	1. Patterns of Enterprise Application Architecture; Fowler, Martin, Addison-Wesley, 2015. 2. Release It! 2nd ed; Michael T. Nygard, Pragmatic Bookshelf, 2018. 3. Mastering Python Design Patterns; Kamon Ayeva, Sakis Kasampalis, Packt Publishing, 2018

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction and orientation Why Do we need architectures Types of architectures: Layered Architecture (n-tier Architecture) Event-Driven Architecture System Microservices Architecture System Space- Based Architecture System Microkernel Architecture System An Introduction to Clean Architecture Why use clean architecture?	4	2
2	The SOLID Principles The Dependency Rule The Classic Three Layered Structure Clean Architecture Components	4	2
3	Other Forms of Layered Software Architectures Clean Architecture: When We Cross Boundaries The Architecture of Application Design Architectural Independence Clean Architecture: The Other Side of the Picture: AKA: Drawbacks!	4	2
4	Services Great and Small The Test Boundary Clean Embedded Architecture	4	2
5	The database is a detail Frameworks are details Case study: video sales	4	2
5	Organizing Domain Logic Mapping to Relational Databases	4	2
7	Web Presentation Session State Distribution Strategies Putting It All Together Starting with the Domain Layer Down to the Data Source Layer Some Technology-Specific Advice Other Layering Schemes	4	2
8	Architectural Patterns Domain Logic Patterns Data Source Architectural Patterns Object-Relational Behavioral Patterns Object-Relational Structural Patterns	4	2

	Object-Relational Metadata Mapping Patterns		
9	Web Presentation Patterns Distribution Patterns Offline Concurrency Patterns	4	2
10	Session State Patterns Base Patterns	4	2
11	Stability Antipatterns Stability Patterns	4	2
12	Case study: Scaling from one to million users Back-of-the-envelope estimation A framework for system design interview	4	2
13	Case study: Design a rate limiter Case study: Design a consistent hashing	4	2
14	Case study: DESIGN A KEY-VALUE STORE Case study: DESIGN A UNIQUE ID GENERATOR IN DISTRIBUTED SYSTEMS	4	2
15	Case study: DESIGN A URL SHORTENER Case study: DESIGN A WEB CRAWLER	4	2
16	Case study: DESIGN A NOTIFICATION SYSTEM Case study: DESIGN A NEWS FEED SYSTEM	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts behind Software architecture, architectural patterns, and system design.
2. Familiarization with software architecture design.	24/32/40	Knowledge, Skills, and Competencies: Students understand and are able to make and justify the selection of software architecture.
3. Familiarization with architectural patterns.	24/32/40	Knowledge, Skills, and Competencies: Students understand and can apply architectural patterns to create software according to specifications.

4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students will be able to perform system analysis and design according to a specification.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part,

	however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Advanced Development Tooling

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Jurijs Čižovs
Preliminary knowledge, Related study courses	Advanced Software Development, Advanced Software Architecture
Aim	To supply students with an understanding of the software development advanced topics, giving them a taste of what practices and tools are included in the modern advanced software development tools.
Planned learning outcomes	
Knowledge	1. Understanding of the basics of DevOps and Version Control Systems (VSC) used in modern software development. 2. Understanding basic principles of the Docker, packaging and Jenkins build server.
Skills	1. The ability to operate with Git VCS, Docker, Jenkins. 2. The ability to setup packaging tools for Python and Java programming languages.
Competencies	1. Show the ability to justify the necessity of CI/CD workflow. 2. Show the ability to incorporate CI/CD process into the software development.
Literature and other sources of information:	
• Compulsory reading	1. Beginning Git and GitHub A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer, Mariot Tsitoara, 2020. 2. Docker in Action (2nd ed.), Jeff Nickoloff, Stephen Kuenzli, 2019. 3. Learn Python Programming: An in-depth introduction to the Fundamentals of Python (3rd ed.) Fabrizio Romano, Heinrich Kruger, 2021. (Chapter: Packaging Python Applications). 4. Introducing Maven - A Build Tool for Today's Java Developers, Balaji Varanasi, 2020. 5. Practical DevOps, Joakim Verona, 2016. (Chapters 1-3)

	6. Jenkins 2: Up and Running Evolve Your Deployment Pipeline for Next-Generation Automation, Brent Laster, 2018.
Recommended	1. Pipeline as Code: Continuous Delivery with Jenkins, Kubernetes, and Terraform, Mohamed Labouardy, Manning, 2021.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction and orientation DevOps: Intro to DevOps and Continuous Delivery DevOps: A View from Orbit DevOps: How DevOps affect the architecture	4	2
2	Git: Version Control Systems Git: Installation and Setup Git: Getting Started	4	2
3	Git: Diving into Git Git: Commits Git: Git best practices	4	2
4	Git: Github primer Git: Quick start with Primer Git: Beginning Project Management: Issues	4	2
5	Git: Diving into Project Management: Branches Git: Better Project Management: Pull Requests Git: Conflicts	4	2
5	Git: More About Conflicts Git: Git GUI Git: Advanced Git	4	2
7	Git: More with Github Git: Common git problems Git: Git and Github workflow	4	2
8	Docker: Docker Intro Docker: Running Software in Containers Docker: Software installation Simplified	4	2
9	Docker: Working with storage and volumes Docker: Single-host networking Docker: Resource control	4	2
10	Docker: Packaging software in images Docker: Building images automatically with dockerfiles Docker: Public and private software distribution	4	2
11	Docker: Image pipelines Docker: Services with Docker and Compose	4	2

12	Docker: First-class configuration abstractions Docker: Orchestrating services on a cluster of Docker hosts with Swarm	4	2
13	Build tools: Setuptools for Python	4	2
14	Build tools: Maven for Java	4	2
15	Build tools: Maven for Java cont'd + Alternatives	4	2
16	Jenkins2	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills and Competences: Students studied the core concepts behind the software development cycle and tooling.
2. Familiarization DevOps principles & Docker.	24/32/40	Knowledge, Skills, and Competencies: Students understand the driving forces behind DevOps, and Docker. Are able to set up Docker and utilize it in software development.
3. Familiarization GIT Version Control System and Jenkins build server.	24/32/40	Knowledge, Skills, and Competencies: Students understand, and can setup and use GIT VSC. Students can justify necessity of build server and perform basic setup of Jenkins platform.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students will be able to perform common software developer operations involving Git, Jenkins and Docker setup and utilization within the software development project.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations;

	2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Cloud Development and Architecture

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Andrejs Bondarenko
Preliminary knowledge, Related study courses	Advanced Software Development, Advanced Software Architecture, Terminal & OS
Aim	Provide students with the knowledge and skills to design, develop, and deploy cloud-based applications and services. Through the course, students should learn about the different cloud computing models and deployment options, as well as the various cloud services and infrastructure technologies available. They should also learn about cloud design patterns, integration techniques, and data management approaches.
Planned learning outcomes	
Knowledge	1. Understanding of the cloud computing concepts and technologies, strong understanding of the fundamentals of cloud computing, including different cloud computing models, deployment options, services, and infrastructure technologies. 2. Understanding of cloud governance, devops, and security, knowledge about the practices and tools needed to ensure the reliability, security, and cost-effectiveness of cloud-based systems.
Skills	1. The ability to use various cloud services and infrastructure technologies to design and implement cloud-based applications and services. 2. The ability to apply cloud governance, devops, and security practices in order to ensure the reliability, security, and cost-effectiveness of cloud-based systems.
Competencies	1. Show the ability to design and implement cloud-based applications and services that are scalable, resilient, and maintainable. This includes the ability to choose appropriate cloud computing models, deployment options, services, and infrastructure technologies, as well as the ability to apply appropriate design patterns and integration techniques.

	2. Show the basic ability to apply cloud governance, devops, and security practices in order to ensure the reliability, security, and cost-effectiveness of cloud-based systems.
Literature and other sources of information:	
Compulsory reading	- Cloud native architectures: design high-availability and cost-effective applications for the cloud, Arora Kamal, Farr Erik, Laszewski Tom, Zonooz Piyum, Packt Publishing, 2018. - Cloud Native Patterns: Architecture, Design and Culture, Pini Reznik, Michelle Gienow, Jamie Dobson, O'Reilly, 2019. - Multi-Cloud Architecture and Governance: Leverage Azure, AWS, GCP, and VMware vSphere to build effective multi-cloud solutions, Jeroen Mulder, Packt Publishing, 2020. - Microsoft Azure Fundamentals Certification and Beyond: Simplified cloud concepts and core Azure fundamentals for absolute beginners to pass the AZ-900 exam, Steve Miles, Packt Publishing, 2022.
Recommended	- Designing data-intensive applications: the big ideas behind reliable, scalable, and maintainable systems, Kleppmann Martin, O'Reilly, 2018. - Cloud Native Apps on Google Cloud Platform: Use Serverless, Microservices and Containers to Rapidly Build and Deploy Apps on Google Cloud, Alasdair Gilchrist, 2022. - Mastering AWS CloudFormation: Plan, develop, and deploy your cloud infrastructure effectively using AWS CloudFormation, Karen Tovmasyan, 2022. - Cloud Computing Solutions Architect: A Hands-On Approach: A Competency-based Textbook for Universities and a Guide for AWS Cloud Certification and Beyond, Arshdeep Bahga, Vijay Madiseti, 2019.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to Cloud Computing. Cloud Computing Models: IaaS, PaaS, SaaS.	4	2

2	Cloud Deployment Models: Public, Private, Hybrid. Cloud Services: Compute, Storage, Networking, Databases, Management, Security.	4	2
3	Cloud Infrastructure: Virtual Machines, Containers, Serverless. Cloud Architecture: Microservices, Monolithic, Serverless.	4	2
4	Cloud Design Patterns: 12-Factor App, CQRS, Event Sourcing. Cloud Integration: APIs, Webhooks, Service Bus, ETL.	4	2
5	Cloud Data Management: Relational, NoSQL, Big Data. Cloud Security: Identity and Access Management, Encryption, Compliance.	4	2
6	Cloud Governance: Cost Management, Resource Management, Compliance. Cloud DevOps: Continuous Integration, Continuous Deployment, Monitoring.	4	2
7	Cloud Monitoring: Metrics, Logging, Alerting. Cloud Disaster Recovery: Backup and Restore, High Availability, Business Continuity.	4	2
8	Cloud Migration: Lift and Shift, Re-platform, Re-factor, Re-architect. Cloud Integration Testing: Unit, Integration, System, Acceptance.	4	2
9	Cloud Performance Testing: Load, Stress, Volume, Scalability. Cloud Load Balancing: Types, Algorithms, Health Checks.	4	2
10	Cloud Auto Scaling: Rules, Policies, Triggers. Cloud Caching: In-memory, Disk-based, Distributed.	4	2
11	Cloud Queues: Job, Message, Event. Cloud Streams: Batch, Real-time, Event-driven.	4	2
12	Cloud Functions: Triggers, Inputs, Outputs, Durability. Cloud Containers: Docker, Kubernetes, Swarm.	4	2
13	Cloud Serverless: AWS Lambda, Azure Functions, Google Cloud Functions. Cloud Microservices: API Gateway, Service Registry, Load Balancer.	4	2
14	Cloud Monolithic: Monolith to Microservices, Strangler Pattern. Cloud Serverless: Monolith to Serverless, Event-driven Architecture.	4	2
15	Cloud DevOps: Infrastructure as Code, Configuration Management, Deployment Pipelines. Cloud Governance: Cost Optimization, Resource Management, Compliance.	4	2

16	Cloud Security: Networking, Identity and Access Management, Compliance. Cloud Architecture: Best Practices, Case Studies, Lessons Learned.	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts behind the software development cycle and tooling.
2. Familiarization challenges of microservices architecture in the cloud.	24/32/40	Knowledge, Skills, and Competencies: Students understand the driving forces behind the microservices architecture and can design cloud-based microservices solution according to the specification.
3. Familiarization with serverless computing in the cloud, security, and governance.	24/32/40	Knowledge, Skills, and Competencies: Students understand and can design serverless computing solutions in the cloud; are knowledgeable in the cloud security and governance areas.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can implement design and, according to the design, implement microservices solutions and serverless solutions in the cloud. In addition, they are capable of planning and implementing governance of such solutions.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations;

	2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course NoSQL DBMS Advanced Topics

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Andrejs Bondarenko
Preliminary knowledge, Related study courses	Advanced Software Development, Advanced Software Architecture, Terminal & OS
Aim	Provide students with a comprehensive introduction to NoSQL database management systems, including their design, architecture, and application. Students will learn about the various types of NoSQL databases, their strengths and limitations, and how to use them in real-world applications effectively. By the end of the course, students will have a solid understanding of NoSQL databases and be able to confidently use them to store, retrieve, and manage data in various contexts.
Planned learning outcomes	
Knowledge	1. Understanding of various types of NoSQL databases, including key-value stores, document stores, column-family stores, and graph stores. 2. Understanding of the underlying concepts and principles that govern the design and operation of NoSQL databases, including the CAP theorem, horizontal scaling, sharding, and distributed consensus.
Skills	The ability to select a specific NoSQL database according to the specifics of a task at hand. 1. The ability to perform data modeling and querying in NoSQL databases, taking into account the specific requirements and constraints of the chosen database system.
Competencies	1. Show understanding of the different types of NoSQL databases, their architecture, data models, and use cases. Students should be able to evaluate the suitability of different NoSQL databases for different scenarios and be able to design and implement NoSQL database solutions to meet specific requirements. 2. Show the usage of NoSQL databases in real-world applications to fulfill the requirements at hand.
Literature and other sources of information:	

Compulsory reading	- Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement, Luc Perkins, Eric Redmond, Jim Wilson, Pragmatic Bookshelf, 2018. - Cassandra: The Definitive Guide: Distributed Data at Web Scale (3rd ed), Jeff Carpenter, Eben Hewitt, O'Reilly, 2022. - MongoDB Fundamentals: A hands-on guide to using MongoDB and Atlas in the real world, Amit Phaltankar, Juned Ahsan, Michael Harrison, Liviu Nedov, 2020.
Recommended	- NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence (4th Edition), by Pramod J. Sadalage and Martin Fowler (2019), - MongoDB in Action (3rd Edition), by Kyle Banker 2019. - Learning Redis (2nd Edition) by Maxwell Dayvson Da Silva and Hugo Lopes Tavares, 2019.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to NoSQL databases. Types of NoSQL databases: key-value stores, document stores, column-family stores, and graph stores.	4	2
2	CAP theorem and how it applies to NoSQL databases. Setting up a NoSQL database: installation and configuration.	4	2
3	Data modeling in NoSQL databases. Working with key-value stores: Redis and DynamoDB.	4	2
4	Working with document stores: MongoDB and Couchbase. Working with column-family stores: Cassandra and HBase.	4	2
5	Working with graph stores: Neo4j and TigerGraph. Importing and exporting data in NoSQL databases.	4	2
6	NoSQL database security: authentication and authorization. NoSQL database performance: indexing and sharding.	4	2
7	NoSQL database scalability: horizontal scaling and load balancing. NoSQL database reliability: backup and recovery.	4	2

8	NoSQL database integration: using NoSQL databases with other systems. Case study: using NoSQL databases in a real-world application.	4	2
9	Querying NoSQL databases: language support and query optimization. Indexing in NoSQL databases: types of indexes and when to use them.	4	2
10	Aggregation in NoSQL databases: group by, distinct, and more. Transactions in NoSQL databases: support and limitations.	4	2
11	Working with large datasets in NoSQL databases: handling data volume and velocity. Real-time processing in NoSQL databases: stream processing and event-driven architectures.	4	2
12	NoSQL database integration: using NoSQL databases with big data systems like Hadoop and Spark. NoSQL database integration: using NoSQL databases with cloud services like Amazon Web Services, Microsoft Azure, and Google Cloud Platform.	4	2
13	NoSQL database integration: using NoSQL databases with serverless architectures. NoSQL database integration: using NoSQL databases with microservices.	4	2
14	NoSQL database integration: using NoSQL databases with containers and container orchestration systems like Docker and Kubernetes. NoSQL database integration: using NoSQL databases with mobile and IoT devices.	4	2
15	NoSQL database administration: monitoring and tuning. NoSQL database deployment: best practices and considerations.	4	2
16	Advanced NoSQL database concepts: distributed systems, distributed consensus, and distributed transactions. NoSQL database use cases: when to use NoSQL databases and when to use traditional relational databases.	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for	Planned learning outcomes
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	full-time/ part-time intramural/ part-time extramural or distance studies	
1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills and Competencies: Students studied the core concepts behind the NoSQL SBMS.
2. Familiarization with NoSQL DBMS types.	24/32/40	Knowledge, Skills, and Competencies: Students understand the driving forces behind the NoSQL DBMSs and can select the appropriate DB for a task at hand to fulfill the specification.
3. Familiarization with NoSQL query specifics.	24/32/40	Knowledge, Skills, and Competencies: Students can implement queries to select, retrieve, update and delete information from NoSQL DBMSs.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can implement design and, according to the design, implement microservices solutions and serverless solutions in the cloud. In addition, they are capable of planning and implementing governance of such solutions.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems;

	9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Data Science Foundations

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Juris Roberts Kalniņš
Preliminary knowledge, Related study courses	System and Object Oriented Programming, Advanced Software Development
Aim	Provide students with a comprehensive introduction to the field of data science, including the tools, techniques, and methods used by data scientists. Students will develop the skills and knowledge they need to work with real-world data sets and apply basic machine-learning algorithms to solve data science problems. The course will also cover the ethical considerations involved in working with data and provide students with the foundation they need to pursue a career in data science or related fields.
Planned learning outcomes	
Knowledge	1. Understand the principles and practices of data science and be able to work with a variety of data types and formats 2. Understanding of statistical and machine learning techniques that can be applied to data sets to identify patterns and trends and make predictions.
Skills	1. The ability to manipulate and clean data using Python. 2. The ability to apply machine learning algorithms to data sets to solve real-world problems.
Competencies	1. Show an understanding of the ethical considerations involved in working with data and be able to apply best practices in data privacy and security. 2. Be able to communicate data science results effectively to a variety of audiences, including technical and non-technical stakeholders.
Literature and other sources of information:	
• Compulsory reading	1. Data Science from Scratch: First Principles with Python (2nd Edition), Joel Grus, O'Reilly, 2019.

	2. Data science, MIT Press essential knowledge series, Kelleher John D., Tierney Brendan, The MIT Press, 2018.
Recommended	1. Practical statistics for data scientists: 50 essential concepts, Bruce Andrew, Bruce Peter C, O'Reilly, 2018.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to data science and the data science workflow. Understanding data types and working with data in Python.	4	2
2	Exploratory data analysis and data visualization. Working with large datasets and distributed computing.	4	2
3	Data wrangling and cleaning. Data preprocessing and feature engineering.	4	2
4	Introduction to statistical analysis Hypothesis testing and A/B testing.	4	2
5	Linear regression. Logistic regression.	4	2
6	Classification algorithms. Clustering algorithms.	4	2
7	Recommendation systems. Time series analysis and forecasting.	4	2
8	Natural language processing Singular value decomposition (SVD) algorithm	4	2
9	Advanced techniques in data wrangling and cleaning. Advanced techniques in data visualization.	4	2
10	Advanced techniques in feature engineering. Advanced techniques in statistical analysis.	4	2
11	Model evaluation and selection. Model deployment and serving.	4	2
12	Building and evaluating a data science project end-to-end. Collaborating and communicating as a data scientist.	4	2
13	Ethical considerations in data science. Data science in industry: case studies.	4	2
14	Data science in academia: case studies. Data science in government: case studies.	4	2
15	Data science in nonprofit organizations: case studies. Data science in startup companies: case studies.	4	2

16	Career paths and job search strategies for data scientists. Wrap-up and next steps for continuing education in data science.	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts behind statistical data analysis.
2. Familiarization with data wrangling and preprocessing.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate skills and competencies in using Python programming language and Pandas library to manipulate and clean data.
3. Familiarization with data modeling techniques and results presentation.	24/32/40	Knowledge, Skills, and Competencies: Students should develop the skills to apply data modeling techniques to real-world data sets, as well as evaluate and compare different models, as well as be able to present data analysis results clearly and effectively to a variety of audiences.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can work with real-world data sets to perform tasks such as data exploration, visualization, analysis, and modeling.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
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1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations;

	2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Scientific Visualization in Python

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Jurijs Čižovs
Preliminary knowledge, Related study courses	Algorithms and Data Structures, Data Science Foundations
Aim	Provide students with a thorough understanding of the principles of scientific data visualization and the tools available in Python for creating effective visualizations. The course will cover a variety of 2D and 3D visualization libraries, as well as techniques for visualizing multidimensional data, and teach students how to use these tools to explore and analyze data sets.
Planned learning outcomes	
Knowledge	1. Understand the principles of effective scientific data visualization, including how to select the appropriate visualization for a given dataset. 2. Understand how to customize plots to convey information effectively, and how to design visualizations that are accurate and easy to interpret.
Skills	1. Skills in using 2D and 3D visualization libraries: including Matplotlib, Pandas, Seaborn, Plotly, Bokeh, and others. 2. The ability to create a wide range of plots and visualizations.
Competencies	1. Show the ability to select the specific visualization that will ensure the best data interpretation and insights. 2. Show the ability to implement visualizations in Python language and present the results.
Literature and other sources of information:	
• Compulsory reading	1. Python Data Visualization Essentials Guide: Become a Data Visualization expert by building strong proficiency in Pandas, Matplotlib, Seaborn, Plotly, Numpy, and Bokeh, Kalilur Rahman, BPB Publications, 2021. 2. The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios, Steve Wexler, Jeffrey Shaffer, Andy Cotgreave, Wiley, 2017.

Recommended	1. Matplotlib documentation [online: https://matplotlib.org/stable/index.html] 2. Pandas documentation [online: https://pandas.pydata.org/docs/] 3. Seaborn documentation [online: https://seaborn.pydata.org/] 4. Plotly documentation [online: https://plotly.com/python/] 5. Bokeh documentation [online: https://docs.bokeh.org/en/latest/] 6. Mayavi documentation [online: https://docs.enthought.com/mayavi/mayavi/] 7. NetworkX documentation [online: https://networkx.org/documentation/networkx-1.9/] 8. PyVis documentation [online: https://pyvis.readthedocs.io/en/latest/documentation.html] 9. PyVista documentation [online: https://docs.pyvista.org/] 10. VTK documentation [online: https://vtk.org/documentation/] 11. yt documentation [online: https://yt-project.org/doc/index.html]
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Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to scientific visualization. Basic plotting with Matplotlib.	4	2
2	Customizing plots with Matplotlib. Plotting 2D arrays with Matplotlib.	4	2
3	Introduction to 3D visualization with Matplotlib. Advanced 3D visualization with Matplotlib.	4	2
4	Visualizing data on maps with Matplotlib and Cartopy. Introduction to data visualization with Pandas.	4	2
5	Advanced data visualization with Pandas. Visualizing data with Seaborn.	4	2
6	Plotly plotting.	4	2
7	Data visualization with Bokeh. Introduction to scientific visualization with Mayavi.	4	2
8	Scientific visualization with Mayavi. Visualizing network data with NetworkX.	4	2
9	Visualizing graphs with Pyvis. Visualizing geometric data with PyVista.	4	2

10	Introduction to volume rendering with VTK. Advanced volume rendering with VTK.	4	2
11	Visualizing multidimensional data with yt. Visualizing data on the web with Plotly and Dash.	4	2
12	Visualizing data in Jupyter notebooks with ipywidgets and Bqplot. Using D3 for data visualization.	4	2
13	Scientific visualization in 3D with Blender.	4	2
14	Scientific visualization in VR with OpenVR.	4	2
15	Best practices for scientific visualization. Common pitfalls in scientific visualization.	4	2
16	Tips and tricks for optimizing scientific visualization. Creating a scientific visualization from start to finish.	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts behind the software development cycle and tooling.
2. Familiarization with 2D visualization libraries.	24/32/40	Knowledge, Skills, and Competencies: Students are capable of using 2D visualization libraries for the creation of various types of plots and visualizations.
3. Familiarization with 3D and multidimensional data visualization techniques.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate their skills in using advanced 3D visualization libraries and show their competencies in creating and customizing 3D plots, as well as their knowledge of best practices for visualizing multidimensional data sets.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can

		work with real-world data sets to perform tasks such as data exploration, visualization, analysis, modeling, and results presentation.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many

	problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Automation and Data Scraping in Python

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author (s)	Jurijs Čižovs
Preliminary knowledge, Related study courses	Algorithms and Data Structures, Data Science Foundations
Aim	Provide students with a thorough understanding of the principles of tasks automation tasks and data scraping from files and websites, and other sources using Python.
Planned learning outcomes	
Knowledge	1. Understand the principles of data automation and are able to explain approaches to the automation. 2. Understand the principles of data scraping from different sources using the Python programming language libraries.
Skills	1. Skills in automation of basic tasks and local data sources crawling using Python language. 2. Skills in web crawling pipelines using the Scrapy library.
Competencies	1. Show the ability to set up the automation pipelines and allow to generate reports to fulfill automated actions. 2. Show the ability to set up the local and remote resources crawling pipelines.
Literature and other sources of information:	
• Compulsory reading	1. Python Automation Cookbook (2nd Edition), Jaime Buelta, 2020. 2. Learning Scrapy: Learn the art of efficient web scraping and crawling with Python, Kouzis-Loukas, Dimitrios, 2016.
• Recommended	1. Python Web Scraping Cookbook: Over 90 proven recipes to get you scraping with Python, microservices, Docker, and AWS, Michael Heydt, 2018.

Study course content and schedule of contact hours

Week	Topic	Academic hours
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		full-time intramural	part-time intramural
1	Introduction to automation, data scraping and web scraping. Setting up a development environment for automation and scraping.	4	2
2	Automating tasks Searching and reading local files.	4	2
3	Generating reports. Working with spreadsheets.	4	2
4	Automating communication/scraping of email, sms, Telegram.	4	2
5	Automating marketing campaign. Automating testing routines.	4	2
6	Understanding HTML, CSS and XPath.	4	2
7	Using the Python requests library to send HTTP requests. Parsing HTML with the BeautifulSoup library.	4	2
8	Navigating the DOM with BeautifulSoup. Extracting data with BeautifulSoup.	4	2
9	Handling pagination. Scraping JavaScript-rendered websites.	4	2
10	Scrapy setup and basic usage	4	2
11	From Scrapy to a Mobile app.	4	2
12	Quick Spider recipes. Deploying Scrapy.	4	2
13	Scrapy: Configuration and Management. Programming Scrapy	4	2
14	Scrapy Pipeline recipes. Scrapy - understanding performance	4	2
15	Distributed crawling Handling CAPTCHAs and IP blocking.	4	2
16	Storing scraped data in databases. Cleaning and processing scraped data. Basic Visualizing scraped data with Python libraries. Legal and ethical considerations for web scraping.	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/	Planned learning outcomes
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	part-time intramural/ part-time extramural or distance studies	
1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts of automation and data scraping principles.
2. Familiarization with automation technologies.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate knowledge of concepts of automation tasks using Python.
3. Familiarization with data scraping technologies.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate their knowledge of scraping technologies for scraping local files and remote resources.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can set up automation, and data scraping projects and implement corresponding pipelines.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;

High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Machine Learning

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Jurijs Čižovs
Preliminary knowledge, Related study courses	Algorithms and Data Structures, Data Science Foundations
Aim	Provide students with the knowledge and skills needed to develop and apply machine learning algorithms to solve real-world problems. This includes understanding the theoretical foundations of machine learning, as well as being able to implement and evaluate machine learning models using appropriate software and tools. Help students understand the various types of machine learning algorithms, such as supervised and unsupervised learning, and be able to choose the appropriate algorithm for a given task. The course should also teach students how to evaluate the results of machine learning models critically and how to use machine learning to gain insights from data.
Planned learning outcomes	
Knowledge	1. Understand the principles of supervised and unsupervised learning, as well as corresponding algorithms. 2. Understand the principles of data preprocessing, model selection and results interpretation.
Skills	1. Skills in training the various models from supervised and unsupervised domains. 2. Skills in preparing the data for modeling tasks, training, and selecting the best model.
Competencies	1. Show the ability to recognize the type of problem at hand and set up the modeling pipeline. 2. Show the ability to preprocess data, interpret the results and present them to the stakeholders.
Literature and other sources of information:	
• Compulsory reading	1. The Elements of Statistical Learning Data Mining, Inference, and Prediction (2nd ed., 12th printing), Trevor Hastie, Robert Tibshirani, Jerome Friedman, 2017.

Recommended	1. The Hundred-Page Machine Learning Book, Andriy Burkov, 2019. 2. Designing Machine Learning Systems, Chip Huyen, O'Reilly Media, 2022.
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Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Overview of Supervised Learning	4	2
2	Linear Methods for Regression	4	2
3	Linear Methods for Classification	4	2
4	Basis Expansions and Regularization	4	2
5	Kernel Smoothing Methods	4	2
6	Model Assessment and Selection	4	2
7	Model Inference and Averaging	4	2
8	Additive Models, Trees, and Related Methods	4	2
9	Boosting and Additive Trees	4	2
10	Neural Networks	4	2
11	Support Vector Machines	4	2
12	Prototype Methods and Nearest-Neighbors	4	2
13	Unsupervised Learning	4	2
14	Random Forests	4	2
15	Ensemble Learning	4	2
16	Selected problems and case studies	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts of machine learning principles.

2. Familiarization with supervised learning techniques.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate knowledge of supervised learning and algorithms implementing classification and regression problems.
3. Familiarization with unsupervised learning techniques, model selection, and ensemble methods.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate their knowledge of the unsupervised algorithms as well as models selection and result interpretation; additionally demonstrate knowledge of ensemble models..
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can set up a machine learning project, prepare data, train models, assess their performance, and present the results.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is

	insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Big Data Processing

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Andrejs Bondarenko
Preliminary knowledge, Related study courses	System and Object Oriented Programming, Advanced Software Development
Aim	Provide students with the knowledge and skills needed to recognize situations requiring big data processing and to develop code for big data processing in a batched and streaming manner using Spark, Kafka and Darts platforms.
Planned learning outcomes	
Knowledge	1. Understand the principles of big data streaming applications, and driving forces behind them. 2. Understand the principles of parallel data processing using the Dask framework.
Skills	1. Skills in developing spark based streaming applications with Kafka used for data transformations. 2. Skills in using Dask framework to run parallel data processing.
Competencies	1. Show the ability to distinguish between streaming and batch data processing, show the ability to implement data processing routines using Apache Spark and Kafka. 2. Show the ability to justify usage of the parallel processing in Dask, ability to setup and develop code for parallel data processing.
Literature and other sources of information:	
• Compulsory reading	1. Data Algorithms with Spark: Recipes and Design Patterns for Scaling Up using PySpark, Mahmoud Parsian, O'Reilly Media, 2022. 2. Building Data Streaming Applications with Apache Kafka, Manish Kumar, Chanchal Singh, PackT, 2017. 3. Data Science with Python and Dask Jesse C. Daniel, 2019.
• Recommended	1. Fundamentals of Data Engineering: Plan and Build Robust Data Systems, Joe Reis, Matt Housley, 2022.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Overview of the big data processing landscape and technologies.	2	1
2	Map-Reduce, Hadoop, HDFS overview	2	1
3	Introduction to Spark and PySpark	2	1
4	Transformation in Action Mapper Transformations	2	1
5	Reduction in Action Partitioning Data	2	1
6	Graph Algorithms	2	1
7	Data Design Algorithms	2	1
8	Introduction to Messaging Systems Introducing Kafka the Distributed Messaging Platform	2	1
9	Kafka Producers Kafka Consumers	2	1
10	Spark Streaming with Kafka	2	1
11	Storm Application with Kafka	2	1
12	Using Kafka in Big Data Applications Streaming Application Design Considerations	2	1
13	Introduction to Dask Dask data frames - Loading/Cleaning	2	1
14	Dask data frames - Transforming/Summarizing	2	1
15	Dask visualization with datashader	2	1
16	Dask working with Bags and Arrays Dask scaling and deploying options	2	1
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning.	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts of machine learning principles.

2. Familiarization with Spark and Kafka.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate knowledge of Spark and Kafka for tasks such as data cleansing, transformation using in a batch and streaming fashion using Python API.
3. Familiarization with Dask.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate their knowledge of Dask parallel computation platform for data ingestion, and transformation using Python API.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can implement data workflows in Spark and optionally Kafka for streaming processing. Additionally students will demonstrate their skills in Dask framework utilization for parallel data processing.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues

	to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Java Development for Enterprise (Spring)

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Viktors Gopejenko
Preliminary knowledge, Related study courses	System and Object Oriented Programming, Advanced Software Development
Aim	Provide students with the knowledge and skills needed to develop enterprise-level applications using the Spring Framework. The course covers topics such as dependency injection, REST services creation and consumption, applications securing, reactive programming and data persistence within Spring 6 framework.
Planned learning outcomes	
Knowledge	1. Understand the core concepts behind Spring Framework and its features, including dependency injection, Spring Security, and Spring Boot. 2. Understanding of data persistence technologies and ways on how to use them with Spring Data to store and retrieve data in a database, as well as understanding of REST services and ways on how to implement them with the help of Spring framework.
Skills	1. Skills in using the Spring Framework to build enterprise-level applications, including knowledge of Spring's core features and advanced topics such as Spring Security and Spring Boot. 2. Skills in designing and implementing data persistence solutions for enterprise applications using Spring Data, including knowledge of various data access technologies and how to use them with Spring Data, as well as creation and consumption of REST services.
Competencies	1. Show the ability to design and implement enterprise-level applications using the Spring Framework. 2. Show the ability to design and implement data persistence solutions for enterprise applications using Spring Data, as well as solutions involving REST-based services.
Literature and other sources of information:	

Compulsory reading	- Spring in Action, Sixth Editio, Craig Walls, Manning, 2021. - Cloud Native Microservices with Spring and Kubernetes: Design and Build Modern Cloud Native Applications using Spring and Kubernetes, Rajiv Srivastava, BPB Publications, 2021.
Recommended	Spring Boot: Up and Running: Building Cloud Native Java and Kotlin Applications, Mark Heckler, 2021.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Getting started with Spring	2	1
2	Developing web applications	2	1
3	Working with data relational/non-relational	2	1
4	Securing Spring	2	1
5	Working with configuration	2	1
6	Creating REST services	2	1
7	Consuming REST services	2	1
8	Securing REST services	2	1
9	Asynchronous messaging	2	1
10	Spring integration	2	1
11	Reactive Spring: Reactor	2	1
12	Developing Native API	2	1
13	Working with RSocket	2	1
14	Persisting data reactively	2	1
15	Spring Boot Actuator	2	1
16	Administering, monitoring and deploying Spring	2	1
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/	Planned learning outcomes

	part-time extramural or distance studies	
1. Compulsory reading, sources, and methodological materials learning.	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts of Spring framework.
2. Familiarization with Spring Data and Spring Security.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate knowledge of Spring data and know how to apply it to relational and non-relational data. Students demonstrate knowledge of Spring Security part of the Spring framework.
3. Familiarization with Spring Reactive programming and REST services.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate their knowledge of reactive programming and REST services, as well as monitoring, configuration, dependency injection and deployment of the Spring-based applications.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can implement Spring-based applications with data-persistence features, security applied to created REST services; applications that are able to consume REST-services, as well as demonstrate ability to configure, monitor and deploy such applications.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements

Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Enterprise Development in C#

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Andrejs Bondarenko
Preliminary knowledge, Related study courses	System and Object Oriented Programming, Advanced Software Development
Aim	To supply students with an understanding of the software development in C# language with an emphasis on backend development including OOP, testing and debugging, data persistency, security best practices, and deployment.
Planned learning outcomes	
Knowledge	1. Understanding of the concepts and principles of software architecture, including design patterns and SOLID principles. 2. Familiarity with the .NET framework and its various components, such as the Common Language Runtime (CLR) and the Base Class Library (BCL).
Skills	1. The ability to design and implement maintainable and secure software solutions using C# and the .NET framework. 2. Proficiency in using debugging and testing tools to ensure the quality of the code.
Competencies	1. Show the ability to apply software design principles and patterns to real-world scenarios. 2. Show the ability to develop software solutions that meet the needs of large organizations.
Literature and other sources of information:	
• Compulsory reading	1. Enterprise Application Development with C# 10 and .NET 6 (2nd ed.), Ravindra Akella, Arun Kumar Tamirisa, Suneel Kumar Kunani, Bhupesh Guptha Muthiyalu, Packt, 2022. 2. Head First C#, 4e: A Learner's Guide to Real-World Programming with C# and .Net Core, Stellman Andrew, Greene Jennifer, O'Reilly, 2021
• Recommended	1. C# 10 in a Nutshell: The Definitive Reference, Joseph Albahari, 2022.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction and orientation. Project setup, structure and OOP.	4	2
2	Designing and Architecting the Enterprise Application.	4	2
3	Introducing .NET 6 Core and Standard.	4	2
4	Introducing C# 10.	4	2
5	Threading and Asynchronous Operations.	4	2
5	Dependency injection in .NET 6. Configuration in .NET 6.	4	2
7	Logging in .NET 6. Caching	4	2
8	Working with Data in .NET 6.	4	2
9	Creating ASP .NET 6 Web API.	4	2
10	Creating ASP .NET 6 Web Application.	4	2
11	Authentication and Authorization .NET 6.	4	2
12	Health and Diagnostics.	4	2
13	Testing.	4	2
14	Deploying to Azure.	4	2
15	Use cases and examples. Course Projects presentation.	4	2
16	Course Projects presentation. Final exam.	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts behind C# programming language, functional programming, and OOP.
2. Familiarization with C# core principles.	24/32/40	Knowledge, Skills, and Competencies: Students understand the core principles of OOP development, testing,

		and debugging and can read and explain C# code.
3. Familiarization with C# enterprise development.	24/32/40	Knowledge, Skills, and Competencies: Students can design and develop enterprise applications in C# covering data persistence and remote services and can apply techniques beyond ordinary data structures to create software according to specifications.
4. Practical Exercises.	24/32/40	Knowledge, Skills, and Competencies: Students can design and implement software with data persistency, remote services, and domain logic layers according to a specification.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however,

	sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course DevOps course

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Dmitrijs Skorodihins
Preliminary knowledge, Related study courses	Advanced Software Development, Development Process and Tooling Foundations, Advanced Development Tooling, Terminal & OS.
Aim	Teach students how to effectively apply DevOps principles and practices in their work. Students will learn how to improve the collaboration and communication between development and operations teams, as well as how to use tools and processes to automate and streamline the software delivery process. Course is not focusing specifically on CI/CD, Version Control Systems, Python programming and work with terminal (Linux) as these are parts of preliminary courses.
Planned learning outcomes	
Knowledge	1. Understand the principles and practices of DevOps and how they can be applied to the development and operation of enterprise systems. 2. Understand the tools and technologies used in a DevOps workflow, including version control, continuous integration, and infrastructure as code.
Skills	1. Be able to use tools and techniques to automate the build, test, and deployment processes for enterprise systems. 2. Be able to design and implement a continuous delivery pipeline for an enterprise system.
Competencies	1. Show the ability to apply the principles and practices of DevOps to the development and operation of enterprise systems. 2. Show the ability to collaborate with cross-functional teams, including developers, operations staff, and business stakeholders, to improve the efficiency and effectiveness of the software development and delivery process.
Literature and other sources of information:	

Compulsory reading	1. Designing and Implementing Microsoft DevOps Solutions AZ-400 Exam Guide: Prepare for the certification exam and successfully apply Azure DevOps strategies with practical labs, (2nd ed), Subhajit Chatterjee, Swapneel Deshpande, Henry Been, Maik van der Gaag, Packt Publishing, 2022. 2. Practical DevOps, Joakim Verona, Packt Publishing, 2016. 3. Learning DevOps: The complete guide to accelerate collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps, Mikael Krie, Packt, 2019. 4. Infrastructure as Code, Patterns and Practices With Examples in Python and Terraform, Rosemary Wang, Manning, 2022. 5. Ansible for DevOps: Server and configuration management for humans, Jeff Geerling, Midwestern Mac, 2020. 6. Pipeline as Code: Continuous Delivery with Jenkins, Kubernetes, and Terraform, Mohamed Labouardy, Manning, 2021.
Recommended	1. The Unicorn Project: A Novel About Developers, Digital Disruption, and Thriving in the Age of Data, Gene Kim, 2019. 2. The Phoenix Project, Gene Kim, Kevin Behr, and George Spafford, 2013.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Course Introduction. Ansible: Introduction to configuration management	2	1
2	Ansible: Setting up and using ansible to manage infrastructure and applications.	2	1
3	Ansible: Best practices for implementing configuration management with ansible.	2	1
4	Ansible: Advanced ansible concepts and techniques	2	1
5	Kubernetes: Introduction to containers and container orchestration.	2	1
6	Kubernetes: Setting up and using Kubernetes to deploy and manage containerized applications.	2	1
7	Kubernetes: Best practices for implementing containerization and orchestration with Kubernetes.	2	1
8	Kubernetes: Advanced Kubernetes concepts and techniques.	2	1

9	Terraform: Introduction to infrastructure as code.	2	1
10	Terraform: Setting up and using Terraform to define infrastructure as code.	2	1
11	Terraform: Best practices for implementing infrastructure as code with Terraform.	2	1
12	Terraform: Advanced Terraform concepts and techniques.	2	1
13	Collaboration and Communication.	2	1
14	Culture and Mindset.	2	1
15	Case Studies.	2	1
16	Recap and Review.	2	1
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning.	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts, philosophy and use cases of DevOps, as well as particularities of Kubernetes, Ansible and Terraform.
2. Familiarization with DevOps processes and Kubernetes.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate the familiarity and knowledge of DevOps processes and Kubernetes platform.
3. Familiarization with Ansible and Terraform.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate the skills in utilization of Ansible and Terraform to implement infrastructure as a code approach in managing and deploying software applications.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can manage deployment to Kubernetes cluster, are able to utilize Ansible for software

		provisioning, configuration management, and application deployment and Terraform for infrastructure as a code.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some

	main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Application Monitoring

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Andrejs Bondarenko
Preliminary knowledge, Related study courses	Advanced Software Development, Development Process and Tooling Foundations, Terminal & OS.
Aim	Teach students how to effectively set up application monitoring infrastructure and what are the main tools and approaches to gather data, structure it and present it. Course equips students with best practices and lays out good foundation for the subject topic.
Planned learning outcomes	
Knowledge	1. Understand the principles and practices of Application Monitoring, design patterns and ways to setup appropriate tools and processes. 2. Understand the tools and technologies used in a Application Monitoring, including, but not limited to Prometheus.
Skills	1. Be able to setup business, frontend, application, network, security monitoring. 2. Be able to utilize monitoring statistics to detect bottlenecks, performance and reliability.
Competencies	1. Show the ability to set up and configure monitoring systems for software applications, including selecting and using appropriate tools and technologies. 2. Show the ability to communicate effectively about the performance and availability of applications to stakeholders, including technical and non-technical audiences; a strong understanding of best practices and industry standards for application monitoring.
Literature and other sources of information:	
• Compulsory reading	1. Monitoring Microservices and Containerized Applications: Deployment, Configuration, and Best Practices for Prometheus and Alert Manager, Navin Sabharwal, Piyush Pandey, Apress, 2020. 2. Practical Monitoring: Effective Strategies for the Real World, Mike Julian, O'Reilly, 2017.

	3. Prometheus: Up & Running Infrastructure and Application Performance Monitoring, Brian Brazil, O'Reilly, 2018. 4. Monitoring Microservices and Containerized Applications Deployment, Configuration, and Best Practices for Prometheus and Alert Manager, Navin Sabharwal, Piyush Pandey, Apress, 2020.
Recommended	1. Getting Started with Grafana : Real-Time Dashboards for Monitoring Business Operations, Ronald McCollam, Apress, 2022.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to Application Monitoring. Monitoring Anti-Patterns.	2	1
2	Monitoring Design Patterns.	2	1
3	Alerts, On-Call, and Incident Management.	2	1
4	Statistics Primer.	2	1
5	Monitoring the Business.	2	1
6	Frontend Monitoring.	2	1
7	Application Monitoring.	2	1
8	Server Monitoring.	2	1
9	Network Monitoring.	2	1
10	Security Monitoring.	2	1
11	Conducting a Monitoring Assessment.	2	1
12	Prometheus: Getting started. Prometheus: Instrumentation.	2	1
13	Prometheus: Labels. Prometheus: Dashboarding with Grafana.	2	1
14	Prometheus: Infrastructure - Node exporter. Prometheus: PromQL.	2	1
15	Prometheus: Introduction to Prometheus and containers monitoring.	2	1
16	Prometheus: Container infrastructure monitoring. Wrapup.	2	1
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning.	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts, philosophy and use cases of Application Monitoring, including monitoring design patterns.
2. Familiarization with overall application monitoring domain.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate the familiarity and knowledge of DevOps processes and Kubernetes platform.
3. Familiarization with Prometheus monitoring application.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate the skills in utilization of Prometheus and its integration with the application at hand.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can set up and configure a monitoring system using Prometheus and setting up monitoring for the application at hand, as well as configuring alerts and notifications. In addition to that use Prometheus to monitor the performance of an application.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Android Development

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Viktors Gopejenko
Preliminary knowledge, Related study courses	System and Object Oriented Programming, Advanced Software Development
Aim	To supply students with an understanding of how to design and build user interfaces, store and retrieve data, and create and consume web services in Android platform; learn how to test and deploy Android applications, as well as how to follow best practices for Android app development; provide students with the skills and knowledge they need to create professional-quality Android apps.
Planned learning outcomes	
Knowledge	1. Understanding of the Android app lifecycle and how to manage the state of an app. 2. An understanding of how to use the Android SDK and its various tools, such as the Android Emulator and ADB.
Skills	1. The ability to design and build user interfaces for Android apps using Java programming language, including design patterns specific to Android GUI. 2. The ability to store and retrieve data in an Android app from/to persistency storage or other data storage options, as well as consumption of WEB services.
Competencies	1. Show the ability to design and implement Android apps that are responsive, efficient, and maintainable. 2. The competence to test and debug Android apps using various tools and techniques.
Literature and other sources of information:	
• Compulsory reading	1. Clean Android Architecture Take a layered approach to writing clean, testable, and decoupled Android applications, Alexandru Dumbravan, Packt, 2022. 2. Android 9 Development Cookbook: Over 100 recipes and solutions to solve the most common problems

	faced by Android developers (3rd ed), Rick Boyer, 2018. 3. Android Cookbook Problems and Solutions for Android Developers, O'Reilly, Ian Darwing, 2017.
Recommended	1. Head First Android Development: A Brain-Friendly Guide (2nd ed), Dawn Griffiths, David Griffiths, 2017.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction and orientation. Activities.	4	2
2	Layouts.	4	2
3	Views, Widgets and Styles.	4	2
4	Menus and Action mode.	4	2
5	Fragments.	4	2
5	Home screen widgets.	4	2
7	Data persistence.	4	2
8	Alerts and notifications.	4	2
9	Touchscreen and sensors	4	2
10	Graphics and Animation.	4	2
11	Multimedia.	4	2
12	Telephony, Networks and Web.	4	2
13	Location and Geofencing.	4	2
14	Preparing your app for AppStore.	4	2
15	Notes on design and architecture.	4	2
16	Notes debugging, testing, and monitoring. Wrap up.	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts

		behind Android development, application lifecycle, and Android SDK, allowing them to create responsive GUIs.
2. Familiarization with Android SDK core aspects.	24/32/40	Knowledge, Skills, and Competencies: Students understand the core aspects and capabilities of Android SDK.
3. Familiarization with Android application architecture and common development practices.	24/32/40	Knowledge, Skills, and Competencies: Students can design and develop modern Android applications, know the architectural aspects and design patterns specific to GUI, as well as able to create asynchronous / responsive applications; familiar with the testing, debugging and overall development process of an Android application.
4. Practical Exercises.	24/32/40	Knowledge, Skills, and Competencies: Students can design and implement Android applications with data persistency, and integration with WEB services, using clean architecture according to a specification.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems;

	9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course iOS Development

Study program	Information Systems
Amount	6 ECTS = 160 ac.hours
Author	Andrejs Bondarenko
Preliminary knowledge, Related study courses	System and Object Oriented Programming, Advanced Software Development
Aim	To supply students with an understanding of how to create efficient iOS apps using React Native. The course covers JavaScript, React, and React Native fundamentals, as well as key development concepts like user input, data management, and navigation. Students will also gain practical experience in debugging, testing, and developing applications.
Planned learning outcomes	
Knowledge	1. Have a comprehensive understanding of the React Native framework, including its architecture, components, and core features. Understand how to utilize the framework to build efficient and performant iOS applications. 2. Have an understanding of the full iOS application development lifecycle. This includes designing, developing, testing, debugging, and deploying apps, along with knowledge of Apple's guidelines and requirements for app submission.
Skills	1. Develop strong programming skills in JavaScript, and particularly in the React library. They will become proficient in creating and managing React components, handling user input, and implementing navigation. 2. Acquire skills in debugging and testing iOS applications built with React Native. They'll learn to use testing frameworks and debugging tools effectively to ensure their apps function correctly and provide a high-quality user experience.
Competencies	1. Show the ability to independently create a complete iOS application from scratch. Be capable of managing all aspects of the development process, from initial design to deployment on the App Store. 2. Competence in identifying and solving programming issues, optimizing app performance, and adhering to best practices in React Native

	development. This includes applying design patterns effectively and making appropriate architectural decisions.
Literature and other sources of information:	
Compulsory reading	- Hands-On Design Patterns with React Native Mateusz Grzesiukiewicz, Packt Publishing, 2018. - React Native Cookbook: Recipes for solving common React Native development problems, 2nd Edition, Dan Ward, Packt Publishing, 2019. - React and React Native: Build cross-platform JavaScript applications with native power for the web, desktop, and mobile, 4th ed. Adam Boduch, Roy Derks, Mikhail Sakhniuk, Packt Publishing, 2022.
Recommended	React Native for Mobile Development: Harness the Power of React Native to Create Stunning iOS and Android Applications, Akshat Paul, Abhishek Nalwaya, Apress, 2019.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Lecture 1: Course Introduction and Setup Course Introduction Introduction to React Native Setup: Installing Node.js, React Native CLI, and Expo Setting up the iOS Simulator	4	2
2	Lecture 2: JavaScript & ES6 Refresher JavaScript Basics Introduction to ES6 Exercise: JavaScript and ES6 Challenges	4	2
3	Lecture 3: Getting Started with React and React Native React and JSX React Native components Exercise: Basic React and React Native application	4	2

4	Lecture 4: Design and Layout in React Native React Native Styling Layout with Flexbox Exercise: Create layouts using Flexbox	4	2
5	Lecture 5: Advanced Components and User Input Handling Text Input and Touches Advanced React Native Components (Cookbook) Exercise: Create a form-based app	4	2
6	Lecture 6: React Native Recipes from the Cookbook Pick relevant recipes from the Cookbook Walk through solutions Exercise: Implement learned recipes in an app	4	2
7	Lecture 7: Networking and Working with APIs Fetch API Integrating third-party APIs in React Native Exercise: Create an app that uses data from an API	4	2
8	Lecture 8: Design Patterns in React Native Introduction to Design Patterns (Hands-On Design Patterns) Implementing patterns in React Native Exercise: Refactor an existing app using learned patterns	4	2
9	Lecture 9: Data Management with Redux Understanding Redux Implementing Redux in React Native Exercise: Implement Redux in an app	4	2
10	Lecture 10: Navigation and Screen Transitions Introduction to React Navigation Stack, Tab, and Drawer Navigation Exercise: Implement navigation in an existing app	4	2

11	Lecture 11: Interacting with Device APIs Camera, Geolocation, Local Files (Cookbook) Exercise: Implement device API usage in an existing app	4	2
12	Lecture 12: Authentication and Security Basics of Authentication (React Native for Mobile Development) Implementing Authentication in React Native Exercise: Add authentication to an existing app	4	2
13	Lecture 13: Animations and Performance Introduction to Animations in React Native Performance considerations in React Native (Cookbook) Exercise: Add animations and optimize an existing app	4	2
14	Lecture 14: Testing, Debugging, and Design Patterns Debugging techniques Testing in React Native Discussion of more complex design patterns (Hands-On Design Patterns) Exercise: Test and debug an existing app, discuss patterns used	4	2
15	Lecture 15: Deployment and Publishing to the App Store Preparing for deployment (React Native for Mobile Development) Publishing on App Store Connect Discussion of App Store policies and review process	4	2
16	Lecture 16: Course Recap and Final Project Review of key concepts Final Project presentations Course feedback and next steps	4	2
	Total:	64 ac.h	32 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts behind React Native for iOS development, application lifecycle, and React Native framework, allowing them to create responsive GUIs.
2. Familiarization with JavaScript aspects.	24/32/40	Knowledge, Skills, and Competencies: Students understand the core aspects and capabilities of JavaScript.
3. Familiarization with React Native application architecture and common development practices.	24/32/40	Knowledge, Skills, and Competencies: Students can design and develop modern React Native based applications, know the architectural aspects and design patterns specific to GUI; and have familiarity with the testing, debugging, and overall development process of and React Native based application.
4. Practical Exercises.	24/32/40	Knowledge, Skills, and Competencies: Students can design and implement React Native applications using clean architecture according to a specification.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Java Script Development - Foundations

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Viktors Gopejenko
Preliminary knowledge, Related study courses	Advanced Software Development, Development Process and Tooling Foundations.
Aim	Teach students the basics of JavaScript and its syntax, teach fundamental programming concepts such as variables, data types, functions, control flow, and loops, and provide an understanding of JavaScript's dynamic and flexible nature and how it can handle asynchronous code.
Planned learning outcomes	
Knowledge	1. Understand the JavaScript syntax and programming concepts. 2. Understand the basics of object-oriented programming in JavaScript.
Skills	1. Be able to write JavaScript code to perform specific tasks. 2. Be able to debug and optimize JavaScript code.
Competencies	1. Show the ability to apply JavaScript to solve problems and build applications. 2. Show the ability of using JavaScript libraries and frameworks to improve development efficiency.
Literature and other sources of information:	
• Compulsory reading	1. JavaScript: The Definitive Guide: Master the World's Most-Used Programming Language, David Flanagan, O'Reilly Media, 2020. 2. Eloquent JavaScript (3rd ed.), Marijn Haverbeke, 2018.
• Recommended	1. You Don't Know JS: ES6 & Beyond, Kyle Simpson, O'Reilly Media, 2015 2. Head First JavaScript Programming: A Brain-Friendly Guide, Eric T. Freeman, Elisabeth Robson, O'Reilly Media, 2014.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction.	2	1
2	Lexical Structure.	2	1
3	Types, Values and Variables.	2	1
4	Expressions and Operators.	2	1
5	Statements.	2	1
6	Objects.	2	1
7	Arrays.	2	1
8	Functions.	2	1
9	Classes.	2	1
10	Modules.	2	1
11	The JS standard library.	2	1
12	Iterators and Generators.	2	1
13	Asynchronous JS.	2	1
14	Metaprogramming.	2	1
15	Presenting solutions to course problems 1.	2	1
16	Presenting solutions to course problems 2. Wrap up.	2	1
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning.	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts, philosophy and use cases of Application Monitoring, including monitoring design patterns.
2. Familiarization with overall JavaScript language syntax and structure.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate the familiarity and knowledge of syntax of JavaScript language as well as core JavaScript library.

3. Familiarization with JavaScript dynamic nature, and ability to debug and unternpret code.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate the skills in utilization of dynamic JavaScript specifics and ability to debug code, find bugs, read and interpret existing code and explain it in full detail.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can create a JavaScript programs utilizing core concepts, like JS data types, core data-structures and OOP to solve the given tasks according to the specification.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however,

	sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Java Script Development - React

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Viktors Gopejenko
Preliminary knowledge, Related study courses	Advanced Software Development, Development Process and Tooling Foundations. Java Script Development - Foundations.
Aim	Provide students with a comprehensive understanding of React, a JavaScript library for building user interfaces, including its concepts, principles, and best practices. Additionally, it will also teach how to use React in combination with other technologies to build performant and maintainable web applications.
Planned learning outcomes	
Knowledge	1. Understand React concepts such as components, state, and properties. 2. Familiarity with React best practices and conventions, such as unidirectional data flow and immutability.
Skills	1. Be able to build and maintain web applications using React and its ecosystem of libraries and tools. 2. Proficiency in using React and its component-based approach to building user interfaces.
Competencies	1. Show the ability to design and implement performant and maintainable React-based user interfaces. 2. Capability of integrating React with other technologies such as Redux and others.
Literature and other sources of information:	
• Compulsory reading	1. React - The Road To Enterprise, Thomas Findlay, 2022. 2. The Road to learn React, Wieruch, Robin, 2018. 3. Pro React 16, Adam Freeman, Apress, 2019.
• Ieteicamā	1. React in Action, Thomas, M.T., Manning Publ., 2018. 2. React cookbook create dynamic web apps with React using Redux, Webpack, Node.js, and GraphQL, Santana Roldan, Carlos, Packt Publishing, 2018. 3. Learning React: A Hands-On Guide to Building Web Applications Using React and Redux Edition: 2, Kirupa Chinnathambi, Addison-Wesley Professional, 2018.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction.	2	1
2	Project configuration.	2	1
3	Scalable and Maintainable Project Architecture.	2	1
4	API Layer and Managing Async Operations.	2	1
5	Managing APIs with API Layer and React-Query.	2	1
6	State Management Patterns in React Apps.	2	1
7	Global State Management.	2	1
8	Global State Management cont'd.	2	1
9	Advanced Component Patterns.	2	1
10	Managing Application Layouts.	2	1
11	Performance Optimisation.	2	1
12	Application Security.	2	1
13	React Testing.	2	1
14	Consuming REST services.	2	1
15	URL Routing.	2	1
16	GraphQL.	2	1
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning.	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts, and React documentation, documentation of the most widespread libraries (Redux).
2. Familiarization with overall concepts behind the React.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate the familiarity and knowledge of standard React application. Students

		can read and explain code of existing React application.
3. Familiarization with deeper concepts behind React.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate the skills in developing React applications using advanced concepts like routing, Redux utilization, API creation and consumption and others.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can create a React programs like form-based apps, apps showing work with APIs, and routing; all of which will solve the given tasks according to the specification.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however

4 –almost satisfactory)	insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Java Script Development – Node.js

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Viktors Gopejenko
Preliminary knowledge, Related study courses	Advanced Software Development, Development Process and Tooling Foundations. Java Script Development - Foundations.
Aim	Provide students with a comprehensive understanding of the fundamentals of NodeJS, including its architecture and key features, as well as best practices for building, testing, and deploying NodeJS applications. The course will cover topics such as setting up a NodeJS development environment, working with modules, building web servers, and working with the file system, as well as more advanced topics such as building RESTful APIs, working with MongoDB, building real-time applications using WebSockets and others.
Planned learning outcomes	
Knowledge	1. Understand React applications architecture and key features of Node.JS and its core modules.. 2. Familiarity with the principles of asynchronous programming, familiarity with the most common libraries used in Node.JS development such as Express.JS, MongoDB, and WebSockets.
Skills	1. Be able to build efficient and robust server-side applications using JavaScript and NodeJS. 2. Be able to set up a development environment, create a web server, handle routes, and work with databases.
Competencies	1. Show the ability to design and implement performant and maintainable Node.js based applications. 2. Capability of writing and debugging Node.js applications following best practices in terms of error handling, securing, debugging, and integrations with other technologies.
Literature and other sources of information:	
• Compulsory reading	1. Full-Stack React Projects: build modern web applications using the MERN stack, Shama Houque, Packt, 2020.

	2. Node.js: The Comprehensive Guide to Server-Side JavaScript Programming, Sebastian Springer, Rheinwerk Computing, 2022. 3. Node.js Design Patterns: Design and implement production-grade Node.js applications using proven patterns and techniques (3rd ed), Mario Casciaro, Luciano Mammino, Packt, 2020.
Recommended	1. Node.js Web Development: Server-side web development made easy with Node 14 using practical examples, David Herron, Packt Publishing, 2020.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to Node.js (history, architecture, and key features)	2	1
2	Setting up a Node.js Development Environment. (tools and techniques needed to set up a Node.js development environment, including installing Node.js and working with package managers such as npm or yarn)	2	1
3	Understanding Node.js Modules (basics of Node.js modules, including how to use the require and export keywords, and how to work with core modules and third-party modules)	2	1
4	Building a Simple Web Server (use Node.js to build a simple web server, including working with the http module and handling HTTP requests and responses)	2	1
5	Working with the File System (use Node.js to read and write files, including working with the fs module and streams)	2	1
6	Understanding Asynchronous Programming (the basics of asynchronous programming in Node.js, including callbacks, promises, and async/await).	2	1
7	Building a RESTful API (use Node.js to build a RESTful API, including working with routing, handling HTTP requests and responses, and working with JSON)	2	1
8	Understanding Express.js (basics of the Express.js framework, including how to set up and use an Express.js application, working with middleware, and handling routes)	2	1
9	Working with MongoDB	2	1

	(use Node.js to connect to a MongoDB database and perform CRUD operations)		
10	Building a Real-time Application (use Node.js to build a real-time application, including working with WebSockets and the socket.io library)	2	1
11	Understanding Authentication and Authorization (basics of authentication and authorization in Node.js, including working with JSON Web Tokens (JWT) and Passport.js)	2	1
12	Deploying a Node.js Application (tools and techniques needed to deploy a Node.js application, including working with cloud providers such as Azure)	2	1
13	Understanding Node.js Security (best practices for securing a Node.js application, including working with helmet and cors, and understanding the OWASP Top 10)	2	1
14	Debugging and Error Handling (tools and techniques needed for debugging and error handling in a Node.js application, including working with the debugger and error-handling middleware)	2	1
15	Best Practices and Tips (best practices and tips for building and maintaining a Node.js application, including working with code linting, testing, and documentation)	2	1
16	Case Study (a case study of a real-world Node.js application, including an overview of the architecture, design patterns, and best practices used in the application)	2	1
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning.	24/32/40	Knowledge, Skills, and Competencies: Students studied the core concepts and Node.js documentation.
2. Familiarization with overall concepts behind the Node.js.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate familiarity and knowledge of standard React applications, working with

		the file system, REST services, MongoDB, and general WEB applications.
3. Familiarization with deeper concepts Node.js.	24/32/40	Knowledge, Skills, and Competencies: Students demonstrate the skills in developing and explaining React applications touching aspects of real-time applications, authorization and authentication, deployment, and other concepts.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can architect and develop a Node.js application using approaches taught during the course, according to the specification.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however,

	sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Java Script Development - Advanced

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Viktors Gopejenko
Preliminary knowledge, Related study courses	Advanced Software Development, Development Process and Tooling Foundations. Java Script Development - Foundations.
Aim	Provide students with a comprehensive understanding of the knowledge and skills necessary to build complex, high-performance, and secure web applications using modern JavaScript development techniques and technologies. This would include learning to use reactive programming with RxJS, advanced type checking with TypeScript, asynchronous programming with Promises and async/await, and common design patterns for structuring code. Additionally, the course would cover best practices for securing web applications, deploying code to production environments, and containerizing applications using Docker.
Planned learning outcomes	
Knowledge	1. Understand the concepts and principles of reactive programming and how to use RxJS to build responsive and efficient web applications. 2. Know how to use TypeScript to add advanced type checking and improved code organization to JavaScript projects.
Skills	1. Be able to use asynchronous programming techniques such as Promises and async/await to handle complex operations and improve application performance. 2. Be able to implement common design patterns in JavaScript to structure and organize code for maintainability and scalability.
Competencies	1. Show the ability to design and implement secure web applications by understanding and applying best practices in web security. 2. Show the ability to deploy and containerize JavaScript applications using Docker and other technologies to production environments.
Literature and other sources of information:	

Compulsory reading	- Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker, Frank Zammetti, Apress, 2020. - Build Reactive Websites with RxJS: Master Observables and Wrangle Events, Randall Koutnik, Pragmatic Bookshelf, 2019. - Mastering Typescript - build enterprise-ready, modular web applications using typescript 4 and modern frameworks (4th ed), Nathan Rozentals, Packt, 2021.
Recommended	- Distributed Systems with Node.js: Building Enterprise-Ready Backend Services, Thomas Hunter II, O'Reilly Media, 2020. - Learning TypeScript: Enhance Your Web Development Skills Using Type-Safe JavaScript 1st Edition, Josh Goldberg, O'Reilly, 2022. - Easy Learning Design Patterns Javascript: Build Better Coding and Design Patterns, Hu Yang, 2020.

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction and orientation.	2	1
2	Functional Programming (immutability, pure functions, and higher-order functions).	2	1
3	Design Patterns in JavaScript.	2	1
4	Advanced JavaScript features (Destructuring, Spread operator, and Template literals)	2	1
5	Asynchronous programming (Async-await, Promises, Generators and Event loop)	2	1
6	JavaScript performance optimization (Profiling and optimizing JavaScript code, and understanding the browser's rendering process)	2	1
7	WebAssembly (understanding how to use WebAssembly with JavaScript to improve performance of your application)	2	1
8	Microservices (building and deploying microservices using JavaScript and Node.js, as well as best practices for designing, deploying, and scaling microservices)	2	1
9	Reactive programming	2	1

	(using libraries such as RxJS and MobX to implement reactive programming patterns in JavaScript)		
10	TypeScript (advanced usage of TypeScript, such as creating custom types and working with decorators)	2	1
11	Advanced debugging and testing (techniques for debugging and testing advanced JavaScript applications, such as code coverage, and test-driven development)	2	1
12	Security (best practices for securing JavaScript applications, such as input validation, and working with libraries such as helmet and cors)	2	1
13	Deployments (Build pipeline, Automated Testing, Modules and packages, Internal npm Registry)	2	1
14	Container orchestration (Kubernetes, Deployment, Service Discovery, Modifying Deployments)	2	1
15	Selected topics and case studies 1. Projects Demonstration 1.	2	1
16	Selected topics and case studies 2. Projects Demonstration 2. Wrap up.	2	1
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning.	24/32/40	Knowledge, Skills, and Competencies: Students studied the concepts related to advanced JavaScript development topics.
2. Advanced topics in development JS applications.	24/32/40	Knowledge, Skills, and Competencies: Students can Ability to apply advanced concepts in functional programming, design patterns, and asynchronous programming to build

		responsive and efficient web applications, and utilize testing and debugging techniques for advanced JavaScript applications.
3. Advanced topics in productionalization of JS applications.	24/32/40	Knowledge, Skills, and Competencies: Students can deploy and containerize JavaScript applications to production environments, design and deploy microservices using Node.js, and implement secure web applications by understanding and applying best practices in web security.
4. Practical Exercises	24/32/40	Knowledge, Skills, and Competencies: Students can architect and develop a JavaScript application using approaches taught during the course, according to the specification.
Total:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues

	to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Robotics

Study program	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Jeļena Čaiko
Preliminary knowledge, Related study courses	Advanced Software Development, Development Process and Tooling Foundations.
Aim	Provide students with a comprehensive understanding of robotics and how to use the Arduino microcontroller to control and program robots. The course will cover topics such as robot movement, sensor input, and basic programming concepts for creating autonomous behaviors in robots. The goal is for students to gain hands-on experience building and programming robots using the Arduino platform.
Planned learning outcomes	
Knowledge	1. Understanding of the fundamental concepts of robotics, including robot movement, sensor input, and control systems. 2. Familiarity with the Arduino microcontroller and its capabilities for programming and controlling robots.
Skills	1. Ability to design and construct basic robots using the Arduino platform. 2. Proficiency in programming robots using the Arduino programming language to create autonomous behaviors.
Competencies	1. Ability to apply the knowledge and skills acquired in the course to design and build functional robots. 2. Understanding of the ethical and societal implications of robotics and the ability to apply this understanding to real-world situations.
Literature and other sources of information:	
• Compulsory reading	1. Exploring Arduino: Tools and Techniques for Engineering Wizardry, Jeremy Blum, Wiley, 2019. 2. Learn Robotics Programming, Danny Staple, Packt Publishing, 2021. 3. Robot Building for Beginners, David Cook, Apress, 2015.

Recommended	1. Programming the Raspberry Pi: Getting Started with Python (3rd ed), Simon Monk, McGraw-Hill Education, 2021.
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Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Getting Started and Understanding the Arduino Landscape. Tools and parts.	2	1
2	Digital multimeter, Resistors, LEDs	2	1
3	Variable Resistors, Comparators, Transistor Switches.	2	1
4	Digital Inputs, Outputs.	2	1
5	Interfacing with Analog Sensors.	2	1
6	Using Transistors and Driving DC Motors .	2	1
7	Driving Stepper and Servo Motors.	2	1
8	Making Sounds and Music USB Serial Communication.	2	1
9	Interfacing with Liquid Crystal Displays.	2	1
10	Interrupts and Other Special Functions.	2	1
11	Data Logging with SD Cards.	2	1
12	Wireless RF Communications, Bluetooth Connectivity.	2	1
13	Wi-Fi and the Cloud.	2	1
14	Hands-on projects.	2	1
15	Hands-on projects.	2	1
16	Hands-on projects and presentations.	2	1
	Total:	32 ac.h	16 ac.h

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources, and methodological materials learning.	12/16/20	Knowledge, Skills, and Competencies: Students studied the core concepts behind electronics, and Arduino documentation, as well as compulsory reading materials.

2. Familiarization with basic electronics concepts.	6/8/10	Knowledge, Skills, and Competencies: Students demonstrate familiarity and knowledge of standard electronics components.
3. Familiarization with concepts behind Arduino.	18/24/30	Knowledge, Skills, and Competencies: Students demonstrate the skills in programming Arduino and interfacing it with digital and analog components, LCD displays, and wireless communication.
4. Practical Exercises	12/16/20	Knowledge, Skills, and Competencies: Students can design and implement Arduino projects according to the specification involving the theoretical concepts acquired during the course.
Total:	48/64/80	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Homeworks	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems;

	7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Environment, Labour and Civil Protection

Study programme	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Valentīna Djakona
Preliminary knowledge, Related study courses	-
Aim	To acquaint students with basic principles of civil protection, to explain its tasks and an order of legal regulation; to acquaint students with the relevant regulations of the Republic of Latvia; to train the main methods of first-aid treatment; to identify the problems connected with pollution of the environment and use of natural resources, to reveal philosophy and instruments of the modern environmental policy; to acquaint students with the normative legal acts regulating issues of labour protection.
Planned learning outcomes:	
knowledge	● be aware of actions in dangerous situations / emergencies. ● understand legal acts of the Republic of Latvia in the field of fire safety and a civil protection, the system of a civil protection in Latvia and also objects of the increased danger. ● be able to apply national legal acts to providing fire safety in business activity. ● be able to identify and respectively to work in emergency situations, to be able to carry out evacuation measures and measures for first-aid treatment. ● to be aware of the problems facing humankind regarding environment pollution and nature protection.
skills	● Meet labour protection, fire safety and environmental protection requirements. ● Comply with the employment relationship rules. ● To be familiar with the documents regulating business activities as well as laws and regulations in the field of labour protection and civil defence.
competences	● The ability to ensure compliance with the regulatory requirements of labour protection and fire safety at an enterprise. ● The ability to ensure compliance with the regulations of labour relations at an enterprise.

Literature and other sources of information:	
Compulsory reading	● Civilās aizsardzības un katastrofas pārvaldīšanas likums. Publicēts: Latvijas Vēstnesis, 100, 25.05.2016. https://likumi.lv/ta/id/282333-civilas-aizsardzibas-un-katastrofas-parvaldisanas-likums ● Civil Protection and Disaster Management Law Publicēts: Latvijas Vēstnesis, 100, 25.05.2016. ● https://likumi.lv/ta/en/id/282333-civil-protection-and-disaster-management-law ● Darba aizsardzības likums. Stājas spēkā: 01.01.2002. Publicēts: Latvijas Vēstnesis, 105, 06.07.2001.; Latvijas Republikas Saeimas un Ministru Kabineta Ziņotājs, 15, 09.08.2001. https://likumi.lv/ta/id/26020-darba-aizsardzibas-likums ● Labour Protection Law. Publication: Latvijas Vēstnesis, 105, 06.07.2001.; Latvijas Republikas Saeimas un Ministru Kabineta Ziņotājs, 15, 09.08.2001. http://www.lm.gov.lv/upload/en/labour_protection_law.pdf ● Ministru kabineta noteikumi Nr. 238, Ugunsdrošības noteikumi. Publicēts: Latvijas Vēstnesis, 78, 22.04.2016. https://likumi.lv/ta/id/281646-ugunsdroshibas-noteikumi ● Republic of Latvia Cabinet Regulation No. 238 Fire Safety Regulations. Publication: Latvijas Vēstnesis, 78, 22.04.2016. https://likumi.lv/ta/en/en/id/281646-fire-safety-regulations ● Ugunsdrošības un ugunsdzēsības likums. Publicēts: Latvijas Vēstnesis, 165, 13.11.2002.; Latvijas Republikas Saeimas un Ministru Kabineta Ziņotājs, 23, 12.12.2002. https://likumi.lv/ta/id/68293-ugunsdroshibas-un-ugunsdzesibas-likums ● Fire Safety and Fire-fighting Law. Publication: Latvijas Vēstnesis, 165, 13.11.2002.; Latvijas Republikas Saeimas un Ministru Kabineta Ziņotājs, 23, 12.12.2002. https://likumi.lv/ta/en/en/id/68293-fire-safety-and-fire-fighting-law ● Vides aizsardzības likums. Publicēts: Latvijas Vēstnesis, 183, 15.11.2006.; Latvijas Republikas Saeimas un Ministru Kabineta Ziņotājs, 24, 28.12.2006. https://likumi.lv/doc.php?id=147917 ● Environmental Protection Law. Publication: Latvijas Vēstnesis, 183, 15.11.2006.; Latvijas Republikas Saeimas un Ministru Kabineta Ziņotājs, 24, 28.12.2006. https://likumi.lv/ta/en/en/id/147917-environmental-protection-law ● Svendsen K. Knock-for-Knock Indemnities and the Law. - Abington: Informa Law from Routledge, 2023.-296p. ● Baskind E. Commercial Law Concentrate. -Oxford: OUP Oxford, 2022.-264p. ● Austen-Baker R. Principles of Commercial Law. - London: Edward Elgar Publishing, 2022.-328p. ● Kārkliņš J. Tort Law in Latvia.-London: Kluwer Law International, 2022.-164p. ● Schäfer H.-B. The Economic Analysis of Civil Law. - London: Edward Elgar Publishing, 2022.-648p.

	• Servais J.-M. International Labour Law. - London: Kluwer Law International, 2022.-398p. • Guerin L. The Essential Guide to Federal Employment Laws. - London: NOLO, 2022.-496p. • Dolzer R. Principles of International Investment Law. - Oxford: OUP Oxford, 2022.-560p. • Slagter T. Fundamental Perspectives on International Law. - Cambridge: Cambridge University Press, 2022.-722p.
Recommended sources	• Hunt, G., Health and Safety Pocket Book, 2nd ed., Routledge, 2018 • Fury, S. The Disaster Survival Handbook: A Disaster Survival Guide for Man-Made and Natural Disasters (Escape, Evasion, and Survival Book 7) Kindle Edition • Eves, D. Disasters: Learning the Lessons for a Safer World, Routledge, 2018 • Krishna, M., Manickam, V., Shah, A., Davergave, N. Environmental Management: Science and Engineering for Industry, Butterworth-Heinemann, 2017 • Labklājības ministrijas materiāli www.lm.gov.lv • Valsts darba inspekcijas materiāli www.vdi.gov.lv • Latvijas Brīvo arodbiedrību savienības materiāli www.lbas.lv • Valsts sociālās apdrošināšanas aģentūras materiāli un vietne www.vsaa.lv • Materiāli www.osha.lv • Materiāli www.likumi.lv • Nacionālais ugunsdzēsības un glābšanas dienests. http://vugd.gov.lv

Contents and schedule of the contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1.	Introduction to the course	2	
2.	Theoretical aspects of civil defence. The state system of a civil protection and the legislation of LR in the field of a civil protection. The rights and duties of citizens in the field of a civil protection. Scheduling of actions in the field of a civil protection.	2	2
3.	Types of accidents. Possible accidents in Latvia. Actions of the population in case of accident.	2	2
4.	Preparation for students' independent work (I)	2	

5.	System of alarm and notification. Evacuation of the population. The organization of evacuation actions in case of accident.	2	2
6.,7.	First aid	4	2
8.	Fire safety	2	2
9.,10.	Global environmental problems: pollution, global warming, ozone depletion, climate change, acid rain, depletion of natural resources, waste disposal, deforestation and loss of biodiversity.	4	2
11.	Preparation for students' independent work (II)	2	
12.,13 .	Environment protection in Latvia. Pollution of the environment as a result of economic activity. Legislation in the field of environment protection.	4	2
14.,15 .	Job safety. Common principles of labor protection	4	2
16.	Review and consolidation. Preparation for the exam.	2	
		32ac.h.	16ac.h.

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1.Compulsory reading, sources and methodological materials learning	20/36/52	Knowledge, skills, competences of: ● basic principles of civil defence, LR State Civil Defence Plan; ● relevant fire safety regulations of the Republic of Latvia; ● the main methods of first-aid treatment; ● problems connected with pollution of the environment and use of natural resources, instruments of the modern environmental policy, Law on Environmental Protection of the Republic of Latvia; ● normative legal acts regulating issues of labour protection. Testing form: examination
2. Individually. Power Point Presentation on Disaster management.	14	Knowledge, skills, competences of: ● public speaking skills; ● presentation skills; ● analysis and synthesis of information;

		• use of professional terminology; • ability to act correctly in different accidents and emergency situations.
3. Group work. Power Point presentation on the topic: "Environment protection in the country of your choice".	14	Knowledge, skills, competences of: • team-work • public speaking skills; • presentation skills; • analysis and synthesis of information; • use of professional terminology • Ability to ensure compliance with environmental protection legislation at the enterprise. • Ability to apply the normative legal acts regulating issues of ecological safety and organize activity of the enterprise with the maximal safety and according to the current legislation.
Total ac.h.:	48/64/80	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Examination	+			40
2. Individual PPT	+	+	+	30
3. Group PPT	+	+	+	30

Evaluation of mastering the study course

Achievable level	Requirements
Very high level (10 excellent, 9 excellent)	10 - Knowledge, skills and competence meet and exceed the course requirements; has acquired knowledge and skills at a level that is able to perceive, memorize, reproduce, use the model in a similar situation, and be able to use it independently to acquire new knowledge and solve creative tasks. 9 - Knowledge, skills and competence meet the requirements of the course, are able to solve relevant problems, justify and reason the idea, discern and explain regularities;
High level (8 - very good, 7 - good)	8 - Knowledge, skills and competence meet the requirements of the training course; expresses personal attitudes more at the core of the curriculum than at the level of analysis; 7 - Knowledge, skills and competence are in line with the requirements of the course, but sometimes there is an inability to use the acquired knowledge independently.
average level (6 - almost good, 5 - average, 4 - almost average)	6 - Knowledge, skills and competence meet the requirements of the training course; sometimes lacking in-depth understanding of the problem, not being able to fully apply knowledge in practice, but being able to use knowledge and skills by model. 5 - Knowledge, skills and competences partially meet the requirements of the training course; lack of competence to apply knowledge in practice 4 - Knowledge meets the minimum requirements of the course.
Low level (3 - 1 - negative rating)	3 - Superficial knowledge of the main problems of the study course. 2 - Upgraded individual study course questions; 1 - Not fully mastered the course. There is no understanding of the basic problems of the study course.

RNU study course Latvian for Foreigners

Study programme	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Sandra Plota
Preliminary knowledge, Related study courses	No preliminary knowledge required
Aim	To provide students the basic knowledge and develop their competence to communicate in the Latvian language in professional and everyday situations at basic level.
Planned learning outcomes:	
knowledge	- professional terminology in the Latvian language - be aware of the social, cultural and linguistic conventions; - ability to exchange information directly on the basic level of Latvian knowledge.
skills	- having mastered the course students are able to - analyze, systematize, synthesize and integrate information necessary for the operation of an enterprise; - use modern technologies of information acquisition, processing and systematization; - acquire new knowledge independently; - communicate in the Latvian language on the basic level. - maintain communication on the everyday situations topics in the Latvian language on the basic level; - use the acquired knowledge in the bounds of professional activities.
competences	ability to communicate in the Latvian language on the basic level.
Literature and other sources of information:	
compulsory reading	“Latviešu valoda. Mācību kurss 25 nodarbībām”Asja Svarinska, Zvaigzne ABC, 2017 “Latvian in three months”, Dumpe Dace, Zvaigzne ABC, 2018

recommended	“Es protu latviešu valodu”, Polikāns Kaspars, Zvaigzne ABC, 2017 - Māci un mācies latviešu valodu http://maciunmacies.valoda.lv/valodas-apguve/e-nodarbibas#tab2 - Sāksim runāt latviski http://maciunmacies.valoda.lv/images/speles/LVA_Saksim_r_unat_latviski/index.html - Languagehelpers https://www.languagehelpers.com - the Latvian Language Helper
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Contents and schedule of the contact hours

week	topic	academic hours	
		full-time intramural	part-time intramural
1.	Iepazīšanās	4	2
2.	Adrese	4	2
3.	Ģimene	4	2
4.	Dzīvesvieta	4	2
5.	Pilsēta	4	2
6.	Ikdiena	4	2
7.	Ēdienreizes	4	2
8.	Group work : “Mana pilsēta”	4	2
9.	Laika apstākļi	4	2
10.	Iepirkšanas	4	2
11.	Kafejnīcā un restorānā	4	2
12.	Veselība	4	2
13.	Brīvais laiks	4	2
14.	Ceļošana	4	2
15.	Svētki	4	2
16.	Consolidation of the course knowledge	4	2
		64 academic hours	32 academic hours

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1.Compulsory reading, sources and	46/78/110	Knowledge of:

methodological materials learning		• vocabulary in compliance with the course topics; • grammar knowledge and practice: - lietvārds - īpašības vārds - vietniekvārds - skaitļa vārds - apstākļa vārds - darbības vārds - prievārds - Testing form: test
2.Grammar test 1	10	Knowledge, skills: - alfabets - divskaņi - lietvārds - īpašības vārds - vietniekvārds
3.Grammar test 2	10	Knowledge, skills: - skaitļi - kalendārs - skaitļa vārds - apstākļa vārds - darbības vārds - prievārds
4. Speaking test 1	10	Knowledge, competences: - speaking on the topics mastered in the framework of the study course: 1. Iepazīšanās 2. Adrese 3. Ģimene 4. Dzīvesvieta 5. Pilsēta 6. Ikdiena 7. Ēdienreizes
5. Speaking test 2	10	Knowledge, competences: - speaking on the topics mastered in the framework of the study course: 1. Laika apstākļi 2. Iepirkšanās 3. Kafeinīcā un restorānā 4. Veselība 5. Brīvais laiks 6. Ceļošana 7. Svētki
6. Group work “Mana pilsēta”	10	Knowledge, competences, skills: To have skills to communicate within related topic, to know vocabulary about related topic, to be competent to use appropriate phrases to design own text
Total ac.h.s:	96/128/160	

Study work	Knowledge	Skills	Competences	% of final evaluation
1.	+			50
2.	+	+		10
3.	+	+		10
4.	+		+	10
5.	+		+	10
6.	+	+	+	10

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10- knowledge, skills and competences exceed the requirements of the study course and demonstrate a student's ability to perceive, memorise and reproduce the obtained knowledge and apply it in a similar situation, as well as to use it for mastering new knowledge and creatively solve problems. 9 - knowledge, skills and competences fully meet the requirements of the study course, student is able justify and logically state the problem, solve relevant problems, identify and explain the regularities.
High (8 –very good 7 - good)	8 –the requirements of the study course are fully met; in the framework of the curriculum a student demonstrates personal attitude more on the level of statement than analysis . 7 – knowledge, skills and competences meet the requirements of the study course, however sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 –. knowledge, skills and competences meet the requirements of the study course, however insufficient understanding of some problems and inability to apply the acquired knowledge at practice is detected, a student can apply the mastered knowledge and skills in accordance with an example. 5 –the requirements of the study course are met for the most part, however insufficient ability to apply the acquired knowledge is detected; 4 – knowledge meets the minimal requirements of the study course.
Low (3 – 1 – negative evaluation)	3 – superficial knowledge of the main concepts of the study course; 2 –superficial and incomplete knowledge of only some problems of the study course; 1 – absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU Study course Basics of Project Management

Study programme	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Ivars Linde
Preliminary knowledge, Related study courses	-, IT Software project management, Course project
Aim	To provide knowledge of project management basics and practical applications in IT, including: project management strategy, project management stakeholders, project life cycle, project planning, and project management application tools.
Planned learning outcomes:	
knowledge	• plan, organize and manages the company's strategy in Project Management, control the execution of work and provide communication in any sector of IT. • understand the principles of Project Management and its role in the strategic development of the company (awareness level). • be able to independently acquire and accordingly apply in business new knowledge in the state language and at least in two foreign languages. Shall know professional terminology in Project Management and apply Project Management analysis to stakeholder research to ensure successful business (application level).
skills	• To analyze the performance of Project Management of an enterprise, to identify problems and develop solutions. • To analyze the Project Management processes taking place in the economic environment and to make decisions according to the changes in the situation. • To analyze, systematize, synthesize and integrate information of Project Management necessary for the operation of an enterprise. • To use modern technologies of Project Management information acquisition, processing and systematization. • To formulate the aims of Project Management of an enterprise, to draw up a strategic development plan and evaluate its implementation. • To understand the principles of Project Management and their role in the strategic development of an enterprise. • To communicate and cooperate in Project Management with personnel, partners and owners of companies, and representatives of media, governmental and non-governmental organisations and institutions.

competences	• To acquire new knowledge independently. • The ability to apply the theoretical and practical knowledge and skills for the effective Project Management of an enterprise and its structural divisions. • The ability to plan and forecast the effective Project Management of an enterprise in accordance with the set aims, economic environment and labour market situation. • The ability to organise the rational Project Management operations of an enterprise in accordance with the set aims, economic environment and labour market situation. • The ability to represent a meaning of Project Management of an enterprise in dealings with other companies, organizations, and institutions including municipalities and state institutions. • The ability to work with other companies, owners, and other stakeholder groups to achieve the aims of Project Management of an enterprise. • The ability to use information technologies for performing their activities in Project Management. Additional: • The ability to organize the Project Management department according to the objectives and market situation. • The ability to conduct research of Project Management of and apply the results obtained in business.
Literature and other sources of information:	
compulsory reading	• Kerzner H. Project Management. A Systems Approach to Planning, Scheduling, and Controlling. 12th Edition. John Wiley&Sons. 2017. – 848 p. ISBN-13: 978-1119165354, ISBN-10: 1119165350 • Geipele Ineta. Projektu vadīšana: studijām un biznesam - [Rīga]: Valters un Rapa, 2004. – 187 lpp. ISBN 9984-7680-3-1 • NCB – Projektu vadīšanas nacionālās kompetences vadlīnijas, versija 3 • ICB - IPMA Competence Baseline, Version 4.0 • Ederson C.A Practical Guide on Environmental Auditing. - Independently published, 2023.-57p. • Dumaine B. Bezonomics: How Amazon Is Changing Our Lives and What the World's Best Companies Are Learning from It. - London: Simon & Schuster UK, 2021.-352p. • Galloway S. Post Corona: From Crisis to Opportunity. London: Corgi , 2020.-256p.

recommended	• Mikose, Maija. Informāciju tehnoloģiju projekts uzņēmumā - Rīga: Biznesa augstskola Turība, 2006. - 242 lpp. ISBN 9984-7667-8-0 • Uzulāns, Juris. Risku vadība projektu kontekstā - Rīga: Drukātava, 2010. - 136 lpp ISBN 9789984853130 • Rurāne M. Finanšu menedžments – Rīga: RISEBA, 2006. – 383 lpp. ISBN10: 9984705129, ISBN13: 9789984705125 • Hermarij J. Better Practices of Project Management Based on IPMA Competences, 3 Revised Edition, 692 pages, Van Haren Pub; 2013, ISBN-10: 9087537174, ISBN-13: 978-9087537173 • Uzulāns, Juris. Projektu vadīšana mūsdienu apstākļos: Microsoft Office Project - [Mārupe]: Drukātava, 2007. - 102 lpp. ISBN 9789984798349 • A Guide to the Project Management Body of Knowledge (PMBOK® Guide),–Sixth Edition, Project Management Institute. 2017. – 756 p. ISBN-10: 1628251840, ISBN-13: 978-1628251845 • Riashchenko V., Zhivitere M., Radin M. Methodology of reengineering business processes in conditions of implementation of contemporary management methods of the enterprise. Collective monograph, edited by Markina I., Aranchiy V., Safonov Y. and others. Management of the 21st century: globalization challenge. — Prague. — Nemoros.r.o. — 2018. — Czech Republic. — 508 p. • Pukala R., Linde I. The Impact of IT Risks on the Development of Innovative Start-Up of Mining Enterprises 2020 Conference Proceedings, E3S Web of Conferences Open Access Volume 17418 June 2020 Article number 040305th International Innovative Mining Symposium, IIMS 2020, 19 October 2020 - 21 October 2020 https://www.scopus.com/record/display.uri?eid=2-s2.0-85088528486&origin=resultslist&sort=plf-f&src=s&sid=a99d5698810f900a1b5bae8d918e5d9a&sot=aff&sdt=a&sl=61&s=AF-ID%28%22Inform%c4%81cijas+sist%c4%93mu+mene d%c5%bementa+augstskola%22+60121147%29&relpos=5&citeCnt=0&searchTerm= • Pukala R., Linde I. The Impact of IT Risks on the Development of Innovative Start-Up of Mining Enterprises 2020 Conference Proceedings, E3S Web of Conferences Open Access Volume 17418 June 2020 Article number 040305th International Innovative Mining Symposium, IIMS 2020, 19 October 2020 - 21 October 2020 https://www.scopus.com/record/display.uri?eid=2-s2.0-85088528486&origin=resultslist&sort=plf-f&src=s&sid=a99d5698810f900a1b5bae8d918e5d9a&sot=aff&sdt=a&sl=61&s=AF-ID%28%22Inform%c4%81cijas+sist%c4%93mu+mene d%c5%bementa+augstskola%22+60121147%29&relpos=5&citeCnt=0&searchTerm=
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Contents and schedule of the contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Project Management definition, concepts	2	2
2	Project triangle of constraints	2	2
2	Project management life cycle	4	2
3	Test work on the mark: "Project initiation document"	1	
3	The aim of the project - scope, analysis of company stakeholders	2	2
4	Test work on the mark: "Analysis of stakeholders in a project"	1	
4	Work Breakdown Structure of a project	4	2
5	Test work on the mark: „Work Breakdown Structure of a company project”	1	
6	Project Network Diagram	3	
6	Project Network Diagram, Critical Path Method	4	2
6	Test work on the mark: „Network Diagram in a project”	1	
7	Project Gantt chart development	3	2
7	Test work on the mark: „Gantt Chart in a project”	1	
8	Project close-out	2	2
9	Final examination and test - course work - project with the mark: "A self-made project of a Company"	1	
		3 ECTS =32ac.h	3 ECTS =16ac.h.

Description of students' self-studies organization and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
Compulsory reading, sources and methodological materials learning Project Management	12/28/44	Knowledge of: - the essence, concepts and principles of Project Management; - basic principles of activities;

		goals and objectives of Project Management, strategies, market research. Evaluation form - test
Preparation for test "Project Initiation Document"	6/0/0	Skills: to be able to define the goals and mission of a company project, to analyze problems, to determine the determinants of internal and external environment and elements of the project management life cycle.
Preparation for test "Project Stakeholder Analysis"	6/0/0	Competences: be able to design a project management research plan, gather information using different methods, identify factors that influence stakeholder behavior. The real business situations of a company project should be taken as an example (case study)
Preparation for test "Work Breakdown Structure of a company project"	6/0/0	Students are able to define the most important components of a company project, to choose appropriate project objectives and sub-goals / events for the company project being studied.
Preparation for "Network Diagram of a company project"	6/0/0	Skills: to be able to make decisions on the timing of a company project, to develop a project flow plan (network diagram), to determine the critical path of a project by studying realistic case studies of a company project.
Preparation for test "Gantt chart of a company project"	6/0/0	Students are able to draw a Gantt chart of a company project, to determine the sequence and duration of events depending on the purpose of the project.
Preparation for the final examination and test - course work - project with the mark "A self-made project of a Company"	6/0/0	Students are familiar with the basic elements of Project Management, including project life cycle elements, are able to set project goals in accordance with the project strategy of the company, develop a master plan, flow chart, Gantt chart and calculate the budget for the necessary.
Final work - Company project work for part time students.		The content of the final work for full-time students consists of tests that are completed during the course.
Total:	48/64/80	

Study work	Knowledge	Skills	Competences	% of final evaluation
Test+project work for full time students / Project work for part time students	+	+	+	40
Examination (test + project case study)	+	+	+	60

Evaluation of mastering the study course

Achievable level	Requirements
Very high level (10 excellent, 9 excellent)	10 - Knowledge, skills and competence meet and exceed the course requirements; has acquired knowledge and skills at a level that is able to perceive, memorize, reproduce, use the model in a similar situation, and be able to use it independently to acquire new knowledge and solve creative tasks. 9 - Knowledge, skills and competence meet the requirements of the course, are able to solve relevant problems, justify and reason the idea, discern and explain regularities;
High level (8 - very good, 7 - good)	8 - Knowledge, skills and competence meet the requirements of the training course; expresses personal attitudes more at the core of the curriculum than at the level of analysis; 7 - Knowledge, skills and competence are in line with the requirements of the course, but sometimes there is an inability to use the acquired knowledge independently.
average level (6 - almost good, 5 - average, 4 - almost average)	6 - Knowledge, skills and competence meet the requirements of the training course; sometimes lacking in-depth understanding of the problem, not being able to fully apply knowledge in practice, but being able to use knowledge and skills by model. 5 - Knowledge, skills and competences partially meet the requirements of the training course; lack of competence to apply knowledge in practice 4 - Knowledge meets the minimum requirements of the course.
Low level (3 - 1 - negative rating)	3 - Superficial knowledge of the main problems of the study course. 2 - Upgraded individual study course questions; 1 - Not fully mastered the course. There is no understanding of the basic problems of the study course.

RNU study course Business Management

Study programme	Information Systems
Amount	9 ECTS=240 ac.hours
Author (s)	Viktoriia Riashchenko
Preliminary knowledge, Related study courses	-
Aim	To provide in-depth knowledge in business processes, to promote the ability to use the acquired knowledge, skills and methods in practice and professional development, starting commercial activities and creating companies, as well as leading teamwork.
Planned learning outcomes	• provide knowledge for building business professional competences, • develop students' skills in the organization and founding of companies, as well as in management, • to provide knowledge about the formation of social dialogue in society and the regulatory enactments regulating labour legal relations, • improve the competence to find, select, evaluate, structure information and explain it to others
Literature and other sources of information:	
• Compulsory reading	• Jones G.R. (2013) Organizational Theory, Design, and Change, 7th ed.2013, Pearson, 512 p. • Tricker, B. (2019). Corporate Governance. Principles, Policies, and Practices. Oxford University Press, 568 p.
• Recommended	• Adizes, I. (2015) Managing Corporate Lifecycles. Part II. Library of Congress Cataloging-in-Publication Data. Published by Adizes Institute Publications, 260 p. • Adizes I. K. (2018) Prasmīga pārmaiņu vadība. Ievads organizāciju terapijā. Zvaigzne ABC, 336 lpp. • Adizes, I.K (2016) Mastering Change - Introduction to Organizational Therapy (Revised & Updated Edition). Adizes Institute Publications, 298 p. • Barney, J.B.& Hesterly W.S. (2015) Strategic Management and Competitive Advantage. 5th ed., Pearson Education • Boddy, D. (2014). Management an introduction. New York: Pearson Education Limited. • Corporate Governance of State-Owned Enterprises A Toolkit (2014). The World Bank, 360 p. • Daft, R.L. (2014). Management. South-Western Cengage Learning

	• Daft, R. L. (2010) New Era of Management. Mason, OH, USA South-Western CENGAGE Learning. • uczynsky A.A., Buchanan D. A. (2013) Organizational Behaviour, Eight edition, Pearson, Education, 760 p. • Lawrence J. Gitman, Chad J. Zutter (2012). Principles of Managerial Finance, Prentice Hall • Lester, D., Parnell, J. and Carraher, S. (2003). Organizational life cycle: A five-stage empirical scale. International Journal of Organizational Analysis, 11(4), p. 339-354 • Performance Management. Multidisciplinary Perspectives (2010) Ed. Thorpe R. & Holloway J, University of Leeds, UK
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Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1.-2.	<u>Corporate Governance.</u> Definitions. Content and topics of the course. Organization life cycle concepts. Stages of organization development. Characteristics of an organization at each stage of the life cycle.	8	4
3.-4.	<u>Corporate development stages and managerial roles.</u> Corporate Lifecycle by Adizes. Organization size and structural control. Control strategies. Weitzel and Jonsson's Model of Organizational Decline. Causes of decline	8	4
5.-6.	<u>Organizations and environment.</u> Interface between organization and environment. General environmental factors and Task factors. Elements of a changing environment. Dimensions of uncertainty and organizational responses. Uncertainty and organizational structures: mechanistic and organic design. Strategic choices.	8	4
7.-8.	<u>Organizational Design and Structure.</u> Purpose of functioning of organizations. Factors affecting the functioning of an organization. Work system and organizational structure. Relation of structural approach to strategy.	8	4
9.-10.	<u>Changes in the Company.</u> Strategic Types of Change. The need for change. The strategic role of change. Elements of successful change.	8	4

	Model of the process of continuous change in organizational change. Barriers and resistance to change. <u>Decision-making and decision-implementation processes.</u>		
11.- 12.	<u>Organizational Effectiveness</u> Assessing the effectiveness of an organization in a particular environment. Organizational effectiveness for sustainable growth. Measuring Organizational Effectiveness: external resource approach; internal systems approach; technical approach. Four dimensions of organizational effectiveness. Indicators of Organizational Effectiveness. Strategic constituencies' satisfaction: Stakeholders approach.	8	4
13.- 14.	<u>Assessment of the internal potential of the organization.</u> Analysis of internal resources. Appraising resources. Organization Capabilities and Competencies. The company's value creation system management. Company's balanced evaluation by different capitals: financial, information, customer, human, social, relationship and intellectual capital. VRIO framework: a strategic internal analysis tool.	8	4
15.- 16.	<u>Organizational Performance and Performance Management.</u> Measuring organizational performance. Performance control tools: financial control, information control; benchmarking, best practice approach. Balanced scorecard approach. Manager's role in helping organizations achieve high performance <u>Ethical dilemmas in corporate governance.</u> Corporate Social Responsibility.	8	4
	Exam		
1.-2.	General provisions of labor law.	4	2
3.-4.	Social organizations of employees and employers.	4	2
5.-6.	Establishment of employment legal relationships and specifics of the employment relationships for individual categories of employees.	4	2
7.-8.	Peculiarities of working time determination.	4	2
9.-10.	General terms and conditions of remuneration	4	2
11.- 12.	Rest time	4	2
13.- 14.	Termination of employment.	4	2
15.- 16.	Arrangements and time limits for dealing with industrial disputes.	4	2
		96 ac.h.	48 ac.h.

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources and methodological materials learning	104/180/200	Acquired knowledge and understanding of the diverse principles of corporate governance.
2. Preparation for discussion of case studies, development of descriptions: Thomas Cook, Aquarius, Nissan, Philips NV, Leya, Herman Miller.	12	Acquired skills to analyse different experiences and evaluate from the perspective of theoretical knowledge. Developed discussion competences .
3. Development and presentation of individual practical tasks: 1) the choice of the company to be analysed in its own country, a short, analytical description of its activities; 2) external environment factor analysis (PESTEL): identification and analysis of general and task factors, determination of impact; 3) SWOT pairs comparison method to determine the degree of influence of factors.	16	Acquired skills to analyse and argue, developed competencies to discuss the results obtained.
4. Preparation for test on corporate governance aspects.	12	Acquired the basic knowledge of business management and the skills to use them in different situations, which are embedded in test work.
Total ac.h.s:	144/192/240	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Studies of literature, sources and methodical materials.	+			10%
2. Performance of individual practical assignments		+	+	40%
3. Case analyses	+	+	+	20%
4. Test on multiple aspects of enterprise management/ corporate governance	+	+		30%

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Study works (Self-study work)	+	+	+	50
2. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Mathematical Foundations for Software Engineering

Study programme	Information Systems
Amount	9 ECTS=240 ac.hours
Author	Evija Liepa
Preliminary knowledge, Related study courses	-, Mathematic Modelling, Mathematical and numerical methods
Aim	The purpose of the study course is to provide basic knowledge in mathematics, which is necessary to understand processes and algorithms in professional subjects, to develop logical thinking and application skills related to specialization study courses and their basic objects.
Planned learning outcomes	• to choose the most appropriate methods to analyze the situation and evaluate the results; • to develop the competence of decision-making based on a preliminary analysis of the situation. • data mining, explication, processing and analysis methods; • advanced mathematics, putting forward and studying alternative decisions;
Literature and other sources of information:	
• Compulsory reading	<u>O'Regan</u> G. Mathematical Foundations of Software Engineering. A Practical Guide to Essentials. Springer, 2023
• Recommended	• Curwin J., Slater R., Eadson D. Quantitative Methods for Business Decisions. 7th Edition, 2013, 606 pp vai. https://www.academia.edu/19514376/Quantitative_Methods_for_Business • Croft T., Burton Gl., Myddelton D.R., Morris Cl., Barrow M. Quantitative Methods. 2004, 322 pp. • Walters D.W., Walters D.J. Quantitative Methods for Business. Pearson Education, 2008, 309 pp. • Кузнецов Б.Т. Математика: учебник, Юнити-Дана, 2012 1http://window.edu.ru/catalog/?p_rubr=2.2.74.12

Study course content and schedule of contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1.-4.	Elements of linear algebra: determinants; matrices; algebra of matrices; solution of systems of linear equations.	8	4
5.-10.	Vector algebra: vectors; operations with vectors; linear independence of vectors; basis of space	12	6
11.-16.	Analytical geometry: equations of curves in a plane; equations of curves and surfaces in three-dimensional space	12	6
	Test	32	16
1.-2.	Introduction to calculus: elementary functions; sequences and their limits; limit of a function, continuity	8	4
3.-4.	One-variable differential calculus: derivative and differential of function, their applications	8	4
5.-6.	Multivariable functions; limits of multivariable functions; continuity	8	4
7.-8.	Multivariable differential calculus: partial derivatives, total differential, their applications	8	4
9.-10	Complex numbers, operations with them	8	4
11.-13.	Integral calculus: indefinite and definite integrals, their applications; improper integrals.	12	6
14.-15.	Multiple integrals (double and triple integrals). Concept of line integral.	8	4
16.	Numerical and functional series. Power series, applications of them	4	2
		96 ak.st.	48 ak.st.

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ Part-Time intramural/ Distance learning	Planned learning outcomes
Compulsory reading, sources and methodological materials learning	72/96/120	The acquired knowledge, skills and competences
Home works	72/96/120	The acquired knowledge, skills and competences
Total:	144/192/240	

Study work	Knowledge	Skills	Competences	% of final evaluation
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3. Home works (Self-study work)	+	+	+	50
4. Exam	+	+	+	50

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10 (with distinction) - knowledge, skills and competences exceed the requirements of the study course and demonstrate the ability to perform independent research as well as the deep understanding of problems; 9 (excellent) - knowledge, skills and competences fully meet the requirements of the study course, student is able to apply the acquired knowledge independently;
High (8 –very good 7 - good)	8 (very good) – the requirements of the study course are fully met, however, there is insufficient understanding of individual issues to use the knowledge independently for the solution of more complex problems; 7 (good) – the requirements of the study course are met in general, however, sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 (almost good) –. the requirements of the study course are met in general, however insufficient understanding of some problems and inability to apply the acquired knowledge is detected; 5 (satisfactory) – the requirements of the study course are met for the most part, however insufficient understanding of many problems and inability to apply the acquired knowledge is detected; 4 (almost satisfactory) – the requirements of the study course are met, for the most part, however insufficient understanding of some main concepts is detected as well as considerable difficulties in the practical application of the acquired knowledge are stated;
Low (3 – 1 – negative evaluation)	3 (bad) – knowledge is superficial and incomplete; the student is unable to use it in specific situations; 2 (very bad) – superficial and incomplete knowledge of only some problems, the most part of the study course is not mastered; 1 (very very bad) – an absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.

RNU study course Research Methodology

Study programme	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Zaiga Oborenko
Preliminary knowledge, Related study courses	Applied Statistics
Aim	• Provide an overview of the basic principles of scientific research and develop abilities to perform scientific work in the study process. • Develop students' skills to learn research methodologies, to make a choice of sources and literature and their analysis. • Develop the individual skills of students in order to promote the development of high-level study papers by providing an overview of the evaluation of the results of the study in the framework of their research work.
Planned learning outcomes:	
knowledge	• Acquire knowledge of research work and of the requirements for research. • Gets understanding of the key concepts in research. • Are aware of the challenges of research methods in research practice. • Gains knowledge on how to deal with information in a digitised environment.
skills	• Search and select literature and data for research. • Works with information sources; puts forward, substantiates the problem under investigation; plans an independent study. • Prepares and presents the research results • Uses digital sources through information management systems.
competences	• Develops competence to critically assess and summarize information from scientific literature (textbooks, manuals, dictionaries, Internet resources, etc.) and sources. • Develops competencies in planning, executing and presenting research work. • Demonstrates ability to synthesize lessons learned and formulate clear conclusions. • Demonstrates ability to carry out research with scientific value in business administration and management.

Literature and other sources of information:	
compulsory reading	• Cottrell, S. (2019) The Study Skills Handbook. 5th ed., UK: MacMillan Education, 432 p. • Kristapsone, S. (2014). Zinātniskā pētniecība studiju procesā. Rīga: Biznesa augstskola Turība, 350 lpp. • Kumar, R. (2014) Research methodology: a step-by-step guide for beginners. 4th ed., Sage Publications, 432 p. • Pētniecība. Teorija un prakse (2016). Mārtinsones K, Piperes A, Kamerādes D. zin. red. Rīga: RAKA, 546 lpp • Zinātniskā rakstīšana un pētījumu rezultātu izplatīšana (2019), 2.papild.izd. Mārtinsones K. un Piperes A zin.red., Rīga: RSU, 301 lpp.
recommended	• Carter, C, Joyce, B., Kravits, S. L (2010) Keys to Effective Learning: Study Skills and Habits for Success. 6th ed., Pearson, 400 p. • Bryman A. (2016) Social Research Methods, 5th ed., Oxford, 766 p. • Eko U. (2006) Kā uzrakstīt diplomdarbu. Humanitārās zinātnes. Rīga: Jāņa Rozes apgāds, 319 lpp. • Eņģele, I. (2012) Pētniecības terminu skaidrojošā vārdnīca. RaKa, Rīga, Latvija. • Mārtinsone K., (2011) Ievads pētniecībā: stratēģija, dizaini, metodes., RaKa, Rīga, Latvija. • Saunders M., Lewis P., Thornhill A. (2015) Research methods for business students. 7th ed., Pearson Education, 678 p. • Sekaran U., Bougie R (2016) Research Methods for Business: A Skill-building Approach, 7th ed, Willey, UK.
Law	• Saeima (2000) Copyright Law. Available https://likumi.lv/ta/en/en/id/5138-copyright-law

Contents and schedule of the contact hours

Week	Topic	Academic Hours	
		full-time intramural	part-time intramural
1.	1. Study process and learning methods.	2	1
2.	2. Nature of scientific research and basics of research methodology	2	1
3.	3. Ethics of scientific research	2	1
4.	4. The progress of the research process and its organisation.	2	1

5.	5. Analysis of scientific and educational literature-	2	1
6.	6. Working with databases and library resources.	2	1
7.	7. The process of developing independent work. Methodological requirements.	2	1
8	8. Selecting the topic of the study – starting point for the study.	2	1
9.	9. Identification and analysis of research literature and sources. Critical approach to various sources of information.	2	1
10.	10. Scientific framework development of research	2	1
11.	11. Methods of obtaining information for research.	2	1
12.	12. Documents as a source of research. Classification of documents. Secondary research.	2	1
13.	13. Types of research. Quantitative and qualitative methods	2	1
14.	14. Structure of scientific study	2	1
15.	15. Requirements for execution and technical design of research work.	2	1
16.	16. Analysis, interpretation and presentation of the obtained research results.	2	1
		32	16

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1. Compulsory reading, sources and methodological materials learning	6/14/22	Acquired knowledge and understanding of: • basic principles of scientific research; • the role of research in entrepreneurship; • the research process. Examination form- test
2. Individual study work: term paper on the chosen topic.	25/25/35	Strengthened knowledge acquired during the study course.

2.1. Choosing a theme and selecting a topic 2.2. Development of scientific framework 2.3. Literature and sources review 2.4. Study design and content. 2.5. Course paper writing according to methodological guidelines and technical requirements 2.6. Presentation of study paper		Acquired skills to use theoretical knowledge in working out study papers. Developed competencies : - to develop research using available resources; - Developed critical assessment of a variety of information sources; - developed and defended his / her study paper.
3. Cases studies/ workshops in classes/class discussions	5/9/5	Developed competences : ability to debate, activity, expression of one's position, ability to argue and defend one's opinion about the researched situation, ability to cooperate. Developed skills : ability to analyse the situation and discover solutions; ability to use theoretical approaches.
4. Preparation for test work on theoretical and practical aspects of the research methodology.	12/16/18	Knowledge of research and skills has been acquired to use them in different business situations embedded in the test.
Total:	48 /64/80	

Study work	Knowledge	Skills	Competences	% of final evaluation
1. Studies of literature, sources and methodical materials.	+			10%
2. Study work according to methodological requirements. Presentation and defence of the paper	+	+	+	50 %
3. Case studies	+	+	+	10%
4. Test	+	+		30%

Evaluation of mastering the study course

Achievable level	Requirements
Very high level (10 excellent, 9 excellent)	10 - Knowledge, skills and competence meet and exceed the course requirements; has acquired knowledge and skills at a level that is able to perceive, memorize, reproduce, use the model in a similar situation, and be able to use it independently to acquire new knowledge and solve creative tasks. 9 - Knowledge, skills and competence meet the requirements of the course, are able to solve relevant problems, justify and reason the idea, discern and explain regularities;
High level (8 - very good, 7 - good)	8 - Knowledge, skills and competence meet the requirements of the training course; expresses personal attitudes more at the core of the curriculum than at the level of analysis;

	7 - Knowledge, skills and competence are in line with the requirements of the course, but sometimes there is an inability to use the acquired knowledge independently.
average level (6 - almost good, 5 - average, 4 - almost average)	6 - Knowledge, skills and competence meet the requirements of the training course; sometimes lacking in-depth understanding of the problem, not being able to fully apply knowledge in practice, but being able to use knowledge and skills by model. 5 - Knowledge, skills and competences partially meet the requirements of the training course; lack of competence to apply knowledge in practice 4 - Knowledge meets the minimum requirements of the course.
Low level (3 - 1 - negative rating)	3 - Superficial knowledge of the main problems of the study course. 2 - Upgraded individual study course questions; 1 - Not fully mastered the course. There is no understanding of the basic problems of the study course.

RNU study course Business Communication in English

Study programme	Information Systems
Amount	3 ECTS = 80 ac.hours
Author	Tatjana Lapaine
Preliminary knowledge, Related study courses	
Aim	To form a notion about the importance of business communication for successful achievement of business goals.
Planned learning outcomes:	
knowledge	students shall understand: • extensive and relevant vocabulary • functional grammar • theory of public communication • intercultural communication in the multicultural society students shall be able to apply: • methods of internal and external communication • methods of intercultural communication • business communication • professional terminology • basics of intercultural communication • conducting business negotiations • methods of public communication
skills	• to use professional terminology
competences	• the ability to comply with the basic principles of professional and general ethics and generally accepted standards of conduct • the ability to represent an organisation in the professional environment • the ability to use knowledge and methods to explain sustainable development issues and to draw evidence-based conclusions • the ability to ensure active and effective participation in the development of social dialogue in society

Literature and other sources of information:	
compulsory reading	- Bovee, C. L., Thill, J. V. (2019). Business Communication Essentials: Fundamental Skills for the Mobile-Digital-Social Workplace, 8th ed., Pearson - Apele, A. Prasme runāt publiski. – Rīga : Zvaigzne ABC, 2014. – 136 lpp; - Lasmane, S., Komunikācijas ētika. – Rīga : LU Akadēmiskais apgāds, 2012. – 304 lpp; - Vēstuļu rakstīšanas VADLĪNIJAS , Valsts kanceleja, 2017, pieejams: https://www.mk.gov.lv/sites/default/files/editor/vestulu_vadlinijas_2017.pdf
recommended	- Adler, R., Elmhurst, J.M. (2019). Communicating at Work , 12th ed., McGraw-Hill eBook - Higgins, J. (2018). 10 Skills for Effective Business Communication: Practical Strategies from the World's Greatest Leaders, Tycho Press - Prince, E.S. (2017). Practical Business Communication, Macmillan Study Skills - Fair, B., Gurrie, C. (2017). Business Communication in a Technological World, 1st ed., Kendall Hunt Publishing - Wayne, F.Stanford, Dauwalder, David P. (2014). Communicating in Business. An Action Oriented Approach, Austen Press Inc., United States - Lesicar, R.V. (2013). Basic Business Communication, Richard P.IRWIN, Inc. United States - Lewis, R.D. (2006). When Cultures Collide: Leading Across Cultures. Nicholas Breadley International, Boston. http://www.utntyh.com/wp-content/uploads/2011/11/When-Cultures-Collide.pdf

Contents and schedule of the contact hours

Week	Topic	Academic hours	
		full-time intramural	part-time intramural
1	Introduction to the process of business communication. Verbal and non-verbal communication. Internal and external, formal and informal channels within the organization. Communication channels "up", "down" and "horizontal". Communication barriers. Coding and encoding skills. Feedback and perception.	4	2
2.	Effective writing strategies. Writing style. Clear purpose, structure and contents of the business	4	2

	message. The sequence of ideas (direct or indirect). Letter style and format. Word choice.		
3.	Written communication. Letter writing guidelines. Business Letter Types: With Good or Bad News, Direct Requests, Persuasive letters and the peculiarities of their writing.	4	2
4.	1st self-study work.	2	
5.	Oral communication. Listening skills. Meetings. Organizing a speech for a public presentation. Presentation skills. Audience analysis.	4	2
6.	Communication for Employment. Writing CV and application letter. 3 types of CV and their differences. Job interview.	4	2
7.	International business communication. Linguistic and cultural shock. Types of culture. Intercultural communication and personality. Stereotypes.	4	2
8.	2 nd self-study work.	2	
9.	Conflict and communication. Conflict types and control styles. Causes of conflict and conflict resolution variants.	4	4
		32	16

Description of students' self-studies organisation and assignments

Self-study work	Ac.hours for full-time/ part-time intramural/ part-time extramural or distance studies	Planned learning outcomes
1.Compulsory reading, sources and methodological materials learning.	16/32/48	Obtained knowledge according to the expected results. Testing form: test
2. 1st self-study work: group work "Business letter writing and correction".	16	Obtained knowledge and skills according to the expected results.
3. 2 nd self-study work: situation analysis "Business Communication in different countries".	16	Obtained knowledge, skills and competences according to the expected results.
Total ac.h.s:	48/64/80	

Study work	Knowledge	Skills	Competences	% of final evaluation
1.	+			40
2.	+	+		30
3.	+	+	+	30

Evaluation of mastering the study course

Level	Requirements
Very high (10 –with distinction 9 – excellent)	10- knowledge, skills and competences exceed the requirements of the study course and demonstrate a student's ability to perceive, memorise and reproduce the obtained knowledge and apply it in a similar situation, as well as to use it for mastering new knowledge and creatively solve problems. 9 - knowledge, skills and competences fully meet the requirements of the study course, student is able justify and logically state the problem, solve relevant problems, identify and explain the regularities.
High (8 –very good 7 - good)	8 –the requirements of the study course are fully met; in the framework of the curriculum a student demonstrates personal attitude more on the level of statement than analysis. 7 – knowledge, skills and competences meet the requirements of the study course, however sometimes the inability to use the acquired knowledge independently is detected;
Average (6 – almost good 5 – satisfactory 4 –almost satisfactory)	6 –. knowledge, skills and competences meet the requirements of the study course, however insufficient understanding of some problems and inability to apply the acquired knowledge at practice is detected, a student can apply the mastered knowledge and skills in accordance with an example. 5 –the requirements of the study course are met for the most part, however insufficient ability to apply the acquired knowledge is detected; 4 – knowledge meets the minimal requirements of the study course.
Low (3 – 1 – negative evaluation)	3 – superficial knowledge of the main concepts of the study course; 2 –superficial and incomplete knowledge of only some problems of the study course; 1 – absence of understanding of the main problems of the subject matter, almost no knowledge of the content of the study course.