University of Information Science and Technology
"St. Paul the Apostle" - Ohrid

Faculty of Computer Science and Engineering

Undergraduate FIRST CYCLE OF STUDIES

Study program: **COMPUTER SCIENCE AND ENGINEERING (CSE) 4 years**

Active from the academic year 2023/2024

Four-year (240 ECTS) studies

Degree: Bachelor of Science in Computer Engineering.

Acquired skills: The study program provides students with a strong foundation in computer science, including programming, databases, algorithms, information systems, and computer networks. Students develop practical skills in modern technologies, including web and parallel programming, cloud computing, artificial intelligence, and machine learning.

The program emphasises problem-solving, critical thinking, and real-world application of knowledge in multidisciplinary environments. Graduates gain strong communication and teamwork skills, preparing them to successfully manage and contribute to ICT projects.

CSE 4 years

Year I				
Semester I				
No.	Code	Course Name	No. of classes	ECTS
Core Courses				
1	CSE11M01	Introduction to Programming	2+4	6
2	CSE11M02	Discrete Mathematics	3+2	6
3	CSE11M03	Mathematics 1	3+2	6
4	CSE11M04	Computer simulation in physics	3+2	6
5	CSE11M05	English for Technical Communication 1	3+2	6
Year I				
Semester II				
No.	Code	Course Name	No. of classes	ECTS
1	CSE12M01	Object-Oriented Programming	3+2	6
2	CSE12M02	Mathematics 2	3+2	6
3	CSE12M03	English for Technical Communication 2	3+2	6
4	CSE12M04	Logic circuits and digital electronics	3+2	6
Elective				

5	CSE12EXX	Course from Faculty elective list	3+2	6

Year II				
Semester III				
No.	Code	Course Name	No. of classes	ECTS
Core Courses				
1	CSE13M01	Script Programming	3+2	6
2	CSE13M02	Algorithms and Data Structures 1	3+2	6
3	CSE13M03	Databases 1	3+2	6
4	CSE13M04	Data Engineering	3+2	6
Elective				
5	XXX13UXX	Course from the University elective list	3+2	6

Year II				
Semester IV				
No.	Code	Course Name	No. of classes	ECTS
1	CSE14M01	Algorithms and Data Structures 2	3+2	6
2	CSE14M02	Network Technologies	3+2	6
3	CSE14M03	Web Application Development	3+2	6
Elective				
4	CSE14EXX	Course from the Faculty elective list	3+2	6
5	XXX14UXX	Course from the University elective list	3+2	6

Year III				
Semester V				
No.	Code	Course Name	No. of classes	ECTS
Core Courses				
1	CSE15M01	Modelling and Simulations	3+2	6
2	CSE15M02	Probability and Statistics	3+2	6
3	CSE15M03	Computer Organisation and Architecture	3+2	6
Elective				

4	CSE15EXX	Course from the Faculty elective list	3+2	6
5	XXX15UXX	Course from the University elective list	3+2	6

Year III				
Semester VI				
No.	Code	Course Name	No. of classes	ECTS
1	CSE16M01	Internet Programming	3+2	6
2	CSE16M02	Databases 2	3+2	6
3	CSE16M03	Operating Systems	3+2	6
Elective				
4	CSE16EXX	Course from the Faculty elective list	3+2	6
5	XXX16UXX	Course from the University elective list	3+2	6

Year IV				
Semester VII				
No.	Code	Course Name	No. of classes	ECTS
Core Courses				
1	CSE17M01	Distributed systems	3+2	6
2	CSE17M02	Artificial intelligence	3+2	6
3	CSE17M03	Multiplatform Programming	3+2	6
Elective				
4	CSE17EXX	Course from the Faculty elective list	3+2	6
5	CSE17EXX	Course from the Faculty elective list	3+2	6

Year IV				
Semester VIII				
No.	Code	Course Name	No. of classes	ECTS
1	CSE18M01	Entrepreneurship	3+2	6
2	CSE18M02	Parallel Programming	3+2	6
3	CSE18M03	Data Science	3+2	6
4	CSE18M04	Bachelor Thesis	3+2	6
Elective				

5	CSE18EXX	Course from the Faculty elective list	3+2	6
Total credits				240

The first cycle of university studies recognises the modules:

- M - mandatory (core courses),
- E - elected from the faculty list of courses
- U – elected from the university list of courses.

List of Faculty Elective courses				
id	**code**	**Course**	**Weekly fund of hours**	**ECTS**
1	CSE12E01	Signals and Systems	3+2	6
2	CSE12E02	Processing of multimedia data	3+2	6
3	CSE12E03	Society and Technological Transformation	3+2	6
4	CSE14E01	Social networks		
5	CSE14E02	Graph theory	3+2	6
6	CSE14E03	Political processes and governance in the 21st century	3+2	6
7	CSE14E04	Communication Theory	3+2	6
8	CSE14E05	Introduction to Robotics	3+2	6
9	CSE14E06	Software Engineering	3+2	6
10	CSE14E07	Legal aspects of computer crime	3+2	6
11	CSE15E01	Optical and wired networks	3+2	6
12	CSE15E02	Digital signal processing	3+2	6
13	CSE15E03	Linear algebra	3+2	6
14	CSE15E04	Computer Graphics	3+2	6
15	CSE15E05	Management theory	3+2	6
16	CSE15E06	Multimedia information systems	3+2	6
17	CSE15E07	Human-Computer Interaction	3+2	6
18	CSE15E08	Business Information Systems	3+2	6
19	CSE15E09	Music Programming	3+2	6
20	CSE16E01	Information Theory	3+2	6
21	CSE16E02	Numerical Methods	3+2	6
22	CSE16E03	Microprocessors	3+2	6
23	CSE16E04	Programmable logic controllers	3+2	6
24	CSE16E05	Data Visualisation	3+2	6
25	CSE16E06	User interface design	3+2	6

26	CSE16E07	Stochastic processes	3+2	6
27	CSE16E08	Management of Information Systems	3+2	6
28	CSE16E09	Decision Methods	3+2	6
29	CSE16E10	Wireless networks	3+2	6
30	CSE16E11	Music and Mathematics	3+2	6
31	CSE17E01	Cryptography	3+2	6
32	CSE17E02	Cloud data processing	3+2	6
33	CSE17E03	Machine Learning	3+2	6
34	CSE17E04	Optimization methods	3+2	6
35	CSE17E05	Digital processing of signals and images	3+2	6
36	CSE17E06	Platform engineering	3+2	6
37	CSE17E07	Wireless mobile systems	3+2	6
38	CSE17E08	Internet of Things	3+2	6
39	CSE17E09	Economics of ERP Systems	3+2	6
40	CSE17E10	Digital Music	3+2	6
41	CSE17E11	Wireless Sensor Networks	3+2	6
42	CSE18E01	Deep learning	3+2	6
43	CSE18E02	Offensive safety	3+2	6
44	CSE18E03	Blockchain Development	3+2	6
45	CSE18E04	Virtual and augmented reality	3+2	6
46	CSE18E05	Natural language processing	3+2	6
47	CSE18E06	Digital Management	3+2	6
48	CSE18E07	Business Intelligence and Analytics	3+2	6
49	CSE18E08	English for Academic Purposes	3+2	6

University of Information Science and Technology
"St. Paul the Apostle" - Ohrid

List of University courses				
id	**code**	**Course**	**Weekly fund of hours**	**ECTS**
1	CSE13U01	Economics	3+2	6
2	CNS13U02	Digital Arts	3+2	6
3	ICS13U03	Ethics of electronic literature	3+2	6
4	ICS13U04	Creative writing for media	3+2	6
5	MIR13U05	Democracy and Technology	3+2	6
6	MIR13U06	Open data	3+2	6
7	MIR13U07	Law in Information Technologies	3+2	6
8	MIR14U01	Business Law	3+2	6
9	CNS14U02	The art of graphic design	3+2	6
10	CNS14U03	Visual arts and 3D modeling	3+2	6
11	CSE14U04	Economics of Electronic Banking	3+2	6
12	CSE14U05	Economics of Business Processes and Transactions	3+2	6
13	ICS14U06	Theory of culture	3+2	6
14	ICS14U07	Literary theories in journalism	3+2	6
15	MIR14U08	Diplomacy in the Modern Age	3+2	6
16	CNS15U01	2D and 3D techniques for concept art	3+2	6
17	CNS15U02	Introduction to New Media Art	3+2	6
18	CSE15U03	Economics of Electronic Commerce	3+2	6
19	CSE15U04	Economic Analysis of Business and Financial Operations	3+2	6
20	MIR15U05	Legal Data Protection	3+2	6
21	ICS15U06	Animated storytelling	3+2	6
22	ICS15U07	Intertextuality and hypertextuality in game theory	3+2	6
23	MIR15U08	Public speaking	3+2	6
24	MIR15U09	Elections, electoral systems and technology	3+2	6
25	CNS16U01	Visual arts and 3D character animation	3+2	6
26	CSE16U02	Economics of Digital Marketing	3+2	6
27	CS16U03	Art and creativity	3+2	6
28	ICS16U04	Creative writing	3+2	6
29	MIR16U05	Negotiations and dispute resolution	3+2	6
30	MIR16U06	Open government	3+2	6
31	ISVMA16U07	English for Special Purposes	3+2	6
32	CNS16U08	Video art and production	3+2	6

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Object-Oriented Programming			
2.	Code	CSE12M01			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	1	semester	II
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Atanas Hristov, PhD			
9.	Language of instruction	Engli			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	The objective of this course is to introduce students to the fundamental concepts of object-oriented programming. The course focuses on a programming language that is new to students, **Java**, and all of its related concepts and paradigms. In order to introduce first-year students to this new programming language, certain prior knowledge from topics related to *Introduction to Programming* is required. This course covers the following topics: syntax, basic methods, algorithms, data types, the object-oriented paradigm, and console-based software. Although the course primarily focuses on the programming language, it also develops essential elements of software engineering. .			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Course Content: • Software design in Java as a console application; • Understanding the general concepts of object-oriented programming; • Demonstrating knowledge and understanding of logic in programming; • Demonstrating the ability to develop software; • Acquiring and developing the capacity to design and develop software within a group environment; • Acquiring and using correct Java terminology and Java programming concepts.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			

15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 30 hours; Tutorials: 30 hours; Labs: 30 hours. Independent preparation, projects, homework: 90 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	30
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	30
		17.2.	Independent tasks: hours	30
		17.3.	Home study – tasks	30
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		

19	Assessment Method		
	19.1.	Tests: Points	45
	19.2.	Seminar paper/project, written and oral presentation: points	10
	19.3.	Final exam: points	45

20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Herbert Schildt	Java: A Beginner's Guide	McGraw Hill	2018
2.	Cay S. Horstmann	Big Java	Wiley	2019
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Harry H., Chris James	Thinking in Java	Programmers Mind Inc.	2014

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Open data			
2.	Code	MIR13U06			
3.	Study program	Computer Science and Engineering – 4 years / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	first			
6.	Academic year / semester	Year	2	semester	III
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Dr. Goran Shibakovski			
9.	Language of instruction	Eng			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	The aim of this course is to build the capacity of students to understand the value of open data and to use open data. Through this course, students will learn about open data and its benefits, the technical characteristics of working with open data, the global movement of open data, and current trends and ways of working with open data in the world.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Introduction to the subject. 2. Open definition and open data. Meaning of open data. Principles for opening government information. 3. Open data legislation. Open data policies. Licensing. 4. Open data sources. Government sources. Other sources. 5. Open data case studies. Government initiatives. Civil society initiatives. 6. Data cleaning process. Common mistakes and elements. 7. Data extraction. Data extraction software. Limitations and challenges. 8. Open data analysis. Data structures. Variables. Qualitative analysis. Quantitative analysis. Limitations and challenges. 9. Open data visualization. Meaning of data visualization. Open data visualization software and tools. 10. Open data publishing. Open data portal. Open data licensing. Open data formats. Storytelling through data. 11. Open data portals. Examples from international organizations. Case studies and practices. 12. Overview of the state of the open data ecosystem in the Republic of Macedonia. 13. Global trends and challenges of open data.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures and theoretical teaching, exercises, independent seminar work, teamwork in groups, project and independent assignments, home study, consultations.			
15.	Total Available Time Allocation	6 ECTS x 30 hours/credit = 180 hours			

16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours		45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours		30
		16.3.	Practical work: hours		35
17.	Other forms of activities	17.1.	Project assignments: hours		35
		17.2.	Independent tasks: hours		35
		17.3.	Home study – tasks		35
18	Conditions for Signature	Regular attendance at classes in accordance with UIST regulations			
19	Assessment Method				
	19.1.	Tests: Points		80	
	19.2.	Seminar paper/project, written and oral presentation: points		20	
	19.3.	Final exam: points		100	
20	Assessment criteria (points/grade)		**up to 50 points**	**5 (five) (F)**	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching		Self-evaluation and mechanisms for monitoring the quality of teaching at UIST		

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Charalabidis, Yannis and Anneke Zuiderwijk, et al.	The World of Open Data: Concepts, Methods, Tools and Experiences	Springer	2018
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year

		1.	Davies, Tim, Walker, Stephen B., Rubinstein, Mor	The State of Open Data: Histories and Horizons	African Minds	2019
		2.	Bolívar, Manuel Pedro Rodríguez and Kelvin Joseph Bwalya, et al.	Governance Models for Creating Public Value in Open Data Initiatives	Springer	2019
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Open government			
2.	Code	MIR16U06			
3.	Study program	Computer Science and Engineering – 4 years / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	first			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Goran Shibakovski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	The course explores the foundations and goals of open government and examines current developments, including the opening and reuse of government data such as the release of data by governments in America and Europe. This course will engage students, helping them to understand the key principles surrounding open government. In addition, students will learn how to analyze the benefits, barriers, and potential negative effects of an open government case. Students will gain skills in analyzing open government practices and applying open government principles to a variety of situations.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Introduction to the subject. 2. Open government: Definitions and principles. Topics, concepts and practices of open government. 3. Comparative aspects of digital policies. Models and consequences of digital administration. Impact on the organization, economy and society. 4. Transparency as a guiding principle of open government. Transparency, openness and accountability. Positive and negative consequences of transparency on democratic societies. 5. Open government and open data. Opening and reuse of public sector information. Metadata and linked data. Advantages, barriers, potential negative outcomes. 6. Open data platforms. Interoperability of data systems. Legal aspects of open data and licenses. 7. Transparency and communication in the public sector. How institutions communicate through data and information. Main international indices for assessing open government. 8. Digital governance and public engagement. From information to co-creation of content. Practical examples. 9. Open government and trust. The role of open government in crisis communication. Global infodemic: information disruption and social media. 10. Open government and case			

		studies. The European Union and the General Data Protection Regulation. The role of civil society. Open government partnership. 11. Open government and public values and conclusions. Technical and legal aspects of public government information sharing. 12. The state of open government in the Republic of Macedonia. 13. Global trends and challenges of open government.				
13	Interconnection of Courses					
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures and theoretical teaching, exercises, independent seminar work, teamwork in groups, project and independent assignments, home study, consultations.				
15.	Total Available Time Allocation	6 ECTS x 30 hours/credit = 180 hours				
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45		
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30		
		16.3.	Practical work: hours	35		
17.	Other forms of activities	17.1.	Project assignments: hours	35		
		17.2.	Independent tasks: hours	35		
		17.3.	Home study – tasks	35		
18	Conditions for Signature	Regular attendance at classes in accordance with UIST regulations				
19	Assessment Method					
	19.1.	Tests: Points		80		
	19.2.	Seminar paper/project, written and oral presentation: points		20		
	19.3.	Final exam: points		100		
20	Assessment criteria (points/grade)	**up to 50 points**	**5 (five) (F)**			
		from 51 to 60 points	6 (six) (E)			
		from 61 to 70 points	7 (seven) (D)			
		from 71 to 80 points	8 (eight) (C)			
		from 81 to 90 points	9 (nine) (B)			
		from 91 to 100 points	10 (ten) (A)			
21.	Method for monitoring the quality of teaching	Self-evaluation and mechanisms for monitoring the quality of teaching at UIST				
22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Wanna, John and Sam Vincent	Opening Government: Transparency and Engagement in the Information Age	Australian National University Press	2018

		2.	Lathrop, Daniel and Laurel Ruma	Open Government: Collaboration, Transparency, and Participation in Practice	O'Reilly Media	2010
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Gascó-Hernández, Mila	Open Government: Opportunities and Challenges for Public Governance	Springer	2014
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Operating systems			
2.	Code	CSE16M03			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – optional subject from the unit			
6.	Academic year/semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Daniela Mechkaroska, PhD			
9.	Language of instruction				
10.	Prerequisites for Attending and Passing the Course	Introduction to Programming			
11.	Course Objectives (Competencies) and Learning Outcomes:	Students completing this course will be able to: • Describe OS architecture, components, and core responsibilities. • Analyze processes, threads, scheduling, synchronization, and IPC. • Apply memory, storage, and file-system management techniques. • Perform Linux and Windows system administration tasks. • Understand virtualization, distributed systems, and cloud OS principles. • Compare Linux, Windows, and Android OS internals. • Implement practical OS-related exercises and simulations.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• **Chapter 1 – Introduction to Operating Systems** Content: OS roles, architecture, system organization, and virtualization basics. Learning outcomes: Students understand OS purpose, components, and hardware interaction. • **Chapter 2 – OS Structure and System Calls** Content: OS services, user interfaces, system calls, kernel structures. Learning outcomes: Students explain OS services and implement basic system calls in Linux. • **Chapter 3 – Process Management** Content: Processes, threads, CPU scheduling, IPC Learning outcomes: Students analyze process states, compare scheduling algorithms, and use IPC mechanisms. • **Chapter 4 – Concurrency and Synchronization** Content: Critical section, semaphores, mutexes, monitors, deadlocks. Learning outcomes: Students apply synchronization tools and describe deadlock prevention/avoidance. • **Chapter 5 – Memory Management** Content: Paging, segmentation, virtual memory, page replacement. Learning outcomes**:** Students explain memory models and evaluate page replacement algorithms. • **Chapter 6 – Storage and I/O Systems**			

<table>
<tr><td></td><td></td><td colspan="3">Content: Disk scheduling, SSD/NVM, device drivers, I/O subsystem. Learning outcomes: Students understand storage technologies and I/O flow in modern OS.
• Chapter 7 – File Systems
Content: File concepts, directories, implementation, VFS Learning outcomes: Students describe file system structures and compare allocation methods.
• Chapter 8 – Security and Protection
Content: Threats, authentication, access control, cryptography basics. Learning outcomes: Students explain OS-level security models and apply permission mechanisms.
• Chapter 9 – Case Studies: Linux & Windows
Content: Kernel architecture, scheduling, memory, file systems. Learning outcomes: Students compare Linux and Windows design and internal mechanisms.
• Chapter 10 – Virtualization, Distributed Systems & Cloud Trends
Content: Hypervisors, VMs, containers, distributed file systems, cloud OS evolution. Learning outcomes: Students understand virtualization models and cloud-driven OS design.
• Chapter 11 – Linux Fundamentals
Content: Shell commands, filesystem, permissions, processes. Learning outcomes: Students perform basic Linux administration tasks.
• Chapter 12 – Linux Shell Scripting & Administration
Content: Bash scripting, cron, system services, firewall configuration. Learning outcomes: Students write scripts and configure essential Linux services.
• Chapter 13 – Android Operating System
Content: Android architecture, runtime, Linux kernel adaptation. Learning outcomes: Students understand Android OS structure and app execution model.</td></tr>
<tr><td>13</td><td>Interconnection of Courses</td><td colspan="3"></td></tr>
<tr><td>14.</td><td>Detailed Description of the Teaching and Working Methods for the Course</td><td colspan="3">This course is based on 45 hours of lectures, supplemented by 30 hours of exercises</td></tr>
<tr><td>15.</td><td>Total Available Time Allocation</td><td colspan="3">6 ECTS credits x 30 hours/credit = 180 hours</td></tr>
<tr><td rowspan="3">16.</td><td rowspan="3">Forms of Teaching Activities</td><td>16.1.</td><td>Lectures – theoretical instruction, hours</td><td>45 hours</td></tr>
<tr><td>16.2.</td><td>Exercises (laboratory, auditory), seminars, teamwork: hours</td><td>30 hours</td></tr>
<tr><td>16.3.</td><td>Practical work: hours</td><td>10 hours</td></tr>
<tr><td rowspan="3">17.</td><td rowspan="3">Other forms of activities</td><td>17.1.</td><td>Project assignments: hours</td><td>25 hours</td></tr>
<tr><td>17.2.</td><td>Independent tasks: hours</td><td>35 hours</td></tr>
<tr><td>17.3.</td><td>Home study – tasks</td><td>35 hours</td></tr>
<tr><td>18</td><td>Conditions for Signature</td><td colspan="3">Students should ensure regular attendance at classes according to the regulations of UINT</td></tr>
<tr><td rowspan="2">19</td><td colspan="4">Assessment Method 30+20+50</td></tr>
<tr><td>19.1.</td><td colspan="2">Tests: Points</td><td>30 points</td></tr>
</table>

	19.2.	Seminar paper/project, written and oral presentation: points		20 points
	19.3.	Final exam: points		50 points
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Monitoring of UINT control procedures	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	A. S. Tanenbaum, H. Bos	Modern Operating Systems, 4th Edition	Pearson	2014
2.	A. Silberschatz, P. Galvin, G. Gagne	Operating System Concepts, 10th Edition	Wiley	2018
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	W. Stallings	Operating Systems: Internals and Design Principles, 9th Edition	Pearson / Prentice Hall	2018
2.	M. Kerrisk	The Linux Programming Interface	No Starch Press	2010
3.	M. Russinovich, D. Solomon, A. Ionescu	Windows Internals, 6th Edition	Microsoft Press	2012
4.	Linux Documentation Project	Linux Documentation Project (Online Resources)	-	Online

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Optical and wired networks			
2.	Code	CSE15E01			
3.	Study program	Computer science and engineering 4 years studies, Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering, Faculty of Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – elective subject specific to faculty			
6.	Academic year / semester	Year	3	Semester	V
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Ile Dimitrievski, PhD,			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Successfully passed Internet Technologies			
11.	Course Objectives (Competencies) and Learning Outcomes:	The student will gain knowledge of wired network technologies such as optical networks, wired networks and hybrid optical-wired networks. They will also gain knowledge of wired end-user technologies such as xDSL, FTTx and DOCSIS.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• Electromagnetic spectrum, properties of light, dual nature of light, concept of photon, wave models, characteristics of light waves, concept of information, general communication systems, evolution of basic optical communication systems, advantages and disadvantages of optical networks, transmission window, transmission through optical fiber, law of reflection and refraction, light rays and light waves, reflection of light from an optical surface, refraction of light from an optical interface, numerical aperture, optical fiber, type of fiber. • Optical fiber characteristics and parameters for describing optical fiber performance (attenuation, dispersion and noise). Optical fiber losses – Gain, Material absorption losses, linear and nonlinear scattering losses, fiber bending losses, dispersion, intermodal dispersion, intramodal dispersion, total optical dispersion and polarization, fibers with shifted dispersion and straightened dispersion, gain and dispersion limitations in fibers. • Optical materials, couplers and connectors – Optical fiber preparation: liquid phase technique, vapor deposition technique, connector principles, fiber end preparation, splicing, connectors. • Optical sources and detectors – Sources: Basic principles of surface emitting LED and edge emitting LED, materials used, structure, internal quantum efficiency and characteristics, LASER diode, materials used, structure, internal quantum efficiency and characteristics, principles			

		of operation and characteristics of a distributed laser with a return channel, Detectors: PIN photodiode, materials used, principle of operation and characteristics, avalanche photodiode, materials used, principle of operation and characteristics. • Fiber Optic Measurements – Test equipment, OTDR, setup for measuring gain, dispersion, NA and eye pattern. • WDM architectures. SDH and next generation SDH networks, 1/10/40/100 Gb Ethernet, Carrier Ethernet. MPLS/GMPLS. OTN – standard. OTN Framework. WDM network design. WDM FTTH – optics to the home. Passive optical networks. NG-PON, WDM-PON. • Hybrid fiber-optic networks (HFC). • Passive fiber networks (PON, EPON, GPON, GEPON). FTTx. • xDSL technologies, architecture and multiplexing. Service solutions for user access via xDSL technology. • DOCSIS.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Tutorials: 30 hours; self - study, projects, homework assigments: 105 hours = Total time of 180 hours		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UIST study rulebook.		
19	Assessment Method			
	19.1.	Tests: Points		90
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		90
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Follow UIST Quality Assurance Procedures.		
22.	Literature			
	22.1.	Mandatory Literature		

		No.	Author	Title	Publisher	Year
		1.	Joseph C. Palais	Fiber Optic Communications (5th Edition)	Prentice Hall	2004
		2.	A.Shami, M.Maier, C.Assi	Broadband Access Networks, Technologies and Deployments	Springer Science	2009
		3.	John M.Senior	Optical Fiber Communication Principles & Practice	PHI, 3rd Edition	2008
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Pierre Lecoy	Fiber Optic Communications	John Wiley & Sons	2008
		2.	Gerd Keiser	Optical Fiber Communication	Mc Graw Hill	2010
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Optimization Methods			
2.	Code	CSE17E04			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FKNI			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid			
5.	Degree (first, second, third cycle)	First			
6.	Academic year / semester	Year	IV	semester	VIII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Elena Hadzieva, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Discrete Mathematics, Mathematics 1, Mathematics 2, Linear Algebra, Numerical Methods			
11.	Course Objectives (Competencies) and Learning Outcomes:	The course aims to develop theoretical knowledge and practical skills in optimization, enabling students to: Understand and apply fundamental concepts from calculus, linear algebra, geometry, and discrete mathematics relevant to optimization; Formulate real-world problems as mathematical optimization models, both unconstrained and constrained; Analyze and implement numerical optimization methods, including line search techniques, gradient-based methods, and Newton-type methods; Evaluate convergence behaviour of optimization algorithms, including rates of convergence and stability; Use geometric understanding of convexity, hyperplanes, polytopes, and feasible regions to interpret optimization problems; Apply linear programming techniques, including the Simplex Method in standard, matrix, and two-phase form; Use computational tools, especially Python, to implement and test optimization algorithms; Communicate mathematical reasoning and algorithmic processes clearly and logically.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Review of basic concepts from discrete mathematics, Mathematics 1, Mathematics 2, and Linear Algebra. Concepts from geometry: line and plane, hyperplane, convex set, neighborhood, polytope and polyhedron. Unconstrained optimization. Golden Section Method. Fibonacci Method. Newton’s Method. Secant Method. Gradient methods. Steepest Descent Method. Analysis of the methods. Convergence and order of convergence. Introduction to linear programming. Real-world problems that can be formulated as linear models. Basic solutions. Feasible solutions. Augmented matrix.			

		Simplex Method. Simplex Method in matrix form. Two-phase Simplex Method. Exercises in Python.			
13	Interconnection of Courses	This course is interconnected with Numerical Methods, Data Science, Machine Learning and Artificial Intelligence.			
14.	Detailed Description of the Teaching and Working Methods for the Course	Interactive teaching – 45 hours and interactive tutorials – 30 hours, individual work through projects.			
15.	Total Available Time Allocation	Lectures: 45 hours; Tutorials: 30 hours; Individual work, homework and projects: 105 hours.			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours	30 hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	25 hours	
18	Conditions for Signature	Regular attendance, in accordance with the UIST Rulebook			
19	Assessment Method				
	19.1.	Tests: Points		5	
	19.2.	Seminar paper/project, written and oral presentation: points		10	
	19.3.	Final exam: points		85	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching		In accordance with the university procedures and quality control methods		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Edwin K. P. Chong, Stanislaw H. Zak	An Introduction to Optimization, 2nd edition	Wiley Interscience Series , John Wiley and Sons, inc	2001
		2.				
		3.				

	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Mark French	Fundamentals of Optimization. Methods, Minimum Principles and Applications for Making Things better	Springer	2018
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Parallel Programming			
2.	Code	CSE18M02			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	4	semester	VIII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Atanas Hristov, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Introduction to Programming, Algorithms and Data Structures			
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives (Competencies):** Upon completion of this course, students will gain a clear understanding of modern multicore and distributed architectures, learn the fundamentals of shared-memory and distributed-memory systems, and acquire the skills to write parallel programs using **Pthreads**. Students will also learn how to perform parallelization at the level of physical and logical threads using **OpenMP** and **Intel TBB**, as well as how to combine both approaches within a single program. Most importantly, students will learn how to optimize programs and how to calculate performance speedup when using parallel programs and algorithms.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Detailed Course Content and Learning Outcomes** 1. **Introduction to Parallel Programming** *Learning outcomes:* Understand the motivation, history, and importance of parallel programming. 2. **Parallel Architectures and Hardware** *Learning outcomes:* Explain parallel architectures, hardware components, and memory models. 3. **Parallel Algorithm Design** *Learning outcomes:* Design basic parallel algorithms and apply decomposition and load balancing. 4. **Parallel Software and Performance** *Learning outcomes:* Measure and evaluate performance using speedup and scalability metrics. **5. Shared-Memory Programming** *Learning outcomes:* Develop parallel programs using OpenMP and Intel TBB.			

		6. OpenMP Programming Structures *Learning outcomes:* Apply OpenMP directives and synchronization mechanisms correctly. **7. Parallel Algorithm Implementations** *Learning outcomes:* Implement and analyze parallel algorithms (e.g., sorting, matrix operations, Monte Carlo). 8. **Performance Analysis and Applications** *Learning outcomes:* Analyze performance, optimize parallel programs, and apply parallelism in bioinformatics and genetic algorithms.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	25
17.	Other forms of activities	17.1.	Project assignments: hours	20
		17.2.	Independent tasks: hours	30
		17.3.	Home study – tasks	30
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19	Assessment Method			
	19.1.	Tests: Points		40
	19.2.	Seminar paper/project, written and oral presentation: points		20
	19.3.	Final exam: points		40
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST		
22.	Literature			

	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Andrew S. Tanenbaum, David J. Wetherall	Computer Networks, Global Edition	Pearson	2021
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	William Stallings	Data and Computer Communications: International Version	Pearson	2010

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Platform engineering			
2.	Code	CSE17E06			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – optional subject from the unit			
6.	Academic year / semester	Year	4	semester	VII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Jovan Karamachoski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Knowledge of virtualization and containerization concepts, DevOps practices, and continuous software development and integration processes. Ability to work with Docker, Kubernetes, Ansible, Terraform, KVM, HyperV. Ability to work with on-premises and cloud-based infrastructure.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• Basic Linux commands, Linux data structure and management of Linux based operating systems (User management, data access management, service management, debugging and working with log documents, firewall management). • Virtualization. Basic concepts of virtualization, types of virtualization and virtualization of system components (storage, network resources, processing resources, etc.), work with Xen, KVM, HyperV and VMware hypervisor • Container Orchestration and Application Lifecycle Management. Introduction to DevOps methodology. Concept of CI/CD (Continuous Integration and Continuous Delivery). Principles of continuous software development and integration. Infrastructure development in OpenStack, local deployment and work with Kubernetes and Docker, container orchestration with Nomad. Cloud-based Container-as-a-service on AWS (Fargate) and Azure (Containers), Kubernetes-as-a-service on EKS (AWS), AKS (Azure), GKE (Google Cloud Services), Function-as-a-service on Lambda (AWS). • Manage module configurations. Ansible/Terraform/Pupper/Salt			
13	Interconnection of Courses				

14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	15 hours	
		16.3.	Practical work: hours	15 hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	35 hours	
18	Conditions for Signature	Students should ensure regular attendance of classes according to the regulations of UINT			
19	Assessment Method 10+10+80				
	19.1.	Tests: Points		10 points	
	19.2.	Seminar paper/project, written and oral presentation: points		10 points	
	19.3.	Final exam: points		80 points	
20	Assessment criteria (points/grade)		**up to 50 points**	**5 (five) (F)**	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Monitoring of UINT control procedures			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	N. G. Nguyen, D.-N. Le, J. M. Chatterjee and R. Kumar	Cloud Computing and Virtualization	Wiley	2018
		2.	M. Portnoy	Virtualization Essentials 2nd Edition	Wiley	2016
		3.				

	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	H. Saito, H.-C. C. Lee and K.-J. C. Hsu	Kubernetes Cookbook: Practical Solutions to Container Orchestration	Packt Publishing	2018
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Political processes and governance in the 21st century			
2.	Code	CSE14E03			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	first			
6.	Academic year / semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Goran Shibakovski, PhD			
9.	Language of instruction	English / Macedonian			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	The course is based on the realization that management and services in the public sector can be improved through the use of information and communication technologies. In this course, students will be introduced to the different concepts and models of e-governance, e-government and infrastructure development, case studies and practices from different countries around the world. Students will acquire skills and knowledge about e-governance, development of e-governance models, as well as a better understanding of how government services are delivered through modern technology.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Introduction to the subject. 2. The concept of governance in the 21st century. Difference between government and remote management. Remote government as an information system. Benefits of remote government. Development cycle of remote government. Evolution, scope and content of remote government. 3. Governance models in the 21st century. Evolution in remote government models. Characteristics of the models. Towards good governance through a remote government model. 4. Development of remote government infrastructure. Network infrastructure. Data centers. Remote government architecture. Legal, institutional, human and technological infrastructure readiness. 5. Remote government security. Challenges and approach to remote government security. Security management model. Security standards. 6. Design and implementation of a strategy for remote government and governance in the 21st century. Remote government: Implementation			

		challenges. 7. Remote government and public policies. Public policy making. Participation and services in the public sector in synergy with modern technologies. 8. National data repositories. Census data. Other areas for storing public data. 9. Trends in remote government in the world. Comparative aspects. 10. Issues, need and evolution of remote governance. 11. Challenges in governance in the 21st century in developing countries. Case studies and practices. 12. The state of remote governance and government in the Republic of Macedonia. Challenges and trends. 13. Global trends and challenges in governance in the 21st century.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures and theoretical teaching, exercises, independent seminar work, teamwork in groups, project and independent assignments, home study, consultations.			
15.	Total Available Time Allocation	6 ECTS x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	35	
17.	Other forms of activities	17.1.	Project assignments: hours	35	
		17.2.	Independent tasks: hours	35	
		17.3.	Home study – tasks	35	
18	Conditions for Signature	Regular attendance at classes in accordance with UIST regulations			
19	Assessment Method				
	19.1.	Tests: Points		80	
	19.2.	Seminar paper/project, written and oral presentation: points		20	
	19.3.	Final exam: points		100	
20	Assessment criteria (points/grade)		**up to 50 points**	**5 (five) (F)**	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching		Self-evaluation and mechanisms for monitoring the quality of teaching at UIST		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year

		1.	Trotta, Anthony	Advances in E-Governance: Theory and Application of Technological Initiatives	Taylor & Francis	2018
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	C.S.R. Prabhu	E-governance: Concepts and Case Studies	PHI Learning	2012
		2.	Ming, Anthony, Omer Awan & Naveed Somani	e-Governance in Small States	Commonwealth Secretariat	2013
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Probability and Statistics			
2.	Code	CSE12M02			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	3	semester	V
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Aneta Naumoska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Course Objectives (Competencies): The objective of this course is to introduce students to the fundamental concepts of probability and statistics, enabling them to perform basic data analysis. The emphasis is placed on core concepts and problem-solving, rather than on theoretical development. Upon successful completion of the course, students will be able to: • Apply statistical methodology and tools in the process of solving engineering problems; • Organize, present, and describe data using tables and graphs; • Explain numerical characteristics of data, including measures of central tendency, measures of variability, and measures of relative position; • Distinguish between experimental and observational (research) processes; • Understand the basic concepts of probability, random variables, and probability distributions; • Identify when and how to use the Normal probability distribution model; • Compute sampling distributions, point estimates of parameters, and understand the Central Limit Theorem; • Compute confidence intervals for sample parameters; • Formulate null and alternative hypotheses; • Perform hypothesis testing for population proportions and population means; • Explain the meaning of the p-value in hypothesis testing;			

		• Identify when and how to use the t-distribution; • Identify when correlation and regression analysis are appropriate; • Compute and interpret correlation coefficients and regression equations; • Conduct the χ^2 (chi-square) test of independence.		
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course Content:** • Process of inferential analysis; population and sample; • Descriptive statistics: tables and graphs; • Descriptive statistics: measures of central tendency and variability; • Experiment, event, sample space, counting techniques, probability, conditional probability, total probability, and Bayes' theorem; • Random variables; expected value and variance; • Binomial, Poisson, and Hypergeometric probability distributions; • Normal and other continuous probability distributions; • Random sampling; Central Limit Theorem; • Point and interval estimation; confidence intervals; • Hypothesis tests for population means and proportions; • Linear regression and correlation; • χ^2 (chi-square) test of independence.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19	Assessment Method 80 + 15 + 5			
	19.1.	Tests: Points		80
	19.2.	Seminar paper/project, written and oral presentation: points		15
	19.3.	Attendance and participation		5

20	Assessment criteria (points/grade)			up to 50 points	5 (five) (F)
				from 51 to 60 points	6 (six) (E)
				from 61 to 70 points	7 (seven) (D)
				from 71 to 80 points	8 (eight) (C)
				from 81 to 90 points	9 (nine) (B)
				from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Following the quality control procedures of UIST		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	M. DeGroot and M. Schervish	Probability and Statistics	Pearson Education	2010
		2.	J. Schiller and R. Srinivasan	Probability and Statistics	Schaum	2008
	22.2.	Additional Literature			
		No.	Author	Title	Publisher	Year

Attachment No. 3	**Subject program from the first cycle of studies**

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Multimedia Data Processing			
2.	Code	CSE12E02			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technology "St. Apostle Paul" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective course from the unit			
6.	Academic year / semester	Year	1	semester	II
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Associate Professor Rasim Salkoski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Mathematics 1, Introduction to Programming			
11.	Course Objectives (Competencies) and Learning Outcomes:	Introducing the student to the basic concepts of working with multimedia data, the ways of modeling and implementing them, and manipulating them.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Introduction, Introduction to Multimedia, Signals, Analog and Digital Data, Sampling and Quantization, Audio/Sound, Introduction to Digital Audio, Representation of Audio Data, WAV Audio Format, Audio Data Compression, MP3, Image, Image Presentation, Color Models – RGB, YCbCr, Main Image Formats, Bitmap, Lossless Image Compression - Run-length Coding (PCX), Lossy Image Compression - Cosine Transform Based Coding (JPEG), Video, Video Data and the Need for Compression, Video Compression Standards – MPEG, H263, H264, Multimedia Transmission over the Internet, Scalable Video Coding, Multiple Description Coding.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Exercises: 30 hours; Independent study, projects, homework: 105 hours = Total time of 180 hours			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	35 hours	

18	Conditions for Signature		Students should ensure regular attendance in classes according to the UINT regulations.		
19	Assessment Method				
	19.1.	Tests: Points		80 points	
	19.2.	Seminar paper/project, written and oral presentation: points		15 points	
	19.3.	Final exam: points		5 points	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching		Monitoring the procedures for UNIT control		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Angelides, Marios C.; Dustdar, Schahram.	Multimedia Information Systems	Springer Science & Business Media. ISBN: 0792399153	1997
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Iain E. G. Richardson	H.264 and MPEG Video Compression	John Wiley & Sons Ltd	2003
		2.				
		3.				

1.	Title of the teaching subject	
2.	Code	CSE12E01
3.	Study program	Computer science and engineering 4 years studies, Faculty of Computer Science and Engineering
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering, Faculty of Computer Science and Engineering

5.	Degree (first, second, third cycle)	First cycle – elective subject specific to faculty			
6.	Academic year / semester	Year	1	Semester	II
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Ass. Prof. Ile Dimitrievski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Mathematics, Calculus			
11.	Course Objectives (Competencies) and Learning Outcomes:	The purpose of this course is to introduce students to the fundamentals of signals and systems which are basic to Digital Signal Processing. The main objective of this subject is to h elp the students to mathematically analyze different types of signals and their associated systems. 1.Various classifications of both Continuous time and Discrete time Signals and Systems. 2. Spectral analysis of Periodic and Aperiodic Signals using Fourier series. 3. Analysis and characterization of the CT system through Laplace transform. 4. Analysis and characterization of the DT system through Difference equation. 5. Analysis and characterization of the DT system through Z transform.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Classification of Signals: Continuous time signals - Discrete time signals – Periodic and Aperiodic signals – Even and odd signals – Energy and power signals –Deterministic and random signals – Complex exponential and Sinusoidal signals. Unit step, Unit ramp, Unit impulse – Representation of signals in terms of unit impulse. Classification of Systems: Continuous time systems- Discrete time systems - Linear system – Time Invariant system – causal system – BIBO system – Systems with and without memory – LTI system. 2. Fourier series: Representation of Continuous time Periodic signals – Trigonometric and exponential- Symmetry conditions- Properties of Continuous time Fourier series – Parseval's relation for power signals –Frequency spectrum Fourier transform: Representation of Continuous time signals- Properties of Continuous time Fourier transform – Parseval's relation for energy signals – Frequency			

		spectrum –Analysis of LTI system using Fourier methods. 3. System modeling: Solution of Differential equation with initial conditions-Zero state response and Zero input response– impulse response – Frequency response – Convolution – Analysis and characterization of LTI system using Laplace transform. 4. Representation of sequences – Discrete Time Fourier Transform (DTFT) – Discrete Fourier Transform (DFT) and its properties – Solution of linear constant coefficient difference equations with initial conditions-Zero state response and Zero input response–- impulse response – Convolution sum - Frequency response. 5. Unilateral &Bilateral Z transforms and its properties - Inverse Z transform: Power series expansion and Partial fraction methods - Analysis and characterization of DT system using Z transform-Realization of structures for DT systems -Direct form-I- Direct form II--Parallel-Cascade forms.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Tutorials: 30 hours; self - study, projects, homework assigments: 105 hours = Total time of 180 hours.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	40
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UIST study rulebook.		
19	Assessment Method 80 + 15 + 5			
	19.1.	Tests: Points		90
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		90
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)

				from 51 to 60 points	6 (six) (E)	
				from 61 to 70 points	7 (seven) (D)	
				from 71 to 80 points	8 (eight) (C)	
				from 81 to 90 points	9 (nine) (B)	
				from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching			Follow UIST Quality Assurance Procedures.		
22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Alan V Oppenheim, Ronald W. Schafer	Discrete Time Signal Processing	Pearson education, 2nd edition	2007
		2.	Simon Haykin and Barry Van Veen	Signals and Systems	John Wiley Sons Inc, 2nd Edition	2007
		3.	Alan V Oppenheim, Alan S. Willsky, S. Hamid Nawab	Signals & Systems	Prentice Hall, 2nd Edition	1997
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	John G. Proakis and Manolakis	Digital Signal Processing, Principles Algorithms an Applications	Pearson Education, 4th Edition	2007
		2.	Rodger E Ziemer, William H. Tranter, D. Ronald Fannin	Signals and Systems – continuous and Discrete	Pearson Education, 4th Edition	2009
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Programmable Logic Controllers			
2.	Code	CSE16E04			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technology "St. Apostle Paul" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective course from the unit			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Associate Professor Rasim Salkoski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Completed Control Theory 1, Sensors and Actuators, and C programming language.			
11.	Course Objectives (Competencies) and Learning Outcomes:	The aim of this course is to familiarize students with the different types of programmable controllers available on the market today, their operating principles, and how to use them. By successfully completing the course, students will be equipped to work with ladder diagrams and logic programming of PLCs. They will also be trained to design PLC control systems, calculate the necessary hardware and software capacities of the control devices, and more.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Programmable logic controllers as part of control systems. Hardware aspects of PLCs. Construction, structure, and operation of PLCs. Digital input modules. Digital output modules. Analog modules. Special and communication modules. Software aspects of PLCs. Ladder programming. Graphical programming. Practical application of PLCs. Controlling a production process using PLCs. Controlling an industrial elevator with PLCs. Controlling a production line with PLCs.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Tutorials: 30 hours; Independent study, projects, homework: 105 hours = total available time of 180 hours			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours		
	Other forms of activities	17.1.	Project assignments: hours	35 hours	

17.		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students should ensure regular attendance in classes according to the UINT regulations.		
19	Assessment Method			
	19.1.	Tests: Points		80 points
	19.2.	Seminar paper/project, written and oral presentation: points		15 points
	19.3.	Final exam: points		5 points
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Monitoring the procedures for UNIT control	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Petruzella, Frank D.	Programmable logic controllers	McGraw-Hill Education	2017
2.	L. A. Bryan, E. A. Bryan	Programmable Controllers: Theory and Implementation	Industrial Text Company	1997
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	E.A. Parr	Programmable Controllers An engineer's guide	Newnes	2003
2.	W. Bolton	Programmable Logic Controllers	Elsevier	2009
3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Public speaking			
2.	Code	MIR15U08			
3.	Study program	Computer Science and Engineering – 4 years / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	first			
6.	Academic year / semester	Year	3	semester	V
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Goran Shibakovski, PhD			
9.	Language of instruction	English / Macedonian			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	This course is an introduction to public speaking and emphasizes it as a practical skill, including techniques for overcoming public speaking anxiety and the use of visual aids to enhance a speaker's presentation. Students will acquire public speaking skills and learn how to overcome public speaking anxiety. The course also aims to prepare students for success in typical public speaking situations and to provide them with the basic principles of speech organization and audience research that are necessary for effective public speaking.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Introduction to the subject. 2. Public speaking as communication. Purpose of public speaking. Being a public speaker. 3. Public speaking. Dealing with the fear of public speaking (stage fright). Tips and techniques for mastering public speaking. 4. Nonverbal communication or body language. 5. Types and types of public speaking. Part One. 6. Types and types of public speaking. Part Two. 7. Choosing a topic and purpose. Analysis and research of the audience. 8. Preparing a speech. Introduction. Organization and development of the speech. Conclusion. 9. Support and accompanying material for public speaking. Using the Internet. Using visual aids, preparing a presentation and presentation software. 10. Tips for public speaking from great speakers. Case studies. Examples from films. 11. Public speaking in practice. Analysis of public speech. 12. Language and style in public speaking. 13. Information and communication technologies and public speaking today.			

13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures and theoretical teaching, exercises, independent seminar work, teamwork in groups, project and independent assignments, home study, consultations.			
15.	Total Available Time Allocation	6 ECTS x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	35	
17.	Other forms of activities	17.1.	Project assignments: hours	35	
		17.2.	Independent tasks: hours	35	
		17.3.	Home study – tasks	35	
18	Conditions for Signature	Regular attendance at classes in accordance with UIST regulations			
19	Assessment Method				
	19.1.	Tests: Points		80	
	19.2.	Seminar paper/project, written and oral presentation: points		20	
	19.3.	Final exam: points		100	
20	Assessment criteria (points/grade)		**up to 50 points**	**5 (five) (F)**	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching		Self-evaluation and mechanisms for monitoring the quality of teaching at UIST		

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	German, Kathleen M. and Bruce E Gronbeck, Douglas Ehninger, Alan H.	Principles of Public Speaking	Routledge	2016
2.				
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Carnegie, Dale	The Art of Public Speaking	Samaira Book Publishers	2019

		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Script programming			
2.	Code	CSE13M01			
3.	Study program	A mandatory course offered by each unit of the University			
4.	Organizer of the study program (unit, i.e. institute, department)	UIST St. Paul the Apostle, Ohrid, Macedonia CSE, CNS, ISVMA, AITMIR			
5.	Degree (first, second, third cycle)	First			
6.	Academic year/semester	Year	2	semester	III
7	Course Workload Expressed in ECTS Credits	6 ECTS Credits			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assistant Prof. Ljubinka Sandjakoska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	NA			
11.	Course Objectives (Competencies) and Learning Outcomes:	Students will gain a foundational understanding of scripting concepts and learn to differentiate scripting from traditional programming. They will develop the ability to use scripting languages effectively and identify situations where scripting is an appropriate solution for a given problem.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Chapter 1: Introduction to Scripting** **Units** 1.1 **What Is Scripting?** • Definition of scripts • Historical context and evolution 1.2 **Differences Between Scripting and Programming** • Scripted vs. compiled languages • Interpreters vs. compilers • Use cases and performance considerations 1.3 **Where Scripts Are Used** • System administration • Web automation • Data tasks • Application integration **Learning Outcomes** • **LO1.1:** Explain what scripting is and how it differs from traditional programming. • **LO1.2:** Distinguish between interpreted and compiled languages. • **LO1.3:** Identify common use cases where scripting is preferred. **Chapter 2: What Is a Script? Creating Scripts & Functionalities** **Units** 2.1 **The Structure of a Script** • Basic elements (variables, logic, I/O)			

		• Syntax rules 2.2 **Creating and Running a Script** • Writing first scripts • Execution environments • File permissions 2.3 **Core Functionalities of Scripts** • Input/output operations • File manipulation • Error handling • Command-line arguments **Learning Outcomes** • **LO2.1:** Describe the internal components of a script. • **LO2.2:** Write and execute basic scripts using a scripting environment. • **LO2.3:** Implement simple automation tasks using I/O, file operations, and error-handling logic. **Chapter 3: Scripting Languages (Python Focus)** **Units** 3.1 **Python Basics for Scripting** • Variables, data types, operators • Input/output 3.2 **Control Structures: Functions, Loops, Iterations** • Defining and calling functions • For/while loops • Iteration techniques (enumerate, zip, list comprehensions) 3.3 **Strings, Lists, Dictionaries, Tuples** • String operations, formatting • Collections and data manipulation • Mutable vs. immutable structures 3.4 **Regular Expressions** • Pattern matching • Searching, replacing, extracting text 3.5 **Task Automation Using Python** • Automating file operations • Working with OS commands • Scheduling jobs • Basic web automation and APIs **Learning Outcomes** • **LO3.1:** Apply Python syntax and conventions to write scripting code. • **LO3.2:** Use control structures to implement logic and iteration. • **LO3.3:** Manipulate core Python data structures effectively. • **LO3.4:** Use regular expressions for data extraction and text processing. • **LO3.5:** Develop Python scripts that automate system tasks and workflows.

		Chapter 4: Approaches in Scripting **Units** 4.1 **Procedural Scripting** • Line-by-line logic • Reusable components 4.2 **Event-Driven Scripting** • Hooks, listeners, triggers • Scripting in GUIs and applications 4.3 **Object-Oriented Scripting** • Classes and objects in scripting languages • When OO scripting is beneficial 4.4 **Modular and Reusable Scripts** • Modular design • Libraries and modules • Version control basics **Learning Outcomes** • **LO4.1:** Distinguish between different scripting paradigms. • **LO4.2:** Implement procedural and event-driven scripts. • **LO4.3:** Apply object-oriented principles when appropriate. • **LO4.4:** Organize scripts into modules and reusable components. **Chapter 5: Scripting Tools** **Units** 5.1 **Integrated Development Environments (IDEs) and Editors** • VS Code, PyCharm, Notepad++, Vim 5.2 **Command-Line Tools** • Shells (bash, PowerShell, cmd) • Pip, virtual environments 5.3 **Version Control Tools** • Git basics • Branching and collaboration 5.4 **Debugging and Testing Tools** • Debuggers • Linters • Unit testing frameworks (pytest, unittest) **Learning Outcomes** • **LO5.1:** Use scripting-friendly IDEs and editors efficiently. • **LO5.2:** Perform scripting tasks through command-line interfaces. • **LO5.3:** Apply version control practices to manage script development. • **LO5.4:** Debug and test scripts using appropriate tools.

<table>
<tr><td></td><td></td><td colspan="3">Chapter 6: Scripts for Automating Application-Level Processes
Units
6.1 Automating Desktop Applications
• GUI automation (PyAutoGUI, AutoHotKey concepts)
6.2 Automating Web and Cloud Applications
• Using APIs
• Web automation with Selenium
6.3 Automating Office and Enterprise Applications
• Excel automation (openpyxl, pandas)
• Database interaction
• Workflow automation
6.4 Integrating Scripts into Larger Systems
• Scheduling with cron / Task Scheduler
• Using scripts in pipelines (CI/CD, ETL)
Learning Outcomes
• LO6.1: Develop scripts that automate interactions with desktop and GUI-based applications.
• LO6.2: Automate web applications using API calls and browser drivers.
• LO6.3: Build automation workflows involving office tools and databases.
• LO6.4: Integrate and schedule scripts to run within larger automated systems.</td></tr>
<tr><td>13</td><td>Interconnection of Courses</td><td colspan="3"></td></tr>
<tr><td>14.</td><td>Detailed Description of the Teaching and Working Methods for the Course</td><td colspan="3">Lectures: 45 hours;
Tutorials: 30 hours;
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<tr><td>15.</td><td>Total Available Time Allocation</td><td colspan="3">6 ECTS credits x 30 hours/credit = 180 hours</td></tr>
<tr><td rowspan="3">16.</td><td rowspan="3">Forms of Teaching Activities</td><td>16.1.</td><td>Lectures – theoretical instruction, hours</td><td>45</td></tr>
<tr><td>16.2.</td><td>Exercises (laboratory, auditory), seminars, teamwork: hours</td><td>30</td></tr>
<tr><td>16.3.</td><td>Practical work: hours</td><td></td></tr>
<tr><td rowspan="3">17.</td><td rowspan="3">Other forms of activities</td><td>17.1.</td><td>Project assignments: hours</td><td>35</td></tr>
<tr><td>17.2.</td><td>Independent tasks: hours</td><td>35</td></tr>
<tr><td>17.3.</td><td>Home study – tasks</td><td>35</td></tr>
<tr><td>18</td><td>Conditions for Signature</td><td colspan="3">Students should attend classes regularly in accordance with the UIST regulations</td></tr>
<tr><td rowspan="4">19</td><td colspan="4">Assessment Method</td></tr>
<tr><td>19.1.</td><td colspan="2">Tests: Points</td><td>80</td></tr>
<tr><td>19.2.</td><td colspan="2">Seminar paper/project, written and oral presentation: points</td><td>20</td></tr>
<tr><td>19.3.</td><td colspan="2">Final exam: points</td><td>100</td></tr>
<tr><td>20</td><td colspan="2">Assessment criteria (points/grade)</td><td>up to 50 points</td><td>5 (five) (F)</td></tr>
</table>

				from 51 to 60 points	6 (six) (E)	
				from 61 to 70 points	7 (seven) (D)	
				from 71 to 80 points	8 (eight) (C)	
				from 81 to 90 points	9 (nine) (B)	
				from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching			Follow UIST Quality Assurance Procedures		
22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Eric Matthes	Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming 2nd Edition	No Starch Press;	2019
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Mark Lutz	Learning Python	O'Reilly Media	2013
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject				
2.	Code	CSE12E01			
3.	Study program	Computer science and engineering 4 years studies, Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering, Faculty of Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – elective subject specific to faculty			
6.	Academic year / semester	Year	1	Semester	II
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Ass. Prof. Ile Dimitrievski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Mathematics, Calculus			
11.	Course Objectives (Competencies) and Learning Outcomes:	The purpose of this course is to introduce students to the fundamentals of signals and systems which are basic to Digital Signal Processing. The main objective of this subject is to h elp the students to mathematically analyze different types of signals and their associated systems. 1.Various classifications of both Continuous time and Discrete time Signals and Systems. 2. Spectral analysis of Periodic and Aperiodic Signals using Fourier series. 3. Analysis and characterization of the CT system through Laplace transform. 4. Analysis and characterization of the DT system through Difference equation. 5. Analysis and characterization of the DT system through Z transform.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Classification of Signals: Continuous time signals - Discrete time signals – Periodic and Aperiodic signals – Even and odd signals – Energy and power signals –Deterministic and random signals – Complex exponential and Sinusoidal signals. Unit step, Unit ramp, Unit impulse – Representation of signals in terms of unit impulse. Classification of Systems: Continuous time systems- Discrete time systems - Linear system – Time Invariant system – causal system – BIBO system – Systems with and without memory – LTI system.			

		2. Fourier series: Representation of Continuous time Periodic signals – Trigonometric and exponential-Symmetry conditions- Properties of Continuous time Fourier series – Parseval's relation for power signals –Frequency spectrum Fourier transform: Representation of Continuous time signals-Properties of Continuous time Fourier transform – Parseval's relation for energy signals – Frequency spectrum –Analysis of LTI system using Fourier methods. 3. System modeling: Solution of Differential equation with initial conditions-Zero state response and Zero input response– impulse response – Frequency response – Convolution – Analysis and characterization of LTI system using Laplace transform. 4. Representation of sequences – Discrete Time Fourier Transform (DTFT) – Discrete Fourier Transform (DFT) and its properties – Solution of linear constant coefficient difference equations with initial conditions-Zero state response and Zero input response–- impulse response – Convolution sum - Frequency response. 5. Unilateral &Bilateral Z transforms and its properties - Inverse Z transform: Power series expansion and Partial fraction methods - Analysis and characterization of DT system using Z transform-Realization of structures for DT systems -Direct form-I- Direct form II--Parallel-Cascade forms.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Tutorials: 30 hours; self - study, projects, homework assigments: 105 hours = Total time of 180 hours.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	40
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25

18	Conditions for Signature		Students should ensure regular attendance at classes in accordance with the UIST study rulebook.		
19	Assessment Method 80 + 15 + 5				
	19.1.	Tests: Points			90
	19.2.	Seminar paper/project, written and oral presentation: points			10
	19.3.	Final exam: points			90
20	Assessment criteria (points/grade)			up to 50 points	5 (five) (F)
				from 51 to 60 points	6 (six) (E)
				from 61 to 70 points	7 (seven) (D)
				from 71 to 80 points	8 (eight) (C)
				from 81 to 90 points	9 (nine) (B)
				from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Follow UIST Quality Assurance Procedures.		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Alan V Oppenheim, Ronald W. Schafer	Discrete Time Signal Processing	Pearson education, 2nd edition	2007
		2.	Simon Haykin and Barry Van Veen	Signals and Systems	John Wiley Sons Inc, 2nd Edition	2007
		3.	Alan V Oppenheim, Alan S. Willsky, S. Hamid Nawab	Signals & Systems	Prentice Hall, 2nd Edition	1997
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year

		1.	John G. Proakis and Manolakis	Digital Signal Processing, Principles Algorithms an Applications	Pearson Education, 4th Edition	2007
		2.	Rodger E Ziemer, William H. Tranter, D. Ronald Fannin	Signals and Systems – continuous and Discrete	Pearson Education, 4th Edition	2009
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Social Networks			
2.	Code	CSE14E01			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Aneta Naumoska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Course Objectives (Competencies): Students will acquire a solid understanding of the fundamental concepts of the emerging science of social networks. They will be able to recognize these concepts at the theoretical, technological, and cultural levels. Students will understand that social networks have always been an integral part of social life, but with the advent of information technologies, they have evolved into platforms for development and online collaboration, fundamentally transforming the way we work by offering new tools that connect individuals, communities, colleagues, and partners on a global scale. Students will learn how to use social networks purposefully—for education, inspiration, and meaningful connections with people around the world. They will also learn how to analyze existing social networks as well as design and create their own.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Course Content: • Social networks as a scientific discipline: terminology • Basic properties of social networks • Types of social networks • Identification and practical work with existing social networks • Stochastic models for the creation of social networks • Social networks represented as graphs • Random graph models for the construction of social networks • Social network analysis: graph classification, clustering of social network graphs, centrality measures, and detection and analysis of communities in social networks			

		• Node-based metrics and ranking algorithms (PageRank) • Detection of overlapping communities, similarity between graph nodes, triangle counting in graphs, and properties of graph neighborhoods • Spreading processes and epidemics • Formation of strategic networks: game-theoretic models for network formation and user behavior in social networks • Dynamic social networks, applications, and research trends; social learning in networks		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19	Assessment Method 80 + 15 + 5			
	19.1.	Tests: Points		80
	19.2.	Seminar paper/project, written and oral presentation: points		15
	19.3.	Attendance and participation		5
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST		
22.	Literature			
	22.1.	Mandatory Literature		

		No.	Author	Title	Publisher	Year
		1.	S. Wasserman, K. Faust,	Social Network Analysis: Methods and Applications	Cambridge University Press	1994
		2.	J. Carrington, J. Scott, S. Wasserman	Models and Methods in Social Network Analysis	Cambridge University Press	2005
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Society and technological transformation			
2.	Code	CSE12E03			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technology "St. Apostle Paul" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	first			
6.	Academic year / semester	Year	1	semester	II
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Goran Shibakovski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	Students will be introduced to the basic topics of the digital society and will learn about the interconnection of digital technologies and social trends. Particular attention is paid to the relationship between technology and society, as well as the dilemma of whether technology is neutral, and whether it always leads to social progress. Students will learn to connect contemporary and historical examples of digital trends through specific case studies from different parts of the world. Students will also acquire skills for implementing and developing an agenda for digital transformation in society, as well as recognizing current digital trends in the world.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Introduction to the subject. 2. The Fourth Industrial Revolution and the development of society. 3. Insight into Estonia's path to becoming a digital society. 4. Digital society strategy. Digital agenda for Europe. 5. Digital society. Social media. Cyber debates. Interaction and identity. Communities and networks. 6. Digital visuality and visibility. Feeling digital. Digital citizenship/citizenship. Digital power and research. Digital activism. Mobile culture. 7. Tech giants. Digitalized workplaces. Internet of things. The rise of smart cities. 8. Comparative case studies and analyses of digital transformation of society in Europe. 9. Comparative case studies and analyses of digital transformation and society in North America. 10. Comparative case studies and analyses of digital transformation and society in Asia. 11. Use of digital media in the developing world. New social movements. Surveillance and the role of databases in the modern digital society. 12. Conditions			

		and challenges for digital transformation in the Republic of Macedonia. 13. Challenges and development of the digital society.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures and theoretical teaching, exercises, independent seminar work, teamwork in groups, project and independent assignments, home study, consultations.			
15.	Total Available Time Allocation	6 ECTS x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	35	
17.	Other forms of activities	17.1.	Project assignments: hours	35	
		17.2.	Independent tasks: hours	35	
		17.3.	Home study – tasks	35	
18	Conditions for Signature	Regular attendance at classes in accordance with UIST regulations			

19	Assessment Method			
	19.1.	Tests: Points	80	
	19.2.	Seminar paper/project, written and oral presentation: points	20	
	19.3.	Final exam: points	100	
20	Assessment criteria (points/grade)	**up to 50 points**	**5 (five) (F)**	
		from 51 to 60 points	6 (six) (E)	
		from 61 to 70 points	7 (seven) (D)	
		from 71 to 80 points	8 (eight) (C)	
		from 81 to 90 points	9 (nine) (B)	
		from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Self-evaluation and mechanisms for monitoring the quality of teaching at UIST		

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Lindgren, Simon	Digital Media & Society	SAGE Publications	2021
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Lim, Tai Wei	Industrial Revolution 4.0, Tech Giants, and Digitized Societies	Palgrave Macmillan	2019

		2.	Mosco, Vincent	Becoming Digital. Toward a Post-Internet Society	Emerald Publishing	2017
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Software Engineering			
2.	Code	CSE14E06			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering -			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle – elective subject from the unit			
6.	Academic year / semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Professor, Aleksandar Karadimche, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Object-oriented programming, Computer networks / Network technologies			
11.	Course Objectives (Competencies) and Learning Outcomes:	Gaining basic knowledge of methodologies for the design and implementation of software systems through requirements analysis, development, analysis of design, implementation, integration, and testing of software. They will become familiar with the basic models of software processes and the ability to use them practically in specific projects. Through analysis of a software development problem, design of a modular structure to solve the problem, analysis and evaluation of alternatives, implementation of efficient and correct modules, their integration and testing, planning, and management of software projects.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Introduction to software engineering, software characteristics and software projects, software development process and methodologies, decomposition, abstraction, object model, requirements analysis and modeling. Software process models: the waterfall model, the evolutionary development model, and agile software development. Software process models: incremental development model, Scrum development model, spiral model, and extreme programming model. Features, scenarios, and engineering stories. Software architecture. Cloud-based software. Microservices-based architecture. Software security and privacy. Confidential programming. Introduction to testing, functional testing, and systematic testing. Fundamentals of the UML language. Design of software systems with the UML language.			
13	Interconnection of Courses	Software Engineering is required for the Business Information Systems			
14.	Detailed Description of the Teaching and Working Methods for the Course	The course uses a combination of lectures, interactive discussions, and hands-on laboratory work to develop practical competence in modern software engineering. Lectures introduce core concepts, models, and methodologies, while guided problem-solving sessions strengthen analytical thinking and application of theory.			

		Laboratory exercises provide experience with tools for requirements analysis, modeling, implementation, version control, testing, and project management. A structured team project simulates real-world development, requiring students to apply process models, design modular solutions, evaluate alternatives, implement components, integrate subsystems, and conduct thorough testing. Independent study, supervised tutorials, and regular feedback ensure continuous learning, while collaborative activities promote teamwork, communication, and professional software engineering practices.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours	35 hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	45 hours	
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UINT regulations.			
19	Assessment Method	80 + 15 + 5			
	19.1.	Tests: Points		80 points	
	19.2.	Seminar paper/project, written and oral presentation: points		15 points	
	19.3.	Final exam: points		5 points	
20	Assessment criteria (points/grade)	up to 50 points		5 (five) (F)	
		from 51 to 60 points		6 (six) (E)	
		from 61 to 70 points		7 (seven) (D)	
		from 71 to 80 points		8 (eight) (C)	
		from 81 to 90 points		9 (nine) (B)	
		from 91 to 100 points		10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Following the UINT quality control procedures			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Sommerville, Ian	Engineering Software Products: An Introduction to Modern Software Engineering, Global Edition	Pearson	2020
		2.				
		3.				

	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Frank Tsui, Barbara Bernal, Orlando, Karam.	Essentials of Software Engineering, Fifth Edition	Jones & Bartlett Learning	2022
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Stochastic Processes			
2.	Code	CSE16E07			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Aneta Naumoska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Course Objectives (Competencies): The objective of the course is for the student to become familiar with the theoretical foundations of stochastic processes underlying martingales and martingale convergence theorems, and to gain knowledge of the basic processes—Markov and Poisson processes—which have wide applications in various fields.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Course Content: • Definition of a stochastic process • Examples of stochastic processes • Martingales and stopping times • Markov chains • Chapman–Kolmogorov equations • Time-homogeneous Markov chains • Long-term (stationary) distribution of a Markov chain • Modeling using Markov chains • Markov jump processes • Poisson process, birth-and-death processes • Time-homogeneous Markov processes • Structure of Markov processes • Simulation of stochastic processes			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			

15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19	Assessment Method 80 + 15 + 5			
	19.1.	Tests: Points		80
	19.2.	Seminar paper/project, written and oral presentation: points		15
	19.3.	Attendance and participation		5
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST		

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	A. Papoulis and S.U.Pillai	Probability, Random Variables and Stochastic Processes	McGraw Hill	2002

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	J. L. Doob	Stochastic Process	Wiley	1953

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Storytelling for Animation			
2.	Code	ICS15U06			
3.	Study program	Computer Science and Engineering – 4 years / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First			
6.	Academic year / semester	Year	3	semester	5
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Associate Professor Mersiha Ismajloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	/			
11.	Course Objectives (Competencies) and Learning Outcomes:	Students will be introduced to the concept of storytelling and to the specific concept of storytelling for animation (animated storytelling). They will learn that contemporary storytelling methods are not limited to a single medium. This course explores how different media can be used as part of the narrative, making both the medium and the story stronger by emphasizing their unity. The course will examine both traditional "linear" approaches and nontraditional approaches in animation development. The principles and questions presented will be relevant to animation, film, and video, with particular emphasis on their practical application. The primary goals of this course are to deepen students' understanding and enhance their creative writing skills. Secondary goals include improving visual and rhetorical presentation abilities and increasing students' potential to work on animation projects.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Linear style: introduction, consequence, temporal sequence, direct causality. Principles of animation. Screening and analysis of a corpus of animated films. Functions of narrative: "boring parts," key events; psychology, emotion, mood; environment, characters; organization, guidance/misguidance of the audience. Critical analysis. Principles of critical storytelling. Classical and non-classical storytelling structures. Structure, conflict (personal, social, fundamental), object of desire. Time–space framework. Digital storytelling.			

		Character development, heroes and villains. Victorian rhyme. Traditional vs. nontraditional approaches to storytelling.			
13	Interconnection of Courses	/			
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures, exercises, and workshops. Work both individually and in teams to develop original stories. Defining and refining concepts. Working on the best ways to tell the story and developing a script for animation.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	35	
17.	Other forms of activities	17.1.	Project assignments: hours	30	
		17.2.	Independent tasks: hours	35	
		17.3.	Home study – tasks	35	
18	Conditions for Signature	Students are required to attend classes regularly in accordance with the UIST regulations.			
19	Assessment Method				
	19.1.	Tests: Points		2x40=80	
	19.2.	Seminar paper/project, written and oral presentation: points		10	
	19.3.	Final exam: points		10	
20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)		
		from 51 to 60 points	6 (six) (E)		
		from 61 to 70 points	7 (seven) (D)		
		from 71 to 80 points	8 (eight) (C)		
		from 81 to 90 points	9 (nine) (B)		
		from 91 to 100 points	10 (ten) (A)		
21.	Method for monitoring the quality of teaching	Compliance with UIST control procedures			

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Mieke Bal	Narratology: Introduction to the Theory of Narrative	University of Toronto Press	2009
2.	Lubbock Percy	The Craft of Fiction, Create Space	Independent Publishing Platform	2011
3.	Lutz Edvin George	Animeted Cartoons	Boston, Applewood	1989

		4.	Scott McCloud	Understanding Comics: The Invisible Art	William Morrow Paperbacks	1994
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Richard, L. Lewis. James, Luciana	Digital Media: An Introduction	Prentice Hall	2004
		2.	Richard, Schickel	The Disney Version: The Life, Times, Art and Commerce of Walt Disney	Ivan R. Dee 3 edition	1997
		3.	Aristotle	Poetics	Penguin Classics	1997

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Decision Making Methods			
2.	Code				
3.	Study program	Digital Business Analytics/ ICS Faculty			
4.	Organizer of the study program (unit, i.e. institute, department)	UIST			
5.	Degree (first, second, third cycle)	First			
6.	Academic year / semester	Year	III	semester	VI
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Elena Hadzieva, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	/			
11.	Course Objectives (Competencies) and Learning Outcomes:	Students will understand the concept of an algorithm and use algorithms for classification, searching, and sorting of various types of data, as well as for solving different problems. They will understand the concepts of graphs and networks and apply them to model problems in economics and entrepreneurship. Students will also formulate linear programming problems and determine their optimal solutions.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Algorithms (*Bubble Sort, Quick Sort, Binary Search, Bin Packing*). Graphs and networks: definitions and types. Graph algorithms (*Kruskal's algorithm, Prim's algorithm, Dijkstra's algorithm*). Eulerian and Hamiltonian paths. Network analysis. Critical events. Critical activities. Critical path. Linear programming. Methods for solving linear programming problems: the graphical method and the vertex-testing method.			
13	Interconnection of Courses	This course is interconnected with Economic Mathematics, Discrete Mathematics and Algorithms and Data Structures.			
14.	Detailed Description of the Teaching and Working Methods for the Course	Interactive teaching – 45 hours and interactive tutorials – 30 hours, individual work through projects.			
15.	Total Available Time Allocation	Lectures: 45 hours; Tutorials: 30 hours; Individual work, homework and projects: 105 hours.			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours	30 hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	

		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	25 hours
18	Conditions for Signature	Regular attendance, in accordance with the UIST Rulebook		
19	Assessment Method			
	19.1.	Presence and activity: Points		10
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		80
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		In accordance with the university procedures and quality control methods	

22.

Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	John Hebborn	Decision Mathematics 1	Heinemann, Pearson Education Limited	2000
2.				
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Sue De Pomerai, John Berry	Decision Mathematics (Discovering Advanced Mathematics)	Collins Educational; 2nd edition	2001
2.				
3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Discrete Mathematics			
2.	Code				
3.	Study program				
4.	Organizer of the study program (unit, i.e. institute, department)	UIST			
5.	Degree (first, second, third cycle)	First			
6.	Academic year / semester	Year	I	semester	I
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Elena Hadzieva, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	/			
11.	Course Objectives (Competencies) and Learning Outcomes:	The course aims to equip students with foundational mathematical tools and reasoning skills essential for computer science, engineering, and mathematics. Specifically, the course develops competencies to: Understand and apply the fundamental concepts of logic, sets, and functions in formal reasoning; Use mathematical proof techniques such as direct proof, contradiction, contrapositive, and mathematical induction; Analyze and construct discrete structures such as sequences, recurrence relations, and graphs; Model real-world problems using graphs and other discrete mathematical structures; Develop algorithmic reasoning through the study of recurrence relations, graph traversal, and related structures; Communicate mathematical ideas precisely, using correct terminology, notation, and logical structure; Apply discrete mathematical tools to support further study in algorithms, data structures, computer programming, and theoretical computer science.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Propositional logic. Predicates and quantifiers. Rules of inference. Methods of proof. Sets. Set operations. Functions and their properties. Sequences and recurrence relations. Mathematical induction. Graphs. Graph models. Special types of graphs. Graph representations. Graph isomorphism. Connectivity. Eulerian and Hamiltonian paths.			
13	Interconnection of Courses	This course is a fundamental course for all computer science and engineering courses.			
14.	Detailed Description of the Teaching and Working Methods for the Course	Interactive teaching – 45 hours and interactive tutorials – 30 hours, individual work through homework and projects.			
15.	Total Available Time Allocation	Lectures: 45 hours; Tutorials: 30 hours; Individual work, homework and projects: 105 hours.			

16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	10 hours
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	45 hours
18	Conditions for Signature	Regular attendance, in accordance with the UIST Rulebook		

19	Assessment Method		
	19.1.	Tests: Points	5
	19.2.	Seminar paper/project, written and oral presentation: points	10
	19.3.	Final exam: points	85

20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	In accordance with the university procedures and quality control methods	

22. Literature

Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Kenneth H. Rosen	Discrete Mathematics and Its Application (7th ed.)	McGraw Hill	2013
2.				
3.				

Additional Literature

No.	Author	Title	Publisher	Year
1.	S. Lipschutz and M. Lipson	Discrete Mathematics (3rd ed.)	Schaum	2007
2.				
3.				

Attachment No. 3		Subject program from the first cycle of studies			
1.	Title of the teaching subject	Theory of Culture			
2.	Code	ICS14U06			
3.	Study program	Computer Science and Engineering – 4-year program / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First			
6.	Academic year / semester	Year	2	semester	
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Mersiha Ismajloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	/			
11.	Course Objectives (Competencies) and Learning Outcomes:	Presentation of key theoretical perspectives Exploration of the concept of culture Analysis of cultural production and consumption Examination of cultural identities Analysis of globalization and cultural hybridity Discussion on power and cultural hegemony Engagement with cultural texts and artifacts Exploration of cultural policy			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Introduction to Cultural Studies and Cultural Theory Definitions of culture and cultural theory The influence of culture on individual and collective identities Cultural determinants of social and political processes The relationship between culture and personal/cultural transformation The performance of culture and the representation of cultural artifacts Mass culture and its impact on society Production and reproduction of culture through media and technology Cultural Politics and Cultural Activism: Engaging the civic and academic community in cultural activism Cultural policy and its impact on identities and social movements Intercultural Ethics and Cultural Responsibility: Ethical challenges in representing and interpreting other cultures			

		The cultural responsibility of creators of cultural content Promoting intercultural cooperation and cultural exchange				
13	Interconnection of Courses	/				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures and discussions. Practical work. Ongoing collaboration with electronic media portals. Monitoring global trends in e-culture.				
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours				
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45		
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30		
		16.3.	Practical work: hours	15		
17.	Other forms of activities	17.1.	Project assignments: hours	20		
		17.2.	Independent tasks: hours	35		
		17.3.	Home study – tasks	35		
18	Conditions for Signature	Students are required to attend classes regularly in accordance with UIST regulations.				
19	Assessment Method					
	19.1.	Tests: Points		40x2=80		
	19.2.	Seminar paper/project, written and oral presentation: points		10		
	19.3.	Final exam: points		10		
20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)			
		from 51 to 60 points	6 (six) (E)			
		from 61 to 70 points	7 (seven) (D)			
		from 71 to 80 points	8 (eight) (C)			
		from 81 to 90 points	9 (nine) (B)			
		from 91 to 100 points	10 (ten) (A)			
21.	Method for monitoring the quality of teaching	Adherence to UIST control procedures				
22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Edward S. Herman, Noam Chomsky	Manufacturing Consent: The Political Economy of the Mass Media	Pantheon Books	1988
		2.	Kiran Prasad	E-journalism New Media and News Media	B.r. Publishing Corporation	2011

		3.	E. B White	Essays of E. B. White (Perennial Classics)	Harper Perennial Modern Classics; Reprint edition	2006
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Richard Lewis, James Luciana	Digital Media: An Introduction	Prentice Hall; 1st edition	2004
		2.	Joe Lambert	Digital Storytelling: Capturing Lives, Creating Community (Digital Imaging and Computer Vision)	Routledge; 4th edition	2012
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	User Interface Design			
2.	Code	CSE16E06			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technology "St. Apostle Paul" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective course from the unit			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Associate professor Rasim Salkoski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	The goal of the program is for students to acquire theoretical knowledge of the fundamental aspects of human perception, cognition, and learning of the user interface, as well as practical application of these concepts, i.e., designing a user interface in a systematic way that is easy to understand and supports user efficiency.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. What is a user interface? 2. Functionality and layout control 3. Designing a user-centered interface 4. Emotional interaction and design 5. Basic principles of user interface organization 6. Usability concepts in user interface interaction 7. User analysis 8. Creating a prototype 9. User interface evaluation - data analysis, interpretation, presentation, and understanding.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours		45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours		30 hours
		16.3.	Practical work: hours		
	Other forms of activities	17.1.	Project assignments: hours		35 hours

17.		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students should ensure regular attendance in classes according to the UINT regulations.		
19	Assessment Method			
	19.1.	Tests: Points		80 points
	19.2.	Seminar paper/project, written and oral presentation: points		15 points
	19.3.	Final exam: points		5 points
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Monitoring the procedures for UNIT control	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Shneiderman, B. and Plaisant, C.	Designing the User Interface: Strategies for Effective Human Computer Interaction (5th ed.)	AddisonWesley	2009
2.	Soren Lauesen	User Interface Design	Pearson	2004
3.	Bill Scott and Theresa Neil	Designing Web Interfaces	O'Reilly Media	2009

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.				
2.				
3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Video Art and Production			
2.	Code	CNS16U08			
3.	Study program	Computer Science and Engineering 4-year/Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" Ohrid			
5.	Degree (first, second, third cycle)	First cycle – elective course from the university list			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Yane Bakreski			
9.	Language of instruction	English, Macedonian			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	The aim of the course is to familiarize students with the fundamental concepts and creative processes of professional video and audio production. Using various equipment, students will learn the essential aspects of video production – from developing an idea, concept, and story, to working with digital video cameras, recording video and audio, and editing the footage into a final product. Upon completion of this course, students will acquire the knowledge and skills to successfully capture and edit both video and audio elements to effectively tell a story.			

12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• Pre-Production
		  ○ Production planning
		  ○ Idea and story development
		  ○ Scriptwriting
		• Production
		  ○ History of the camera
		  ○ Technical characteristics of the camera
		  ○ Concepts and processes of filming
		  ○ Composition
		  ○ Mise-en-scène
		• Post-Production
		  ○ Editing
		  ○ Image and sound processing
		  ○ Distribution			

13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Exercises: 30 hours; Independent study, projects, homework: 105 hours = Total of 180 hours			
15.	Total Available Time Allocation				
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction		45 hours

		16.2.	Exercises (laboratory, auditory), seminars, and teamwork	30 hours
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments	35 hours
		17.2.	Independent tasks	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students are required to ensure regular attendance in accordance with the UIST regulations.		
19	Assessment Method			
	19.1.	Tests		50 points
	19.2.	Seminar paper/project, written and oral presentation		40 points
	19.3.	Activity and participation		10 points
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Compliance with UIST control procedures	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	David Bordwell and Kristin Thompson	Film Art: An Introduction	McGraw-Hill Education	2012
2.	Jim Owens and Gerald Millerson	Video Production Handbook	Focal Press	2011
3.	Проф. д-р Антонио Митрикески	Филмот како уметност	Универзитет „Св. Кирил и Методиј“, Скопје	2021

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Barbara London, Jim Stone and John Upton	Photography	Pearson	2016
2.				
3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Virtual and Augmented Reality			
2.	Code	CSE18E04			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	4	semester	VIII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Dijana Capeska Bogatinoska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives (Competencies):** Through various combinations of lectures, discussions, practical examples, and detailed presentations, students will become familiar with a wide range of interesting topics related to virtual reality (VR) and augmented reality (AR), 3D interaction, and spatial user interfaces. Upon completion of the course, students will be able to fully understand and utilize virtual and augmented reality, develop virtual 3D environments, and develop virtual 3D applications. During the semester, students will also have the opportunity to complete a project.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course Content:** 1. Introduction 2. Introduction to AR (Augmented Reality)/VR (Virtual Reality)/MR (Mixed Reality)/XR (Extended Reality): Technologies, Applications and Issues; XR Terminology and Applications 3. XR Concepts and Technologies 4. Trends and open issues in XR 5. XR Strategy 6. User experience and interaction design for AR/VR/MR/XR - XR design process 7. Design, ethics and guidelines for XR 8. Storyboarding and physical prototypes for XR experiences 9. Digital prototyping and evaluation of XR experiences 10. Development of AR/VR/MR/XR applications with WebXR and introduction to Unity - XR approaches for application development 11. Development of VR applications 12. Development of AR applications			

		13. Special topics in XR				
13	Interconnection of Courses					
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.				
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours				
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45		
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30		
		16.3.	Practical work: hours	30		
17.	Other forms of activities	17.1.	Project assignments: hours	25		
		17.2.	Independent tasks: hours	25		
		17.3.	Home study – tasks	25		
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST				
19	Assessment Method					
	19.1.	Tests: Points		45		
	19.2.	Seminar paper/project, written and oral presentation: points		10		
	19.3.	Final exam: points		45		
20	Assessment criteria (points/grade)		**up to 50 points**	**5 (five) (F)**		
			from 51 to 60 points	6 (six) (E)		
			from 61 to 70 points	7 (seven) (D)		
			from 71 to 80 points	8 (eight) (C)		
			from 81 to 90 points	9 (nine) (B)		
			from 91 to 100 points	10 (ten) (A)		
21.	Method for monitoring the quality of teaching		Following the quality control procedures of UIST			
22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year

		1.	Ralf Doerner (Editor), Wolfgang Broll (Editor), Paul Grimm (Editor), Bernhard Jung (Editor)	Virtual and Augmented Reality (VR/AR): Foundations and Methods of Extended Realities (XR)	Springer; 1st ed. 2022 edition	2022
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Bernard Marr	Extended Reality in Practice: 100+ Amazing Ways Virtual, Augmented and Mixed Reality Are Changing Business and Society	Wiley; 1st edition	2021
		2.				
		3.				

1.	Title of the teaching subject	Visual Arts and 3D Character Animation			
2.	Code	CNS16U01			
3.	Study program	Computer Science and Engineering 4-year/Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" Ohrid			
5.	Degree (first, second, third cycle)	First cycle – elective course from the university list			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Yane Bakreski			
9.	Language of instruction	English, Macedonian			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	By using the so-called "box" modeling technique, the course content includes modeling a character with proper topology, as well as preparing the character for animation: creating a rig, animating the character, rendering, and more. Additional techniques will be studied to add realistic details and visual effects to both the character and the environment. The focus of the course is on building strong 3D environments and 3D characters and animating them, which is a key component of modern industries such as film, games, advertising, as well as contemporary fields like science, medicine, and architecture.			

12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• Pre-Production
		  ○ Production planning
		  ○ Idea and story development
		  ○ Scriptwriting
		  ○ Character and environment design
		  ○ Storyboarding
		  ○ Animatic and previsualization
		• Production
		  ○ Modeling and texturing of characters and environments
		  ○ Creating a rig
		  ○ Character animation
		  ○ Scene setup, lighting, and rendering
		• Post-Production
		  ○ Editing
		  ○ Visual effects (VFX)
		  ○ Color correction
		  ○ Packaging the final product and distribution			

13	Interconnection of Courses				

14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Exercises: 30 hours; Independent study, projects, homework: 105 hours = Total of 180 hours		
15.	Total Available Time Allocation			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, and teamwork	30 hours
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments	35 hours
		17.2.	Independent tasks	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students are required to ensure regular attendance in accordance with the UIST regulations.		

19	Assessment Method		
	19.1.	Tests	50 points
	19.2.	Seminar paper/project, written and oral presentation	40 points
	19.3.	Activity and participation	10 points

20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Compliance with UIST control procedures	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Ami Chopine	3D Art Essentials: The Fundamentals of 3D Modeling, Texturing, and Animation	Focal Press	2011
2.	Andy Beane	3D Animation Essentials	John Wiley & Sons	2012
3.	William Vaughan	Digital Modeling	Pearson	2012

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Ollie Johnston and Frank Thomas	The Illusion of Life: Disney Animation	Disney Editions	1995
2.				
3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Visual Arts and 3D Modeling			
2.	Code	CNS14U03			
3.	Study program	Computer Science and Engineering 4-year/Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" Ohrid			
5.	Degree (first, second, third cycle)	First cycle – elective course from the university list			
6.	Academic year / semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Yane Bakreski			
9.	Language of instruction	English, Macedonian			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	The aim of the course is to introduce the fundamental concepts and creative processes of 3D modeling and animation. Through instruction covering both the technical and artistic aspects of this field, and through active use of leading 3D modeling and animation software such as Autodesk Maya and Adobe Photoshop, students will acquire the knowledge and skills necessary to work in industries such as computer games, computer animation, design, advertising, and more.			

12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• Introduction to the User Interface and Navigation in Autodesk Maya
		• Creation and Modification of Basic Geometric Forms
		• Introduction to Different Types of Geometry for 3D Modeling in Autodesk Maya (Polygons, NURBS, and Subdivision Surfaces) and the Modeling Techniques Characteristic to Each
		• Modeling Three-Dimensional Objects and Environments
		• Texturing and Shading
		  o Introduction to different types of shaders and their basic characteristics
		  o Creating textures for virtual 3D models using images
		  o Mapping
		  o Preparing textures in Adobe Photoshop
		• Setting Up, Lighting, and Rendering a 3D Scene
		• Introduction to 3D Computer Animation (Keyframe Animation)
		  o Modeling and preparing a character for 3D animation			

		○ Creating animation poses ○ Adding character motion – introduction to the Graph Editor and application of Disney principles for animation creation			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Exercises: 30 hours; Independent study, projects, homework: 105 hours = Total of 180 hours			
15.	Total Available Time Allocation				
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction		45 hours
		16.2.	Exercises (laboratory, auditory), seminars, and teamwork		30 hours
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments		35 hours
		17.2.	Independent tasks		35 hours
		17.3.	Home study – tasks		35 hours
18	Conditions for Signature	Students are required to ensure regular attendance in accordance with the UIST regulations.			
19	Assessment Method				
	19.1.	Tests			50 points
	19.2.	Seminar paper/project, written and oral presentation			40 points
	19.3.	Activity and participation			10 points
20	Assessment criteria (points/grade)		up to 50 points		5 (five) (F)
			from 51 to 60 points		6 (six) (E)
			from 61 to 70 points		7 (seven) (D)
			from 71 to 80 points		8 (eight) (C)
			from 81 to 90 points		9 (nine) (B)
			from 91 to 100 points		10 (ten) (A)
21.	Method for monitoring the quality of teaching	Compliance with UIST control procedures			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Richard Lewis and James Luciana	Digital Media: An Introduction	Prentice Hall	2004
		2.	Paul Naas	Autodesk Maya 2014 Essentials: Autodesk Official Press	Sybex	2013
		3.	Andy Beane	3D Animation Essentials	John Wiley & Sons	2012
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year

		1.	William Vaughan	Digital Modeling	New Riders Pub	2011
		2.	Ollie Johnston and Frank Thomas	The Illusion of Life: Disney Animation	Disney Editions	1995
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Web development			
2.	Code	CSE14M03			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Dijana Capeska Bogatinoska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives (Competencies):** In this course, students will become familiar with the methods and principles of developing a web application. The data flow from frontend to backend will be examined. Detailed description of HTTP Requests. Students will also become familiar with the principle of form validation on the client and server side. Creating and connecting a database to the web application. Introduction to CRUD operations. It will also be mentioned how the web application can be used as an API.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course Content:** 1. Introduction to HTML. 2. Introduction to CSS. 3. Introduction to Javascript. 4. Connecting HTML with JavaScript. 5. Introduction to PHP. 6. Using PhpMyAdmin for creating and maintaining tables in the database. 7. Setting up the environment for web application development using a framework. 8. Deploying the web application on a server. 9. Server configuration.			

13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	30	
17.	Other forms of activities	17.1.	Project assignments: hours	25	
		17.2.	Independent tasks: hours	25	
		17.3.	Home study – tasks	25	
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST			
19	Assessment Method				
	19.1.	Tests: Points		45	
	19.2.	Seminar paper/project, written and oral presentation: points		10	
	19.3.	Final exam: points		45	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Michael Mendez	The Missing Link: An Introduction to Web Development and Programming	Open SUNY Textbooks	2014

		2.	Kevin Tatroe, Peter MacIntyre	Programming PHP: Creating Dynamic Web Pages	O'Reilly Media; 4th edition	2020
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Matt Stauffer	Laravel: Up & Running: A Framework for Building Modern PHP Apps	O'Reilly Media; 2nd edition	2019
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Wireless mobile systems			
2.	Code	CSE17E07			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – optional subject from the unit			
6.	Academic year / semester	Year	4	semester	VII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Ninoslav Marina, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	• To learn about wireless networks, protocol stack and standards • To learn about the basics of 3G services, their protocols and applications • To learn about the evolution of 4G networks, their architecture and applications • To acquire competence in the latest 3G/4G/5G/6G and WiMAX networks and their architecture • Design and implementation of wireless networks for their applications using the latest wireless protocols and standards • Implements various types of smartphone and mobile applications with latest network strategies			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• Introduction: Types of wireless technologies, WLAN technologies, infrared, UHF narrowband, spread spectrum. IEEE 802.11: system architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a, HiperLAN, WATM, BRAN, HiperLAN2. Bluetooth: architecture, radio level, baseband level, link management protocol, security. IEEE 802.16 WiMAX: physical layer, MAC, spectrum allocation for WiMAX. Mobile cellular systems. Characteristics of cellular systems. • Network Layer in Mobile Networks: Introduction, Mobile IP, IP Packet Delivery, Agent Discovery, Tunneling and Encapsulation, IPv6 Internet Network Layer, Mobile IP Session Initialization Protocol, Mobile Ad-Hoc Networks: Routing, Destination Sensing, Distance Vector, Dynamic Source Routing • Transport layer in mobile networks: TCP enhancements for wireless protocols, traditional TCP,			

		congestion control, fast retransmission/fast recovery, mobility implications, classic TCP enhancement, indirect TCP, TCP snooping, mobile TCP, dial freeze, selective retransmission, transaction-oriented TCP, TCP over 3G wireless networks • Wireless WAN: overview of UMTS terrestrial radio access network, UMTS core architecture, 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP, HSDPA, LTE network architecture and protocols • 4G Networks: Introduction, 4G Characteristics and Challenges, Applications in 4G, 4G Technologies, Multicarrier Modulation, Smart Antenna Techniques, OFDM-MIMO Systems, Adaptive Modulation and Time Slot Coding, Cognitive Radio • 5G and 6G networks: Introduction, features, challenges.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students should ensure regular attendance of classes according to the regulations of UINT		
19	Assessment Method 10+10+80			
	19.1.	Tests: Points		10 points
	19.2.	Seminar paper/project, written and oral presentation: points		10 points
	19.3.	Final exam: points		80 points
20	Assessment criteria (points/grade)		**up to 50 points**	**5 (five) (F)**
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)

21.	Method for monitoring the quality of teaching			Monitoring of UINT control procedures		
22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Martin Sauter	From GSM to LTE-Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband (4th Edition)	Wiley	2021
		2.	Jochen Schiller	Mobile Communications	Second Edition, Pearson Education	2011
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming	3G Evolution HSPA and LTE for Mobile Broadband	Second Edition, Academic Press	2008
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Wireless networks			
2.	Code	CSE16E10			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – optional subject from the unit			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Jovan Karamachoski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	This course covers the principles underlying the analysis and design of wireless communication networks • Understand the functions and operating principles of various components of wireless networks, and how connections are established and maintained • Understand the complicated nature of wireless propagation and apply simple models to calculate link budget • To become familiar with the existing and future technologies of wireless communications			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• Wireless Media – Air Interface Design, Radio Propagation Mechanism, Path Loss and Signal Coverage Models, Multipath and Doppler Effect, Channel Measurements and Modeling, Radio Channel Simulation • Wireless media access – Fixed access allocation for voice networks, random access for data networks, integration of voice and data traffic, types of media access (TDMA, FDMA, CDMA) • Wireless network operation – Wireless network topology, Point-to-point wireless links. Cell Topology, Cell Basics, Signal-to-Interference Ratio, Capacity Expansion, Mobility Management, Resource and Power Management, Security in Wireless Networks • Wireless LAN and HIPERLAN – Introduction to Wireless LAN, IEEE 802.11, WPAN IEEE 802.15, Mobile Ad Hoc Networks (MANET), Principles and Operation, Wireless Home Networking, Bluetooth Technology Concept, Wireless Geolocation			

		• Wireless WAN – GSM and TDMA technology, cellular environment, infrastructure communication, CDMA technology, IS95, IMT2000, Mobile data networks, CDPD networks, GPRS, mobile application protocol			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	35 hours	
18	Conditions for Signature	Students should ensure regular attendance of classes according to the regulations of UINT			
19	Assessment Method 10+10+80				
	19.1.	Tests: Points		10 points	
	19.2.	Seminar paper/project, written and oral presentation: points		10 points	
	19.3.	Final exam: points		80 points	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Monitoring of UINT control procedures			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	William Stallings,	Wireless Communications and Networks	Prentice Hall	2007

		2.	Leon Garcia, Widjaja	Communication Networks	TMH	2000
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Jon W Mark, Weihua Zhuang	Wireless communication and Networking	Prentice Hall	2003
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Wireless Sensor Networks			
2.	Code	CSE17E11			
3.	Study program	Computer science and engineering 4 years studies, Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering, Faculty of Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – elective subject specific to faculty			
6.	Academic year / semester	Year	4	semester	VII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Ass. Prof. Ile Dimitrievski, PhD			
9.	Language of instruction	English, Macedonian			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	The student will understand the concepts of sensor networks 1. To understand sensor networks 2. To learn sensor network architectures and different protocols			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Overview of Sensor Networks – Introduction, applications, design problems, requirements, sensor node architecture 2. Network architecture – Optimization objectives, evaluation metrics, principles of network design, operating system for sensor networks and a brief introduction to sensor network programming 3. Network protocols – MAC protocols and energy efficiency 4. Routing protocols – Data-centric, hierarchical, location-based, energy-efficient routing, etc., sensor deployment, coverage and transmission scheduling problems, self-organization and topological control, requirements, data collection and processing, collaborative information processes and group connectivity, target tracking, localization and identity management, power management, security and privacy			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Tutorials: 30 hours; self - study, projects, homework assigments: 105 hours = Total time of 180 hours			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours		45

		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UIST study rulebook.		
19	Assessment Method			
	19.1.	Tests: Points		90
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		90
20	Assessment criteria (points/grade)		**up to 50 points**	**5 (five) (F)**
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Follow UIST Quality Assurance Procedures.	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Charles E.Perkins	Ad hoc Networking	Pearson education	2001
2.				
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Raheem Beyah	Security in Ad hoc and Sensor Networks	World Scientific Publications / Cambridge University Press	2010
2.				
3.				

No. 23

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Law in Information Technologies			
2.	Code	MIR13U07			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective course from the university list			
6.	Academic year/semester	Year	2	semester	III
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Ivan Bimbilovski, Ph.D.			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course objectives** By the end of the semester, students will be able to: • Critically analyze complex legal issues and challenges related to the application of information technologies, propose well-founded solutions and conclusions, and present them convincingly, both orally and in writing. • Independently research and study primary and secondary sources of information technology law; critically analyze, interpret, evaluate, and synthesize information and data obtained through such research; identify additional sources for further investigation; and develop a research strategy using both traditional and electronic research tools and methods.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course content:** The course is primarily a legal program adapted to the specifics of the Digital Business Informatics study program and to the needs of students in this field. It explores the legal challenges that arise from the application of information technologies in areas such as intellectual property, data protection, business operations, contracts, liability for damages, criminal offenses, human rights, and ethics, with particular emphasis on a constitutional-law perspective. The course covers topics and issues including, but not limited to: global governance in cyberspace; jurisdiction and judicial procedure in cyberspace; contract law in information			

		technologies; consumer protection law in the application of information technologies; liability for damages arising from the use of information technologies; the right to privacy in the context of information technologies; criminal offenses and misdemeanors committed through the use of information technologies; legal regulation of content available on the Internet and in cyberspace (constitutional principles and aspects of freedom of speech and expression as applied to information technologies); protection of copyright, trademarks, trade secrets, and patents in information technologies; legal regulation of electronic and digital signatures; legal regulation of cryptocurrencies and payments in cyberspace; and related topics.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students should ensure regular attendance at classes according to the regulations of UINT		
19	Assessment Method			
	19.1.	Tests: Points		40 points
	19.2.	Seminar paper/project, written and oral presentation: points		20 points
	19.3.	Final exam: points		40 points
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)

21.	Method for monitoring the quality of teaching			Monitoring of UINT control procedures		
22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Michael L. Rustad	Global Internet Law, 4th Edition	West Academic Publishing	2019
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Andrej Savin	EU Internet Law, 3rd Edition	Edward Elgar Publishing	2020

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Legal Aspects of Computer Crime			
2.	Code	CSE14E07			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective course from the unit			
6.	Academic year/semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Ivan Bimbilovski, Ph.D.			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course objectives** By the end of the semester, students will be able to: • Identify the legal nature of various cyber threats; • Demonstrate knowledge and understanding of national and international legal frameworks for combating cybercrime, cyberterrorism, cyber espionage, and cyber warfare; • Develop clear and coherent arguments and analyses of cyber threats under constitutional and international law; • Critically evaluate national and international criminal offenses related to computer (cyber) crime; and • Propose legal reforms in various areas of computer (cyber) crime.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course content:** The course covers topics and issues such as: • criminal offenses related to computer misuse; • criminal offenses related to data protection; • criminal offenses related to violations of property; • criminal offenses related to violations of communications; • criminal offenses related to Internet content; criminal offenses against the person; • cyber evidence and forensics; cyberterrorism; cyber wars and cyber espionage; • the Deep Web;			

		• cybersecurity policies, measures, and operations; and related topics.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	35 hours	
18	Conditions for Signature	Students should ensure regular attendance at classes according to the regulations of UINT			
19	Assessment Method				
	19.1.	Tests: Points		40 points	
	19.2.	Seminar paper/project, written and oral presentation: points		20 points	
	19.3.	Final exam: points		40 points	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Monitoring of UINT control procedures			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Matthew Richardson	Cyber Crime: Law and Practice, 2nd Edition	Wildy, Simmonds and Hill Publishing	2019

		2.	Catherine D. Marcum	Cybercrime, 3rd Edition	Aspen Publising	2019
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Joshua B. Hill, Nancy E. Marion	Introduction to Cybercrime: Computer Crimes, Laws, and Policing in the 21st Century	Praeger	2016
		2.	Janine Kremling, Amanda M Sharp Parker	Cyberspace, Cybersecurity, and Cybercrime	Sage Publications, Inc.	2017

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Legal Protection of Data			
2.	Code	MIR15U05			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective course from the university list			
6.	Academic year/semester	Year	3	semester	V
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Ivan Bimbilovski, Ph.D.			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course objectives** By the end of the semester, students will be able to: • Understand how the European data protection regulation (GDPR) and related European Union legal instruments function; • Understand how compliance with the European data protection regulation (GDPR) and related European Union legal instruments is achieved; • Independently identify and fulfill legal obligations for data protection arising from the European data protection regulation (GDPR) and related European Union legal instruments; • Introduce data control and protection within business processes; • Develop and implement data protection policies and procedures for data controllers and data processors; • Identify shortcomings in existing data protection policies and procedures of data controllers and data processors; • Conduct data protection audits and assess the impact of data processing on privacy (Privacy Impact Assessments); • Initiate actions aimed at improving data security.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	The course is primarily a legal program adapted to the specifics of the Digital Business Informatics study program and to the needs of students in this field. It addresses topics and issues such as: key definitions (what constitutes personal data; who are data controllers and data processors); data protection principles (lawfulness, fairness, and transparency; purpose and use limitation; data minimization; accuracy; storage limitation; integrity and confidentiality (security); accountability); legal			

		bases for data processing (consent; contract; legal obligation; vital interests; public task; legitimate interests; special categories of data; data relating to criminal convictions and sentences); data subject rights (right to be informed about data processing; right of access; right to rectification; right to be forgotten (right to erasure); right to restriction of processing; right to data portability; right to object to processing; rights related to automated decision-making and profiling); accountability and governance (contracts, documentation; data protection by design and by default; data protection impact assessments; data protection officers; codes of conduct; certification; fees related to data processing services and access to processed data); security (encryption; ransomware; passwords in online services; system intrusions); international data transfers (agreements and guidelines for international data transfers; risk assessment in international data transfers); exceptions (exceptions on grounds such as immigration); national security and defense; and related topics.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students should ensure regular attendance at classes according to the regulations of UINT		
19	Assessment Method			
	19.1.	Tests: Points		40 points
	19.2.	Seminar paper/project, written and oral presentation: points		20 points
	19.3.	Final exam: points		40 points
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)

<table>
<tr><td></td><td colspan="3"></td><td>from 81 to 90 points</td><td>9 (nine) (B)</td></tr>
<tr><td></td><td colspan="3"></td><td>from 91 to 100 points</td><td>10 (ten) (A)</td></tr>
<tr><td>21.</td><td colspan="3">Method for monitoring the quality of teaching</td><td colspan="2">Monitoring of UINT control procedures</td></tr>
<tr><td rowspan="8">22.</td><td colspan="5">Literature</td></tr>
<tr><td rowspan="4">22.1.</td><td colspan="4">Mandatory Literature</td></tr>
<tr><td>No.</td><td>Author</td><td>Title</td><td>Publisher</td><td>Year</td></tr>
<tr><td>1.</td><td>Eduardo Ustaran</td><td>European Data Protection: Law and Practice, 2nd Edition</td><td>International Association of Privacy Professionals (IAPP)</td><td>2019</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="4">22.2.</td><td colspan="4">Additional Literature</td></tr>
<tr><td>No.</td><td>Author</td><td>Title</td><td>Publisher</td><td>Year</td></tr>
<tr><td>1.</td><td>Information Commissioners Office</td><td>Guide to the General Data Protection Regulation (GDPR)</td><td>Information Commissioners Office</td><td>2022</td></tr>
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Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Linear Algebra			
2.	Code	CSE15E03			
3.	Study program	Computer science and engineering 4 years studies, Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering, Faculty of Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	2	semester	III
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Elena Hadzieva, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Mathematics 1			
11.	Course Objectives (Competencies) and Learning Outcomes:	The course aims to provide students with fundamental theoretical and practical competencies in linear algebra, enabling them to: Understand and apply the basic concepts of linear systems, matrices, determinants, vector spaces, and linear transformations; Develop abstract reasoning skills and the ability to work with mathematical structures and proofs; Model and solve real-world problems using linear algebraic methods; Interpret and analyze the geometric meaning of vectors, bases, dimensions, and transformations; Use linear algebra tools to express mathematical relationships in engineering, computer science, data analysis, and related fields; Communicate mathematical ideas clearly and logically, using appropriate terminology and notation. Apply computational thinking and algorithmic approaches to operations on matrices and vector spaces.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Systems of linear equations. Gauss and Gauss-Jordan Elimination Methods. Inconsistent and Consistent Systems. Matrices and matrix operations. Matrix equations. Elementary matrices. Inverse Matrix. Determinants and their properties. Kramer's rules. Vectors. Scalar and vector products. Vector spaces. Vector subspaces. Linear independence. Linearly independent and linearly dependent vectors. Basis and dimension. Linear transformations: reflection, rotation, translation, projection. Matrix representation of linear transformations. Characteristic polynomial of a matrix. Eigenvalues,			

		eigenvectors, and eigenspaces of a matrix. Python coding related to the course.			
13	Interconnection of Courses	This course is connected to Mathematics 1, and all engineering courses that involve matrices, transformations and vector spaces.			
14.	Detailed Description of the Teaching and Working Methods for the Course	Interactive teaching – 45 hours and interactive tutorials – 30 hours, individual work through homework and projects.			
15.	Total Available Time Allocation	Lectures: 45 hours; Tutorials: 30 hours; Individual work, homework and projects: 105 hours.			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours	15 hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	55 hours	
18	Conditions for Signature	Regular attendance, in accordance with the UIST Rulebook			
19	Assessment Method				
	19.1.	Tests: Points		5	
	19.2.	Seminar paper/project, written and oral presentation: points		10	
	19.3.	Final exam: points		85	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	In accordance with the university procedures and quality control methods			

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Steven Leon	Linear Algebra with Application, 8th Edition	Pearson Education, Inc	2010
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year

		1.	S. W. Goode, S. A. Annin	Differential equations and linear algebra	Pearson prentice hall	2007
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Literary Theories in Journalism			
2.	Code	ICS14U07			
3.	Study program	Computer Science and Engineering – 4-year program / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First			
6.	Academic year / semester	Year	2	semester	4
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Associate Professor, Mersiha Ismajloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	/			
11.	Course Objectives (Competencies) and Learning Outcomes:	In the theoretical part of the course, students will be introduced to the main features of the development of information technology and its application in journalism. In this context, special attention will be devoted to the protection of personal data, e-commerce, cybercrime, copyright, and the internet, the digital public sphere, etc. In the practical part of the course, students will be trained to search for relevant information in cyberspace, search databases, use computer programs for text processing, and understand the basics of electronic and interactive journalism etc. Students will learn the characteristics of journalism in print and electronic media, global media models, the production of print media and the influence of technology, as well as factors that affect print media such as the market and marketing, monopolies, and media magnates. The internet as a medium and its strong influence on other media will also be explored.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	A theoretical and practical approach to studying the press as a medium and its specific features. Characteristics of journalism in print media. Media models around the world. Print production and the influence of technology. Aspects that affect the press, such as the market and marketing. Monopolies and media magnates. The internet as a new medium and its strong influence on other media.			
13	Interconnection of Courses	/			
14.	Detailed Description of the Teaching and Working Methods for the Course	Method of oral presentation, method of independent work. Participation of experts in the field. Visits to institutions involved in media work.			

15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	35
17.	Other forms of activities	17.1.	Project assignments: hours	30
		17.2.	Independent tasks: hours	35
		17.3.	Home study – tasks	35
18	Conditions for Signature	Students are required to attend classes regularly in accordance with the UIST regulations.		
19	Assessment Method			
	19.1.	Tests: Points		2x40=80
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		10
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Compliance with UIST control procedures		

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Kiran Prasad	E-journalism New Media and News Media	B.r. Publishing Corporation	2011
2.	E. B White	Essays of E. B. White (Perennial Classics)	Harper Perennial Modern Classics; Reprint edition	2006
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Lessig, Lawrence	Free Culture: How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity	The Penguin Press	2004
2.				
3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Logic Circuits and Digital Electronics			
2.	Code	CSE12M04			
3.	Study program	Computer science and engineering 4 years studies, Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering, Faculty of Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – mandatory subject			
6.	Academic year / semester	Year	1	semester	II
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Ass. Prof. Ile Dimitrievski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Discrete Mathematics			
11.	Course Objectives (Competencies) and Learning Outcomes:	The main goal of the course is to introduce students to methods of analysis and design digital logic circuits and logic networks, both combinational and sequential circuits, registers and counters.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Introduction, Introduction to Numerical Systems, Numerical System Transformation, Binary Code, Boolean algebra, Boolean functions, logic circuits, families of logic circuits, basic logic circuits, minimization of Boolean functions with Karnaugh maps. 2. Combinational networks: design of combinational networks, adder, subtractor, combinational networks: multiplier, coder, decoder, multiplexer, demultiplexer. 3. Sequential networks: bistable circuits, rs flip flop, jk, d, t flip flop, counters: synchronous, asynchronous, binary, decade, structure and design, registers, memories. 4. HDL and Verilog description language of hardware, digital systems design. 5. Synthesis of sequential networks. Diagram of states, state table minimization. Registers, counters.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Tutorials: 30 hours; self - study, projects, homework assigments: 105 hours = Total time of 180 hours			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	30	

17.	Other forms of activities	17.1.	Project assignments: hours	35
		17.2.	Independent tasks: hours	35
		17.3.	Home study – tasks	35
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UIST study rulebook.		
19	Assessment Method			
	19.1.	Tests: Points		90
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		90
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Follow UIST Quality Assurance Procedures.	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Morris Mano, Michael Ciletti	Digital Design, 4th ed.	Prentice Hall	2006
2.				
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Jr. Charles H. Roth, Larry L Kinney	Fundamentals of Logic Design, 6th ed.	CL Engineering	2009
2.				
3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Machine learning			
2.	Code	CSE17E03			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective subject from the unit			
6.	Academic year / semester	Year	4	semester	VII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Anis Sefidanoski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Linear Algebra, Probability and Statistics, Mathematics 3			
11.	Course Objectives (Competencies) and Learning Outcomes:	The aim of the course is to introduce students to decision-making methods for classifying samples (Nearest Neighbor Algorithm and Bayesian Decision Theory), and how to optimize classifiers. The method of analyzing samples by groups, Basic concepts of the K-means clustering algorithm, Processing structured and unstructured human speech, Construction of neural networks, and application of deep learning			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Introduction to Machine Learning, Supervised Learning and Linear Regression, Classification and Logistic Regression, Unsupervised Learning, Natural Language Processing (NLP), Introduction to Deep Learning, Time Series Analysis			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			

15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	30	
17.	Other forms of activities	17.1.	Project assignments: hours	25	
		17.2.	Independent tasks: hours	25	
		17.3.	Home study – tasks	25	
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST			
19	Assessment Method				
	19.1.	Tests: Points		45	
	19.2.	Seminar paper/project, written and oral presentation: points		10	
	19.3.	Final exam: points		45	
20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)		
		from 51 to 60 points	6 (six) (E)		
		from 61 to 70 points	7 (seven) (D)		
		from 71 to 80 points	8 (eight) (C)		
		from 81 to 90 points	9 (nine) (B)		
		from 91 to 100 points	10 (ten) (A)		
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year

		1.	Ian Goodfellow, Aaron Courville, Yoshua Bengio	Deep Learning	MIT Press	2015
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.				
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Information Systems Management			
2.	Code	CSE16E08			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering -			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle – elective subject from the unit			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Aleksandar Karadimche, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Software Engineering			
11.	Course Objectives (Competencies) and Learning Outcomes:	The course develops competencies that enable students to understand the strategic importance of information systems in enhancing business performance. Students learn how IS supports operational efficiency, tactical planning, strategic decision-making, competitive advantage, and digital innovation. The program emphasizes the managerial models and techniques needed to plan, implement, and oversee management information systems. Upon completion, students will have in-depth knowledge of business and e-business systems, digital organization design, large-scale IS implementation approaches, and key enterprise applications. They will understand current trends in the digital era and apply IS to strategic decision-making. Students also gain basic competencies in IT ethics, governance, and the application of security frameworks to ensure responsible and secure IS management.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Business models and competitive strategies, relationship between the organizational structure of companies and information structures, types of organizational structures 2. Goals of business and e-business systems 3. Need for management and types of management within a company (with special reference to the goals of IS management), digital organization, security management, and ethics in IS 4. The contribution of IS to the work of a company (strategic, competitive, operational level) 5. ICT infrastructure and its impact on the development of IS in a company, IT mass systems 6. Key applications and paradigms, how they are determined in relation to the strategic goals of the company (e.g., profit centers, optimization of the number of users, satisfied users, etc.) 7. Digital era and its impact on IS in companies (globalization,			

		personalization, penetration, involvement) 8. Decision support systems, knowledge management systems 9. Trends and challenges in information management information systems.		
13	Interconnection of Courses	Business intelligence and analytics		
14.	Detailed Description of the Teaching and Working Methods for the Course	The course uses a combination of lectures, case studies, and practical analytical exercises to help students understand how information systems support business strategy and performance. Lectures introduce managerial models, digital transformation concepts, and IS governance frameworks, while case studies illustrate real-world challenges in implementing and managing enterprise systems. Practical sessions focus on evaluating IS solutions, assessing organizational needs, and applying tools for strategic decision-making. Group work encourages collaboration in analyzing digital initiatives, proposing IS strategies, and addressing security and ethical issues. Independent study, assigned readings, and short research tasks deepen conceptual understanding. Regular feedback, discussions, and problem-solving activities ensure students can apply theoretical knowledge to modern organizational contexts and digital-era management challenges.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	35 hours
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	45 hours
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UINT regulations.		
19	Assessment Method	80 + 15 + 5		
	19.1.	Tests: Points		80 points
	19.2.	Seminar paper/project, written and oral presentation: points		15 points
	19.3.	Final exam: points		5 points
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)

21.	Method for monitoring the quality of teaching			Following the UINT quality control procedures		
22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Kenneth C. Laudon and Jane P. Laudon	Management Information Systems: Managing the Digital Firm, 17th Global Edition	Pearson ISBN 978-0-13-697127-6	2021
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	James O'Brien, George Marakas	Management Information Systems, 10th Edition	McGraw-Hill/Irwin	2010
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Mathematics 1			
2.	Code	CSE11M03			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	1	semester	I
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Aneta Naumoska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Course Objectives (Competencies): The objective of this course is to introduce students to the fundamental concepts of Linear Algebra and Calculus. These subjects are essential tools in many areas of mathematics and computer science. Starting from basic definitions and progressing to more advanced ideas, the course provides students with a comprehensive introduction to mathematical analysis, focusing on differentiation and functions of a single variable, as well as the application of differentials in the analysis of the properties of single-variable functions. In addition, the course offers an overview of the fundamental techniques used in linear algebra.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course Content:** • Sums and products of matrices, inverse matrices, and solving systems of linear equations using matrices and Gaussian transformations (Gaussian elimination); • Sequences and limits of sequences; • Fundamental concepts of functions of one variable, implicit functions, composition of functions, and inverse functions; • Basic properties and graphs of linear, quadratic, and cubic functions of one variable, as well as higher-degree polynomial functions, rational functions, exponential, logarithmic, trigonometric, and hyperbolic functions; • Limits and continuity of functions of one variable; • Differentiation of standard functions of one variable and implicit functions; • L'Hôpital's rule;			

		• Monotonicity of functions; convexity and concavity of functions; local extrema, global extrema; • Graphing of functions of one variable; • Rolle's Theorem and the Mean Value Theorem; • Function approximation using Taylor's Theorem.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	30	
17.	Other forms of activities	17.1.	Project assignments: hours	25	
		17.2.	Independent tasks: hours	25	
		17.3.	Home study – tasks	25	
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST			
19	Assessment Method 80 + 15 + 5				
	19.1.	Tests: Points		80	
	19.2.	Seminar paper/project, written and oral presentation: points		15	
	19.3.	Attendance and participation		5	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	G. B. Thomas	THOMAS' CALCULUS, 12/E	Pearson Addison-Wesley	2010

		2.	S. Leon	LINEAR ALGEBRA WITH APPLICATIONS, 8/E	Pearson Addison-Wesley	2010
		3.	H. Anton, I. Bivens, S. Davis	CALCULUS, 10/E	John Willey & Sons, Inc.	2012
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Mathematics 2			
2.	Code	CSE12M02			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	1	semester	II
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Aneta Naumoska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Course Objectives (Competencies): The objective of this course is to introduce students to the concepts of integrals, applications of integrals, series, ordinary differential equations, and various techniques for solving them. These topics are essential for several courses in subsequent semesters as outlined in the study program.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course Content:** • Indefinite integrals of basic functions of one variable; substitution method and integration by parts; • Other integration techniques: trigonometric integrals, trigonometric substitutions, and integration of rational functions; • Definite integrals; the Fundamental Theorem of Calculus; • Determination of the area under a given curve and between two curves using definite integrals; • Calculation of arc length and volumes of solids of revolution; • Series, basic properties of series, and special series; • Tests for convergence of series; • Power series and functions; • Differential equations: solutions of separable equations and first-order linear differential equations; • Homogeneous and non-homogeneous second-order linear differential equations.			
13	Interconnection of Courses				

14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		

19	Assessment Method 80 + 15 + 5		
	19.1.	Tests: Points	80
	19.2.	Seminar paper/project, written and oral presentation: points	15
	19.3.	Attendance and participation	5

20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST	

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	G. B. Thomas	THOMAS' CALCULUS, 12/E	Pearson Addison-Wesley	2010
		2.	H. Anton, I. Bivens, S. Davis	CALCULUS, 10/E	John Willey & Sons, Inc.	2012
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Microprocessors			
2.	Code	CSE16E03			
3.	Study program	Computer science and engineering 4 years studies, Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering, Faculty of Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – elective subject specific to faculty			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Ass. Prof. Ile Dimitrievski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Digital logic circuits			
11.	Course Objectives (Competencies) and Learning Outcomes:	Upon completion of this course, students should be able to: • to know, of course, apply professional terminology and concepts for digital circuits and microprocessors; • to know, of course, apply terminology and concepts from processor programming to assembler and connection of various hardware components; • identify different generations of microprocessors.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• Microprocessor architecture, data types • Global microprocessor architecture, registers, arithmetic logic unit, control unit • Microprocessor pin diagram • Use of stack memory • Basic concepts when connecting a microprocessor • Connect to RAM and ROMs • Virtual memory • Cache organization • Connection with input-output ports • Interrupt systems • DMA transmission • Address coding • Microprocessor programming • Division of programming languages • Components of assembly instruction • Ways of addressing • General microprocessor instruction set			

		• Writing programs			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Tutorials: 30 hours; self - study, projects, homework assigments: 105 hours = Total time of 180 hours			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	30	
17.	Other forms of activities	17.1.	Project assignments: hours	25	
		17.2.	Independent tasks: hours	25	
		17.3.	Home study – tasks	25	
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UIST study rulebook.			
19	Assessment Method				
	19.1.	Tests: Points		90	
	19.2.	Seminar paper/project, written and oral presentation: points		10	
	19.3.	Final exam: points		90	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Follow UIST Quality Assurance Procedures.			

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	K. Udaya Kumar	The 8085 Microprocessor: Architecture, Programming and Interfacing	Pearson	2008
2.	Barry B. Brey	Digital Design: Principles and Practices	Pearson	2013
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.				

		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Modeling and Simulations			
2.	Code	CSE15M01			
3.	Study program	A mandatory course offered by each unit of the University			
4.	Organizer of the study program (unit, i.e. institute, department)	UIST St. Paul the Apostle, Ohrid, Macedonia CSE, CNS, ISVMA, AITMIR			
5.	Degree (first, second, third cycle)	First			
6.	Academic year/semester	Year	III	semester	IV
7	Course Workload Expressed in ECTS Credits	6 ECTS Credits			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Ljubinka Sandjakoska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	NA			
11.	Course Objectives (Competencies) and Learning Outcomes:	This course equips students with a solid understanding of modern concepts and methodologies for modeling and simulating real-world systems. It enables students to recognize the opportunities and potential of using models, and to develop simulations that support the improvement of systems and processes.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Principles of Modeling and Simulation. 2. Theoretical Underpinnings. 3. Practical Domains. • The first part covers a brief history of the processes: modeling and simulation, followed by an overview of numerous functions. Furthermore, the advantages and disadvantages of using models in problem solving will be learned. And at the end of the first part, two main reasons for using modeling and simulation will be illustrated, through the study of a specific problem related to the use, which provides insight into complex concepts. • The second part of the program, Theoretical Underpinning, examines various modeling techniques and introduces students to two important concepts of simulation: discrete event simulation and continuous system simulation. This part details the two basic methods, and also covers the importance of verification and validation. • The third part of this course, covering practical domains, delves into specific topics related to business, medicine, and social sciences. Furthermore, the challenges of modeling and simulation are covered, along with advanced applied modeling and simulation principles such as representation			

		techniques, integration into application infrastructure, and new technologies.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Tutorials: 30 hours; Independent preparation, projects, homework: 105 hours Total time 180 hours			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours		45 h
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours		30 h
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments: hours		35 h
		17.2.	Independent tasks: hours		35 h
		17.3.	Home study – tasks		35 h
18	Conditions for Signature	Students should attend classes regularly in accordance with the UIST regulations			
19	Assessment Method				
	19.1.	Tests: Points			80
	19.2.	Seminar paper/project, written and oral presentation: points			20
	19.3.	Final exam: points			100
20	Assessment criteria (points/grade)		up to 50 points		5 (five) (F)
			from 51 to 60 points		6 (six) (E)
			from 61 to 70 points		7 (seven) (D)
			from 71 to 80 points		8 (eight) (C)
			from 81 to 90 points		9 (nine) (B)
			from 91 to 100 points		10 (ten) (A)
21.	Method for monitoring the quality of teaching	Follow UIST Quality Assurance Procedures			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	John A. Sokolowski, Catherine M. Banks	Principles of Modeling and Simulation: A Multidisciplinary Approach, 1st Edition	Wiley	2009

		2.	Giuseppe Ciaburro	Hands-On Simulation Modeling with Python: Develop simulation models to help you get accurate results and enhance the decision-making process, 2nd Edition	Packt Publishing	2023
		3.	Jonah O'Kelly	Computer Simulation: Advanced Techniques, Methods and Applications	Willford Press	2019
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Mark Lutz	Learning Python	O'Reilly Media	2013
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Multimedia information systems			
2.	Code	CSE15E06			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering – FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective subject from the unit			
6.	Academic year / semester	Year	3	semester	V
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Anis Sefidanoski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Introducing the student to the basic concepts of working with multimedia data, ways of modeling and implementing and manipulating them. The student will be able to model multimedia data, will know how to practically apply content-based search of multimedia data, and will acquire introductory knowledge for creating applications based on multimedia content.			

12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Introduction. Multimedia data organization. Multimedia standards. Digitization techniques. Data models and access. Multimedia data representation and processing. Multimedia data compression (text, image, video and audio). Multimedia content representation, description and management. MPEG – 7 multimedia description scheme. Content-based search and filtering of multimedia data. Visual descriptors. Descriptors for searching multimedia content by color. Descriptors for searching multimedia content by texture. Descriptors for searching multimedia content by shape (regions and contours). Descriptors for searching 3D objects and their application. Descriptors for describing and searching multimedia content by motion. Techniques for indexing and searching audio data. Distributed sensor multimedia systems. Aspects of multimedia communications. Multimedia information transmission, protocols, interfaces and standards for coding and data exchange formats. Relation to MPEG-4. Parameters for assessing quality of service (QoS) in multimedia systems and communications. Media synchronization and support for real-time display. Interactive multimedia environments. Multimedia systems in a cloud environment (processing, transmission and quality of service). Overview of multimedia application design. Application of multimedia systems in medicine and education. Other topics.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25

		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature		The student must ensure regular attendance of classes according to the regulations of UIST	
19	Assessment Method			
	19.1.	Tests: Points		45
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		45
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Following the quality control procedures of UIST	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Ralf Steinmetz, Klara Nahrstedt	Multimedia Fundamentals: Media Coding and Content Processing	Prentice Hall	2002
2.	Ralf Steinmetz, Klara Nahrstedt	Multimedia Systems	Springer	2004

		3.				
	22.2.	Additional Literature				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Multiplatform programming			
2.	Code	CSE17M03			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering -			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle - compulsory subject			
6.	Academic year / semester	Year	4	semester	VII
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Aleksandar Karadimche, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Object-oriented programming, Internet programming			
11.	Course Objectives (Competencies) and Learning Outcomes:	The course develops competencies in designing and implementing mobile applications that run on multiple platforms, including Android and iOS. Students learn the fundamentals of mobile app development using React Native, understanding platform-specific differences, common pitfalls, and cross-platform challenges. Upon completion, students will be able to design responsive, functional mobile applications, debug platform-specific issues, and apply best practices for efficient, maintainable, and user-friendly apps. The course equips learners with practical skills to deliver consistent performance and user experience across diverse mobile environments.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Preparing the environment (operating system) for development. 2. Downloading and installing the dependencies required for building and debugging the application. 3. Introduction to the concept of a mobile application. 4. Introduction to the visual components used in the graphical interface. 5. Introduction to the programming language used to build the logic and functionality of the mobile application itself. 6. Using the hardware components of the phone. 7. Communication with an external API, and asynchronous calls to the server. 8. Using the internal memory of the phone. 9. Uploading the application to the PlayStore/AppStore.			
13	Interconnection of Courses	/			
14.	Detailed Description of the Teaching and Working Methods for the Course	The course combines lectures, demonstrations, and hands-on programming exercises to teach cross-platform mobile development. Lectures introduce React Native concepts, platform differences, and best practices. Practical sessions allow students to build, test, and debug applications on Android and iOS simulators, addressing platform-specific issues. Guided tutorials and projects reinforce learning, while collaborative			

		tasks encourage problem-solving and code review. Independent assignments and continuous feedback help students apply concepts to real-world scenarios, ensuring they acquire practical skills to design, implement, and maintain efficient, multi-platform mobile applications.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours	35 hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	45 hours	
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UINT regulations.			
19	Assessment Method 80 + 15 + 5				
	19.1.	Tests: Points		80 points	
	19.2.	Seminar paper/project, written and oral presentation: points		15 points	
	19.3.	Final exam: points		5 points	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Following the UINT quality control procedures			

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Bonnie Eisenman	Learning React Native Building Mobile Applications with JavaScript	O'Reilly Printed in United states of America	2016
2.	Jonathan Peppers	Xamarin Cross-platform Application Development	Packt Publishing	2014

		3.	Chris Griffith	Mobile app Development with Ionic 2	O'Reilly Media	2017
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Scott Olson, John HUnter,Ben Horgen, Kenny Goers	Professional Cross-Platform Mobile Development in C#	Wiley	2012
		2.				
		3.				

Attachment No. 3	**First cycle study program**					
1.	Title of the course	Music and Mathematics				
2.	Code	CSE16E11				
3.	Studio program / Faculty	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FKNI				
4.	Organizer of the study program (unit, i.e. institute, department , division)	University of Information Sciences and Technologies " St. Paul the Apostle " - Ohrid; Faculty of Computer Science and Engineering - FCNI				
5.	Degree (first , second, third cycle)	First cycle – elective subject from the unit				
6.	Academic year / semester	3/VI	7.	Number of ECTS credits	6	
8.	Teacher	Dr. Aneta Velkoska				
9.	Prerequisites for enrolling in the course					
10.	Objectives of the subject program (competencies): The goal of this course program is to awaken students' interest in the general science of harmony, whose task is to explore new connections between certain sciences and arts, especially mathematics and music.					
11.	Course content: • Mathematics and music together throughout history. • Number and tone. • Math, music and spirals, logarithmic spiral. • Rhythm theory. • Using logarithms in music. • History of tonal scales. • Fourier analysis and partial tones. • Universal law of the octave. • The Fibonacci sequence in music. • Plato's Bodies and Music.					
12.	Learning methods : This course is based on 45 hours of lectures, supplemented by 30 hours of exercises .					
13.	I bought an available fund on time	6 ECTS credits x 30 hours/credit = 180 hours				
14.	Distribution of available resources time	Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time of 180 hours				
15.	Forms of teaching activities	15.1.	Lectures - theoretical teaching	45 hours		
		15.2.	Exercises (laboratory , classroom) , seminars , teamwork	30 hours		
16.	Others forms of activities	16.1.	Project tasks	35 hours		
		16.2.	Independent tasks	35 hours		
		16.3.	Homemade learning	35 hours		

17.	Grading method 80 + 15 + 5					
	17.1.	Tests				80 points
	17.2.	Seminar paper/project (presentation : written and oral)				15 points
	17.3.	Activity and participation				5 points
18.	Assessment criteria (points / grade)			up to 50 points		5 (five) (F)
				from 51 to 60 points		6 (six) (E)
				from 61 to 70 points		7 (seven) (D)
				from 71 to 80 points		8 (eight) (C)
				from 81 to 90 points		9 (nine) (B)
				from 91 to 100 points		10 (ten) (A)
19.	Requirement for signature and passing the final exam			Students should ensure regular attendance at classes in accordance with the UINT regulations.		
20.	Language in which it is performed the teaching			English, Macedonian		
21.	Method of monitoring the quality of teaching			Monitoring UINT control procedures		
	Literature					
	22.1	Required literature				
		Serial number	Author	Title	Publisher	Year
		1.	J. Fauvel , R. Flood , R. Wilson	Music and Mathematics: From Pythagoras to Fractals	Oxford University Press	20 06
		2.				
		3.				
	22.2	Additional literature				
		Serial number	Author	Title	Publisher	Year
		1.				
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Music and Mathematics			
2.	Code	CSE16E11			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Associate Prof. Aneta Velkoska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives (Competencies):** The objective of this course is to stimulate students' interest in the general science of harmony, whose purpose is to explore new relationships between specific sciences and arts, particularly between mathematics and music.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course Content:** • Mathematics and music throughout history. • Number and tone. • Mathematics, music, and spirals; the logarithmic spiral. • Theory of rhythm. • Application of logarithms in music. • History of musical scales. • Fourier analysis and harmonic (partial) tones. • Universal law of the octave. • The Fibonacci sequence in music. • Platonic solids and music.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours		45
		16.2.	Exercises (auditory), seminars, teamwork: hours		30
		16.3.	Practical work: hours		30
17.	Other forms of activities	17.1.	Project assignments: hours		25
		17.2.	Independent tasks: hours		25

		17.3.	Home study – tasks		25
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST			
19	Assessment Method 80 + 15 + 5				
	19.1.	Tests: Points		80	
	19.2.	Seminar paper/project, written and oral presentation: points		15	
	19.3.	Attendance and participation		5	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching		Following the quality control procedures of UIST		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	J. Fauvel, R. Flood, R. Wilson	Music and Mathematics: From Pythagoras to Fractals	Oxford University Press	2006
	22.2.	Additional Literature			
		No.	Author	Title	Publisher	Year
		1.	D. Wright	Mathematics and Music	American Mathematical Society	2009

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Music Programming			
2.	Code	CSE15E09			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	3	semester	V
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)				
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives (Competencies):** To familiarize students with the fundamental concepts of working with multimedia data, including methods for modelling, implementation, and manipulation. Students will be able to model multimedia data with a particular focus on music as multimedia content. They will gain practical knowledge in applying content-based retrieval techniques for multimedia data in the context of music programming and acquire introductory knowledge for developing applications based on multimedia and musical content.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course Content:** • Introduction • Organization of multimedia data • Digitization techniques • Data models • Distributed sensor multimedia systems • Design of multimedia applications • Acoustics and psychoacoustics • Cognitive science • Mathematics and programming • Digital signal processing • Computer programming • User interface design • Music theory • Music composition			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			

15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19	Assessment Method 80 + 15 + 5			
	19.1.	Tests: Points		80
	19.2.	Seminar paper/project, written and oral presentation: points		15
	19.3.	Attendance and participation		5
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST		

22. Literature

Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Ajay Kapur, Perry Cook, Spencer Salazar, and Ge Wang	"Programming for Musicians and Digital Artists"	eBook, ISBN 9781617291708	2014
2.	Borko Furht	Multimedia Systems and Applications	Springer ISSN 1568-2358,	2016

Additional Literature

No.	Author	Title	Publisher	Year
1.	Andrew R. Brown, Bill Manaris	Making Music with Computers: Creative Programming in Python, 1st Edition	Chapman & Hall/CRC Textbooks in Computing	2014

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Natural Language Processing (NLP)			
2.	Code	CSE18E05			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First cycle – elective subject from the unit			
6.	Academic year / semester	Year	4	semester	VIII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Anis Sefidanoski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Upon completion of the course, students will be able to elaborate and apply basic algorithms and techniques in the field of natural language processing (NLP).			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Understanding approaches to syntax and semantics of NLP technologies Understanding approaches to discourse, generation, dialogue and summarization of results within NLP Understanding current methods for statistical approaches to machine translation Mastering machine learning techniques in NLP, including “Hidden Markov” models and context-free grammars, clustering and unsupervised learning methods, log-linear and discriminant models, as well as the application of the EM algorithm in NLP.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			

15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments: hours	
		17.2.	Independent tasks: hours	
		17.3.	Home study – tasks	
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19	Assessment Method			
	19.1.	Tests: Points		
	19.2.	Seminar paper/project, written and oral presentation: points		
	19.3.	Final exam: points		
20	Assessment criteria (points/grade)	up to 50 points		5 (five) (F)
		from 51 to 60 points		6 (six) (E)
		from 61 to 70 points		7 (seven) (D)
		from 71 to 80 points		8 (eight) (C)
		from 81 to 90 points		9 (nine) (B)
		from 91 to 100 points		10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST		

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Lewis Tunstall, Leandro von Werra, Thomas Wolf	Natural Language Processing with Transformers, Revised Edition	O'Reilly Media	2022
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.				
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Negotiation and Dispute Resolution			
2.	Code	MIR16U05			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective course from the university list			
6.	Academic year/semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Ivan Bimbilovski, Ph.D.			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course objectives** By the end of the semester, students will be able to: • Understand the main theories, models, and concepts underlying negotiation and dispute resolution, including how negotiation and dispute resolution processes are conducted; • Recognize different approaches to negotiation and dispute resolution and adapt to them; • Develop skills for effective and persuasive negotiation and dispute resolution and apply them in various situations in everyday life and business practice.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course content:** The course covers topics and issues such as: negotiation (negotiation strategies and tactics; negotiation through an intermediary or authorized representative; negotiation between teams or multiple parties; emotions in negotiation; cultural differences in negotiation; reasons why negotiations sometimes fail); mediation (objectives of mediation; the structure and conduct of a mediation session; mediators' listening skills; mediation techniques); fairness and quality of mediation (state incentives for the use of mediation; advantages and disadvantages of mediation from a social sciences perspective; regulation of mediation; professional responsibility of the mediator); confidentiality of mediation (the right to refuse disclosure of information obtained during mediation in court proceedings; the obligation to maintain			

		confidentiality; limitations of confidentiality due to public interest or rights of public access); arbitration (procedures and legal issues in arbitration; arbitration of claims based on statutory rights; arbitration ethics); and related topics.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	35 hours	
18	Conditions for Signature	Students should ensure regular attendance at classes according to the regulations of UINT			
19	Assessment Method				
	19.1.	Tests: Points		40 points	
	19.2.	Seminar paper/project, written and oral presentation: points		20 points	
	19.3.	Final exam: points		40 points	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching		Monitoring of UINT control procedures		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year

		1.	Stephen B. Goldberg, Frank E.A. Sander, Nancy H. Rogers, Sarah Rudolph Cole	Dispute Resolution: Negotiation, Mediation, Arbitration, and Other Processes, 7th Edition	Aspen Publishing	2020
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Russell Korobkin	Negotiation: Theory and Strategy, 3rd Edition	Aspen Publishing	2014

1.	Title of the teaching subject	Network Technology			
2.	Code	CSE14M02			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Atanas Hristov, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Course Objectives (Competencies): This course aims to enable students to learn fundamental networking technologies and to establish communication through computer networks. Students will gain an understanding of the importance of computer networks and the services they provide. They will also acquire knowledge and skills in the implementation and analysis of network protocols, which in turn leads to network design.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Chapter 1: Introduction to Computer Networks** Basic concepts, types of networks, and services. Learning outcome: Understand fundamental networking concepts and terminology. **Chapter 2: Network Models and Protocols** OSI and TCP/IP models, protocol layering. Learning outcome: Explain network architectures and protocol functions. **Chapter 3: Application Layer** Web, HTTP, FTP, P2P applications, socket programming. Learning outcome: Understand application-layer communication and services. **Chapter 4: Transport Layer** TCP and UDP protocols. Learning outcome: Compare reliable and unreliable transport mechanisms. **Chapter 5: Network Layer** IP (IPv4/IPv6), routing algorithms, broadcast and multicast routing. Learning outcome: Explain packet forwarding, routing, and addressing.			

		Chapter 6: Link Layer and LANs Error detection, multiple access, Ethernet, switches, VLANs. Learning outcome: Understand LAN technologies and link-layer operations. **Chapter 7: Mobility and Network Services** Mobile IP, DNS, DHCP, SNMP, ICMP, IGMP. Learning outcome: Explain mobility support and real-world network services.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	25	
17.	Other forms of activities	17.1.	Project assignments: hours	20	
		17.2.	Independent tasks: hours	30	
		17.3.	Home study – tasks	30	
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST			
19	Assessment Method				
	19.1.	Tests: Points		45	
	19.2.	Seminar paper/project, written and oral presentation: points		10	
	19.3.	Final exam: points		45	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year

		1.	Andrew S. Tanenbaum, David J. Wetherall	Computer Networks, Global Edition	Pearson	2021
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	William Stallings	Data and Computer Communications: International Version	Pearson	2010

Attachment No. 3		Subject program from the first cycle of studies			
1.	Title of the teaching subject	Numerical Methods			
2.	Code	CSE16E02			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First			
6.	Academic year / semester	Year	IV	semester	VIII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Elena Hadzieva, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Mathematics 1, Linear Algebra			
11.	Course Objectives (Competencies) and Learning Outcomes:	The course aims to provide students with theoretical foundations and practical skills in numerical methods, enabling them to: Understand basic numerical concepts and their role in solving mathematical problems that cannot be addressed analytically; Use Python as a computational tool for implementing numerical algorithms; Apply numerical techniques to solve systems of linear and nonlinear equations; Perform interpolation and approximation of data using suitable numerical methods; Use numerical differentiation and integration techniques to approximate derivatives and definite integrals; Understand the fundamentals of differential equations, including first-order differential equations and systems of first-order linear differential equations. Solve initial value problems numerically, using standard methods for ordinary differential equations (ODEs); Analyze the accuracy, stability, and convergence of numerical methods; Develop computational thinking and problem-solving skills through implementing and testing numerical algorithms.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Introduction to Python for numerical methods. Numerical methods for solving systems of linear algebraic equations. Interpolation. Fitting curves. Numerical methods for solving nonlinear equations. Numerical methods for solving systems of nonlinear equations. Numerical differentiation. Numerical integration. Concept of a			

		differential equation. First-order differential equation. System of first-order linear differential equations. Numerical solution of a first-order differential equation with initial conditions (initial value problems). Numerical solution of a system of first-order differential equations with initial conditions.			
13	Interconnection of Courses	This course is interconnected with Mathematics 1, Mathematics 2, Linear Algebra, Optimisation Methods, Data Science, Machine Learning.			
14.	Detailed Description of the Teaching and Working Methods for the Course	Interactive teaching – 45 hours and interactive tutorials – 30 hours, individual work through projects.			
15.	Total Available Time Allocation	Lectures: 45 hours; Tutorials: 30 hours; Individual work, homework and projects: 105 hours.			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours	30 hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	25 hours	
18	Conditions for Signature	Regular attendance, in accordance with the UIST Rulebook			
19	Assessment Method				
	19.1.	Tests: Points		5	
	19.2.	Seminar paper/project, written and oral presentation: points		10	
	19.3.	Final exam: points		85	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	In accordance with the university procedures and quality control methods			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year

		1.	Edwin K. P. Chong, Stanislaw H. Zak	An Introduction to Optimization, 2nd edition	Wiley Interscience Series , John Wiley and Sons, inc	2001
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Mark French	Fundamentals of Optimization. Methods, Minimum Principles and Applications for Making Things better	Springer	2018
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	2D and 3D Techniques for Concept Art			
2.	Code	CNS15U01			
3.	Study program	Computer Science and Engineering 4-year/Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" Ohrid			
5.	Degree (first, second, third cycle)	First cycle – elective course from the university list			
6.	Academic year / semester	Year	3	semester	V
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Yane Bakreski			
9.	Language of instruction	English, Macedonian			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	The aim of the course is to introduce the fundamental concepts and creative processes for 2D and 3D visualization. Students begin with modeling, texturing, lighting, scene setup, and rendering of three-dimensional scenes, and then continue to refine these scenes using 2D painting software such as Adobe Photoshop. The course allows students to develop all their creative ideas, translating them into stunning imaginary landscapes. The final result is the creation of complex, photorealistic scenes, which play a significant role in the computer gaming and film industries, among others.			

12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• Advanced 3D Modeling Techniques
		• Modeling a Three-Dimensional Environment
		  o Using references
		  o 3D sketching
		  o Modeling complex three-dimensional objects
		  o Creating natural elements
		• Texturing and Shading
		  o Introduction to different types of shaders and their basic characteristics
		  o Creating textures for virtual 3D models using images
		  o Mapping
		  o Preparing textures in Adobe Photoshop
		  o Advanced texturing techniques (mapping complex objects, alpha mapping)
		• Lighting a 3D Scene
		  o Lighting with Physical Sky
		  o Creating atmosphere volume using Arnold
		  o Image-based lighting			

		• Rendering for 2D – Creating Render Passes • Importing and Compositing Render Passes in Adobe Photoshop • 2D Painting in Adobe Photoshop and Finalizing the Digital Image		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Exercises: 30 hours; Independent study, projects, homework: 105 hours = Total of 180 hours		
15.	Total Available Time Allocation			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, and teamwork	30 hours
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments	35 hours
		17.2.	Independent tasks	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students are required to ensure regular attendance in accordance with the UIST regulations.		

19	Assessment Method		
	19.1.	Tests	50 points
	19.2.	Seminar paper/project, written and oral presentation	40 points
	19.3.	Activity and participation	10 points

20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Compliance with UIST control procedures	

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Les Pardew and Don Seegmiller	Mastering Digital 2D and 3D Art	Thomson Course Technology	2004
		2.	David Franson	2D Artwork and 3D Modeling for Game Artists	Premier Press	2003
		3.				
	22.2.	Additional Literature				

		No.	Author	Title	Publisher	Year
		1.	Richard Lewis and James Luciana	Digital Media: An Introduction	Prentice Hall	2004
		2.	Paul Naas	Autodesk Maya 2014 Essentials: Autodesk Official Press	Sybex	2013
		3.	Andy Beane	3D Animation Essentials	John Wiley & Sons	2012

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Algorithms and Data Structures 1			
2.	Code	CSE13M02			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First-cycle studies – compulsory course			
6.	Academic year/semester	Year	2	semester	III
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Daniela Mechkaroska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Introduction to Programming, Object-Oriented Programming			
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives** • Introduce fundamental data structures and their applications. • Develop skills for implementing algorithms in Java. • Build understanding of searching, sorting, recursion, and complexity analysis. • Strengthen problem-solving through appropriate data structure selection. **Learning Outcomes** Students will be able to: • Explain and use basic data structures (arrays, stacks, queues, lists, trees). • Implement core algorithms in Java. • Apply searching and sorting methods effectively. • Analyze algorithm performance using Big-O notation. • Design and apply recursive solutions.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Unit 1: Introduction to Data Structures & ADTs** **Topics:** Data structures, ADTs, arrays, references. **Learning Outcomes:** Describe basic structures and implement simple array operations. **Unit 2: Algorithm Analysis & Complexity** **Topics:** Big-O, time/space complexity, best/average/worst case. **Learning Outcomes:** Analyze runtime and compare algorithm efficiency. **Unit 3: Stacks** **Topics:** Stack ADT, push/pop/peek, array & linked implementations.			

		Learning Outcomes: Implement stacks and apply them in basic problems. **Unit 4: Queues** **Topics:** FIFO, circular queues, linked queues. **Learning Outcomes:** Implement queues and explain their applications. **Unit 5: Linked Lists** **Topics:** Singly, doubly, circular lists. **Learning Outcomes:** Build and manipulate linked lists using references. **Unit 6: Recursion** **Topics:** Recursive functions, base cases, divide-and-conquer. **Learning Outcomes:** Design simple recursive solutions. **Unit 7: Basic Sorting Algorithms** **Topics:** Bubble, Selection, Insertion Sort. **Learning Outcomes:** Implement and compare basic sorting methods. **Unit 8: Advanced Sorting Algorithms** **Topics:** Merge Sort, Quick Sort, Radix Sort. **Learning Outcomes:** Apply advanced sorting and analyze performance. **Unit 9: Searching Algorithms** **Topics:** Linear search, binary search. **Learning Outcomes:** Implement and evaluate search methods. **Unit 10: Trees & Binary Search Trees (BSTs)** **Topics:** Tree structure, BST operations, traversals. **Learning Outcomes:** Implement BST insert/search/delete and traversals. **Unit 11: Hashing** **Topics:** Hash functions, collisions, chaining, probing. **Learning Outcomes:** Implement hash tables and discuss performance factors. **Unit 12: Introduction to Graphs** **Topics:** Graph basics, adjacency structures, DFS, BFS. **Learning Outcomes:** Represent graphs and perform DFS/BFS traversals.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	
	Other forms of activities	17.1.	Project assignments: hours	35 hours

17.		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students should ensure regular attendance at classes according to the regulations of UINT		
19	Assessment Method 10+10+80			
	19.1.	Tests: Points		10 points
	19.2.	Seminar paper/project, written and oral presentation: points		10 points
	19.3.	Final exam: points		80 points
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Monitoring of UINT control procedures	

22.

Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Robert Lafore	Data Structures and Algorithms in Java	Pearson	2017

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Robert Sedgewick & Kevin Wayne	Algorithms	Addison-Wesley	2011
2.	Steven S. Skiena	The Algorithm Design Manual	Springer	2020

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Algorithms and Data Structures 2			
2.	Code	CSE14M01			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First-cycle studies – compulsory course			
6.	Academic year/semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Daniela Mechkaroska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Object-Oriented Programming, Algorithms and Data Structures 1, Discrete Mathematics			
11.	Course Objectives (Competencies) and Learning Outcomes:	The course develops competencies in: • Advanced data structures (graphs, binary trees, BSTs). • Understanding and using nonlinear abstract data types. • Applying graph algorithms (DFS, BFS, shortest paths, MST). • Using hashing, hash tables, and collision-resolution methods. • Evaluating algorithms through time-complexity analysis and simulation. • Choosing suitable data structures and algorithms for complex problems. • Implementing advanced algorithms in practical laboratory settings. **Learning Outcomes** Upon completion, students will be able to: • Describe and use nonlinear data structures (graphs, trees, heaps). • Represent graphs using adjacency lists and matrices. • Apply and analyze DFS, BFS, Dijkstra, Bellman–Ford, Prim, and topological sort. • Build and manipulate binary trees, BSTs, and heaps. • Implement hashing techniques and evaluate hash table performance.			

		• Analyze advanced algorithms using time-complexity measures. • Conduct algorithm simulations and interpret performance results.
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Unit 1: Nonlinear Data Structures** **Content**: Linear vs. nonlinear structures; advanced ADTs. **Learning Outcomes:** Distinguish structure types; describe nonlinear ADTs. **Unit 2: Graph Basics & Representations** **Content:** Vertices, edges, paths, directed/undirected graphs; adjacency lists/matrices. **Learning Outcomes:** Explain graph terminology; represent graphs effectively. **Unit 3: Directed Acyclic Graphs (DAGs)** **Content:** DAG properties; topological ordering; applications. **Learning Outcomes:** Identify DAGs; perform topological sorting. **Unit 4: Graph Traversals** Content: DFS, BFS, connected components; traversal use cases. Learning Outcomes: Implement DFS/BFS; apply traversal to problem-solving. **Unit 5: Minimum Spanning Trees** **Content:** MST concepts; Prim's algorithm. **Learning Outcomes:** Construct MSTs; implement and analyze Prim's method. **Unit 6: Shortest Path Algorithms** **Content:** Weighted graphs; Dijkstra; Bellman–Ford. **Learning Outcomes:** Implement shortest-path algorithms; compare efficiency. **Unit 7: Trees and Binary Search Trees** **Content:** Binary trees, BST operations, tree traversals, binary heaps. **Learning Outcomes:** Build and manipulate trees/BSTs; apply heap operations. **Unit 8: Hashing and Hash Tables** **Content:** Hash functions; collision handling; load factor. **Learning Outcomes:** Implement hash tables; evaluate hashing performance. **Unit 9: Advanced Algorithm Techniques** **Content:** Simulation; performance evaluation; time-complexity computation. **Learning Outcomes:** Analyze advanced algorithms; interpret performance results. **Unit 10: Practical Implementation & Lab Applications** **Content:** Applying algorithms in real tasks; problem-solving with datasets; integrated exercises. **Learning Outcomes:** Implement complete solutions using multiple structures; apply algorithms in real-world scenarios.
13	Interconnection of Courses	

14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students should ensure regular attendance at classes according to the regulations of UINT		

19	Assessment Method 10+10+80		
	19.1.	Tests: Points	10 points
	19.2.	Seminar paper/project, written and oral presentation: points	10 points
	19.3.	Final exam: points	80 points

20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Monitoring of UINT control procedures	

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser	Data Structures and Algorithms in Java	Wiley	2014
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year

		1.	Steven S. Skiena	The Algorithm Design Manual	Springer	2020
		2.	Thomas H. Cormen, Charles Leiserson, Ronald Rivest, Clifford Stein	Introduction to Algorithms (CLRS)	MIT Press	2009

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Art and Creativity			
2.	Code	ICS16U03			
3.	Study program	Computer Science and Engineering – 4 years / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First			
6.	Academic year / semester	Year	3	semester	6
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Mersiha Ismajloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	/			
11.	Course Objectives (Competencies) and Learning Outcomes:	Gaining knowledge of the general elements and concepts of art history and becoming familiar with the development of artistic disciplines throughout history. Over time, art has been classified in various ways—from the medieval distinction between liberal arts and mechanical arts, to the modern distinction between fine and applied arts, as well as many contemporary definitions that describe art as a manifestation of human creativity.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	The concept, tasks, and methods of art history. Artistic disciplines and artistic techniques. A chronological overview of artistic production throughout prehistoric and historical periods—the art of prehistory, the creativity of the protohistoric period, the art of ancient civilizations, the creations of antiquity and the Middle Ages, the eras of the Renaissance and Baroque, and modern and contemporary artistic production, including authors, works, and aesthetic achievements.			
13	Interconnection of Courses	/			
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures, exercises, visits to exhibitions and sites significant to the History of Art.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	35	
17.	Other forms of activities	17.1.	Project assignments: hours	30	
		17.2.	Independent tasks: hours	35	
		17.3.	Home study – tasks	35	

18	Conditions for Signature		Students are required to attend classes regularly in accordance with the UIST regulations.			
19	Assessment Method					
	19.1.	Tests: Points			2x40=80	
	19.2.	Seminar paper/project, written and oral presentation: points			10	
	19.3.	Final exam: points			10	
20	Assessment criteria (points/grade)			**up to 50 points**	**5 (five) (F)**	
				from 51 to 60 points	6 (six) (E)	
				from 61 to 70 points	7 (seven) (D)	
				from 71 to 80 points	8 (eight) (C)	
				from 81 to 90 points	9 (nine) (B)	
				from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching		Compliance with UIST control procedures			
22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Hugh Honour & John Fleming	The Visual Arts: A History (revised 7th edition)	Pearson	2010
		2.	Giorgio Vasari, Julia Conway Bondanella, Peter Bondanella	The Lives of the Artists (Oxford World's Classics	Oxford University Press; Reissue edition	2008
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Lessig, Lawrence	Free Culture: How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity	The Penguin Press	2004
		2.				
		3.				

No. 35

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Art of Graphic Design			
2.	Code	CNS14U02			
3.	Study program	Computer Science and Engineering 4-year/Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" Ohrid			
5.	Degree (first, second, third cycle)	First cycle – elective course from the university list			
6.	Academic year / semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Yane Bakreski			
9.	Language of instruction	English, Macedonian			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	The aim of the course is to familiarize students with the form and function of graphic design. Students study the theory and principles of basic design, that is, the principles of visual perception and their application in visual communication, combined with knowledge and skills on how to shape a two-dimensional surface. Upon completion of this course, students will be able to convey ideas through visualization and design.			

12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• Introduction to Graphic Design as an Artistic Expression
		• Perception
		  o Gestalt principles of visual organization
		  o Semiotics
		  o Figure–ground
		• Vector Graphics – Application of Vector Graphics in Graphic Design
		• Dynamic Balance
		  o Visual dynamics
		  o Achieving visual balance through the use of symmetry and asymmetry
		• Gestalt Principles of Organization in Visual Perception and Their Application in Logo Design
		  o Wholeness and constituent parts
		  o Gestalt principles (figure–ground, similarity, proximity, continuation, closure)
		  o Study of the logo design process
		• Typography and Layout of Text-Based Content
		  o History and development of written communication			

<table>
<tr><td></td><td></td><td colspan="3">History and development of typefaces, types of fonts, and their characteristics
Use of typography (font size, line length, leading, formatting)
Conceptual and graphic design of a book
Design of a Dynamic, Unified Publication
Visual balance
Size and proportions
Visual rhythm
Structure creation
Conceptual and graphic design of a brochure
Web Design
Introduction to the basic elements of web design
Basic principles of user interface organization
Usability concepts in user interface interaction
Website structure creation
Website design and prototype development</td></tr>
<tr><td>13</td><td>Interconnection of Courses</td><td colspan="3"></td></tr>
<tr><td>14.</td><td>Detailed Description of the Teaching and Working Methods for the Course</td><td colspan="3">Lectures: 45 hours; Exercises: 30 hours;
Independent study, projects, homework: 105 hours = Total of 180 hours</td></tr>
<tr><td>15.</td><td>Total Available Time Allocation</td><td colspan="3"></td></tr>
<tr><td rowspan="3">16.</td><td rowspan="3">Forms of Teaching Activities</td><td>16.1.</td><td>Lectures – theoretical instruction</td><td>45 hours</td></tr>
<tr><td>16.2.</td><td>Exercises (laboratory, auditory), seminars, and teamwork</td><td>30 hours</td></tr>
<tr><td>16.3.</td><td>Practical work: hours</td><td></td></tr>
<tr><td rowspan="3">17.</td><td rowspan="3">Other forms of activities</td><td>17.1.</td><td>Project assignments</td><td>35 hours</td></tr>
<tr><td>17.2.</td><td>Independent tasks</td><td>35 hours</td></tr>
<tr><td>17.3.</td><td>Home study – tasks</td><td>35 hours</td></tr>
<tr><td>18</td><td>Conditions for Signature</td><td colspan="3">Students are required to ensure regular attendance in accordance with the UIST regulations.</td></tr>
<tr><td rowspan="4">19</td><td colspan="4">Assessment Method</td></tr>
<tr><td>19.1.</td><td colspan="2">Tests</td><td>50 points</td></tr>
<tr><td>19.2.</td><td colspan="2">Seminar paper/project, written and oral presentation</td><td>40 points</td></tr>
<tr><td>19.3.</td><td colspan="2">Activity and participation</td><td>10 points</td></tr>
<tr><td rowspan="6">20</td><td colspan="2" rowspan="6">Assessment criteria (points/grade)</td><td>up to 50 points</td><td>5 (five) (F)</td></tr>
<tr><td>from 51 to 60 points</td><td>6 (six) (E)</td></tr>
<tr><td>from 61 to 70 points</td><td>7 (seven) (D)</td></tr>
<tr><td>from 71 to 80 points</td><td>8 (eight) (C)</td></tr>
<tr><td>from 81 to 90 points</td><td>9 (nine) (B)</td></tr>
<tr><td>from 91 to 100 points</td><td>10 (ten) (A)</td></tr>
<tr><td>21.</td><td colspan="2">Method for monitoring the quality of teaching</td><td colspan="2">Compliance with UIST control procedures</td></tr>
<tr><td>22.</td><td colspan="4">Literature</td></tr>
</table>

	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Amy Arnston	Graphic Design-Basics (6th edition)	Wadsworth Publishing	2006
		2.	Richard Lewis and James Luciana	Digital Media: An Introduction	Prentice Hall	2004
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.				
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Artificial Intelligence			
2.	Code	CSE17M02			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering -			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle - compulsory subject			
6.	Academic year / semester	Year	4	semester	VII
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Aleksandar Karadimche, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Introduction to programming, Object-oriented programming			
11.	Course Objectives (Competencies) and Learning Outcomes:	The course develops competencies in understanding the principles, methods, and architectures used to build intelligent computer systems. Students learn how to represent complex problems using appropriate knowledge structures and how to select suitable AI techniques—including search algorithms, logic-based reasoning, probabilistic models, machine learning, and agent architectures—to solve them effectively. Emphasis is placed on understanding how intelligent agents perceive, reason, and act in dynamic environments. Upon completion, students will be able to model real-world problems, design AI-driven solutions, evaluate algorithmic performance, and apply foundational AI methods across domains such as planning, decision-making, and learning. Learners will also gain insight into the limitations, ethical considerations, and societal implications of modern AI technologies.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Introduction to Artificial Intelligence: Knowledge Representation. Introduction to search. Uninformed search. Informed search. Contrastive search. Condition fulfillment. Logical agents and predicate calculus. Probability reasoning. Knowledge representation. Learning about artificial systems. Additional units explore machine learning principles, natural language processing, and visual object recognition, enabling students to understand how AI systems learn, interpret language, and perceive the world. Each chapter includes learning outcomes focused on problem representation, algorithm selection, reasoning accuracy, and practical application. The course concludes with a review of real-world AI applications, emphasizing benefits, limitations, and ethical implications.			
13	Interconnection of Courses	/			

14.	Detailed Description of the Teaching and Working Methods for the Course	The course employs a combination of lectures, demonstrations, and practical exercises to build a solid understanding of Artificial Intelligence concepts and methods. Lectures introduce theoretical foundations, algorithms, and architectures, supported by visual explanations and real-world examples. Practical sessions allow students to implement search algorithms, reasoning models, and machine learning techniques using appropriate tools and programming environments. Problem-solving workshops encourage experimentation with AI methods for tasks such as classification, language processing, and perception. Group activities and discussions help students explore ethical issues and evaluate AI applications in everyday life. Independent study, reading assignments, and short coding tasks reinforce theoretical learning, while continuous feedback ensures students can apply AI techniques to model, analyze, and solve complex problems.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	35 hours
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	45 hours
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UINT regulations.		
19	Assessment Method	80 + 15 + 5		
	19.1.	Tests: Points		80 points
	19.2.	Seminar paper/project, written and oral presentation: points		15 points
	19.3.	Final exam: points		5 points
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the UINT quality control procedures		
22.	Literature			

	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Stuart Russell, Peter Norvig	Artificial Intelligence: a modern approach, 4th ed.	Pearson Series in Artificial Intelligence	2020
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Wolfgang Ertel	Introduction to Artificial Intelligence	Springer International Publishing, 2nd edition	2017
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Blockchain Development			
2.	Code	CSE18E03			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective course from the unit			
6.	Academic year/semester	Year	4	semester	VIII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Jovan Karamachoski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives** Students will be able to: 1. Understand basic cryptography and blockchain concepts. 2. Explain how blockchain supports secure digital currencies. 3. Analyze blockchain platforms and consensus mechanisms. 4. Develop simple blockchain applications and smart contracts. 5. Evaluate security, privacy, legal, and economic aspects of cryptocurrencies. **Learning Outcomes** Students will be able to: 1. Describe cryptocurrencies and digital money basics. 2. Explain cryptography and hashing in blockchain. 3. Understand blockchain structure, transactions, and ledgers. 4. Compare major blockchain platforms. 5. Explain core consensus mechanisms. 6. Build simple smart contracts/dApps. 7. Use wallets and understand mining basics. 8. Identify blockchain security and privacy issues. 9. Recognize risks and regulations. 10. Analyze real blockchain applications.			

12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Unit 1: Introduction to Digital Money and Cryptocurrencies** **Text Content:** History of money, digital currencies, basic crypto concepts. **Learning Outcomes:** Understand the evolution and core ideas of cryptocurrencies. **Unit 2: Cryptographic Foundations** **Text Content:** Symmetric/asymmetric cryptography, keys, and hash functions. **Learning Outcomes:** Explain basic cryptographic primitives used in blockchain. **Unit 3: Blockchain Basics** **Text Content:** Blocks, transactions, ledgers, decentralization. **Learning Outcomes:** Describe how blockchain works and its main components. **Unit 4: Consensus Mechanisms** **Text Content:** Byzantine Generals Problem, PoW, PoS. **Learning Outcomes:** Understand the purpose of consensus and compare methods. **Unit 5: Bitcoin System** **Text Content:** Bitcoin structure, transactions, mining. **Learning Outcomes:** Explain Bitcoin operations and security principles. **Unit 6: Blockchain Platforms** **Text Content:** Ethereum, Cosmos, Hyperledger. **Learning Outcomes:** Identify key features of major blockchain platforms. **Unit 7: Smart Contracts and dApps** **Text Content:** Smart contract principles, decentralized applications. **Learning Outcomes:** Build simple smart contracts and basic dApp logic. **Unit 8: Scalability and Performance** **Text Content:** Scalability issues, Layer 2 solutions. **Learning Outcomes:** Describe the main blockchain scalability challenges. **Unit 9: Wallets and Mining** **Text Content:** Digital wallets, private keys, mining basics. **Learning Outcomes:** Use wallets securely and understand mining processes. **Unit 10: Security and Privacy** **Text Content:** Attacks, risks, privacy issues. **Learning Outcomes:** Identify blockchain security threats and privacy concerns. **Unit 11: Regulation and Economics** **Text Content:** Legal frameworks, regulation, economic impact. **Learning Outcomes:** Understand regulatory and economic aspects of cryptocurrencies. **Unit 12: Applications and Emerging Trends** **Text Content:** Blockchain in finance, business, IoT, and AI. **Learning Outcomes:** Recognize key real-world applications and future trends.

13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	35 hours	
18	Conditions for Signature	Students should ensure regular attendance at classes according to the regulations of UINT			
19	Assessment Method 10+10+80				
	19.1.	Tests: Points		10 points	
	19.2.	Seminar paper/project, written and oral presentation: points		10 points	
	19.3.	Final exam: points		80 points	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching		Monitoring of UINT control procedures		

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Pedro Franco	Understanding Bitcoin: Cryptography, Engineering, and Economics	Wiley	2015

		2.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder	Bitcoin and Cryptocurrency Technologies	Princeton University Press	2016
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Satoshi Nakamoto	Bitcoin: A Peer-to-Peer Electronic Cash System	Online Source	2006
		2.	Imran Bashir	Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications	Packt Publishing	2018

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Business Information Systems			
2.	Code	CSE15E08			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering -			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle – elective subject from the unit			
6.	Academic year / semester	Year	3	semester	V
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Associate Prof. Aleksandar Karadimche, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Software Engineering			
11.	Course Objectives (Competencies) and Learning Outcomes:	The course aims to develop competencies in understanding, evaluating, and managing business information systems that support organizational operations and decision-making. Students will gain knowledge of the types and characteristics of information systems used in companies, including transactional, managerial, and strategic systems. They will learn criteria for selecting, implementing, and integrating business information systems, as well as analytical tools for assessing organizational needs and aligning technology with business goals. Upon successful completion, students will be able to analyze existing systems, recommend suitable solutions, evaluate integration challenges, and support the design of efficient information flows. Learners will also develop skills in assessing system performance, identifying improvement opportunities, and understanding the ethical and managerial implications of information systems.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Fundamentals of the business information system (BIS), New approaches to information systems and architectures, Introduction of a business information system, Data, information management and information security, Conceptual and logical aspects of business information systems, Components of the business information system, Operational aspects of the business information system (installation), Integration of individual business information systems, Master data management, Business intelligence systems and the business information system, BI and the supplier system, Information delivery via Web 2.0., Advanced technologies in BI.			
13	Interconnection of Courses	Business Information Systems is required for the Information Systems Management			

14.	Detailed Description of the Teaching and Working Methods for the Course	The course uses a combination of lectures, interactive discussions, and hands-on laboratory work to develop practical competence in modern software engineering. Lectures introduce core concepts, models, and methodologies, while guided problem-solving sessions strengthen analytical thinking and application of theory. Laboratory exercises provide experience with tools for requirements analysis, modeling, implementation, version control, testing, and project management. A structured team project simulates real-world development, requiring students to apply process models, design modular solutions, evaluate alternatives, implement components, integrate subsystems, and conduct thorough testing. Independent study, supervised tutorials, and regular feedback ensure continuous learning, while collaborative activities promote teamwork, communication, and professional software engineering practices.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	35 hours
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	45 hours
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UINT regulations.		
19	Assessment Method	80 + 15 + 5		
	19.1.	Tests: Points		80 points
	19.2.	Seminar paper/project, written and oral presentation: points		15 points
	19.3.	Final exam: points		5 points
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the UINT quality control procedures		
22.	Literature			

	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Thomas Chesney, George Reynolds, Ralph Stair,	Principles of Information Systems, Thirteenth Edition	Cengage Learning edition	2020
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Boris Shishkov	Designing Enterprise Information Systems: merging enterprise modelling and software specification	Springer	2020
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Business intelligence and analytics			
2.	Code	CSE18E07			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering -			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First cycle – elective subject from the unit			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Aleksandar Karadimche, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Probability and statistics			
11.	Course Objectives (Competencies) and Learning Outcomes:	The course provides students with an introduction to the fundamental concepts and tools needed to understand the role of modern business analytics in organizations, apply basic business analytics tools in a spreadsheet environment, and communicate with analytics professionals to effectively use and interpret analytical models and results to make better business decisions. A balanced, holistic approach is required in viewing business analytics from the descriptive, predictive, and prescriptive perspectives that define the discipline.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Business and Analytics Fundamentals. Descriptive Analytics: Data visualization, descriptive statistical measures, probability distributions, data modeling, sampling and estimation, and statistical inference. Predictive Analytics: Develop approaches to applying trend and regression analysis, forecasting, introductory data mining techniques, building and analyzing spreadsheet models, and simulation and risk analysis. Prescriptive Analytics: Models and applications for linear, integer, and nonlinear optimization. Optimization Analysis focuses on what-if and sensitivity analysis in optimization. Decision Making: Tools and techniques for decision analysis.			
13	Interconnection of Courses	/			
14.	Detailed Description of the Teaching and Working Methods for the Course	The course combines lectures, case studies, and hands-on analytical exercises to develop practical skills in business intelligence and analytics. Lectures introduce key concepts, data models, and decision-making frameworks, supported by examples from real organizational settings. Practical sessions focus on using analytical tools to perform data preparation, descriptive and predictive analytics, visualization, and model evaluation. Students work with datasets to apply forecasting, optimization, and simulation techniques presented in the			

		textbook. Case studies and group discussions encourage critical thinking about how analytics informs strategic and operational decisions. Independent study, guided readings, and short projects reinforce theoretical knowledge. Continuous feedback, problem-solving activities, and collaborative tasks ensure students can translate analytical results into actionable business insights.				
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours				
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours		
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours		
		16.3.	Practical work: hours	35 hours		
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours		
		17.2.	Independent tasks: hours	35 hours		
		17.3.	Home study – tasks	45 hours		
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UINT regulations.				
19	Assessment Method 80 + 15 + 5					
	19.1.	Tests: Points		**80 points**		
	19.2.	Seminar paper/project, written and oral presentation: points		**15 points**		
	19.3.	Final exam: points		**5 points**		
20	Assessment criteria (points/grade)		**up to 50 points**	**5 (five) (F)**		
			from 51 to 60 points	6 (six) (E)		
			from 61 to 70 points	7 (seven) (D)		
			from 71 to 80 points	8 (eight) (C)		
			from 81 to 90 points	9 (nine) (B)		
			from 91 to 100 points	10 (ten) (A)		
21.	Method for monitoring the quality of teaching	Following the UINT quality control procedures				
22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	James R. Evans	Business Analytics Methods, Models, and Decisions, 3rd edition, Global Edition	Pearson	2020
		2.				
		3.				

	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann	Business Analytics, Fourth Edition	Cengage Learning, Inc.	2021
		2.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Business Law			
2.	Code	MIR14U01			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective course from the university list			
6.	Academic year/semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Ivan Bimbilovski, Ph.D.			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course objectives** By the end of the semester, students will be able to: • Understand and explain the role of law in economic relations and business transactions; • Understand and explain the functioning of the free market and entrepreneurship, as well as the legal protection provided to them; • Understand the role of the judiciary in protecting personal freedom and private property; • Apply analytical and logical reasoning as a technique for making business decisions; • Understand and apply business ethics and social responsibility.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course content:** The course is primarily a legal program adapted to the specifics of the Digital Business Informatics study program and to the needs of students in this field. It addresses topics and issues such as: the legal and constitutional foundations of business operations; the role of courts and alternative dispute resolution in business activities; liability for damages arising from the use of purchased products; intellectual property in business operations; the use of the Internet, social media, and privacy in business activities; criminal offenses and computer crime in business operations; business ethics; consumer protection; securities; the role of banks in business operations; creditors' rights, bankruptcy, and liquidation;			

		conducting business through an intermediary or authorized representative; labor law and employment relations; company law and how to establish and manage a small enterprise; investor protection; insider trading; corporate governance; property rights and other real rights in business operations; insurance; environmental protection in business activities; the role of international law in the global economy; and related topics.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	35 hours	
18	Conditions for Signature	Students should ensure regular attendance at classes according to the regulations of UINT			
19	Assessment Method				
	19.1.	Tests: Points		40 points	
	19.2.	Seminar paper/project, written and oral presentation: points		20 points	
	19.3.	Final exam: points		40 points	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching		Monitoring of UINT control procedures		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year

		1.	Roger LeRoy Miller	Business Law Today, the Essentials: Text and Summarized Cases	Cengage Learning	2016
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Alix Adams, Stephanie Caplan, Graeme Lockwood	Law for Business Students, 11th Edition	Pearson	2020
		2.	Fred S. Steingold	Legal Guide for Starting and Running a Small Business, 15th Edition	Nolo	2017

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Cloud Computing			
2.	Code	CSE17M01			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	4	semester	VII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Aneta Naumoska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Course Objectives (Competencies): Cloud computing has evolved into one of the most important computing models, enabling information, software, and other shared computing and information resources to be delivered over the Internet as on-demand services. The aim of this course is to familiarize students with current practices in cloud computing. Upon completion of the course, students will understand the fundamental principles and technologies of cloud computing, the various architectures of these technologies, as well as their practical implementation and application in everyday use of cloud technologies and services. The course covers a wide range of information technologies, including networking, data storage, computer applications, security, and other relevant aspects related to cloud computing.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Course Content: • Peer-to-peer systems; • **Infrastructure-as-a-Service (IaaS)**; • **Platform-as-a-Service (PaaS)**; • **Software-as-a-Service (SaaS)**; • Different cloud models: public cloud, private cloud, hybrid cloud; • Application of various data processing paradigms in the cloud; • Parallel programming and architecture; • **MapReduce programming**; • Distributed computing models and technologies; • Global state of a group of processes; • Communication protocols and process coordination;			

		• Logical clocks; • Runs and cuts; causal history; • Concurrency; • Consensus protocols; • Virtualization; • Data storage systems; • Fault detection and recovery in cloud systems; • Gossip algorithm; • Security and privacy of cloud data.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19	Assessment Method 80 + 15 + 5			
	19.1.	Tests: Points		80
	19.2.	Seminar paper/project, written and oral presentation: points		15
	19.3.	Attendance and participation		5
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST		
22.	Literature			

	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	D. C. Marinescu	Cloud Computing, Theory and Practice	Elsevier Inc	2013
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	M. Jelasity	Gossip-based Protocols for Large-scale Distributed Systems	PhD Dissertation	2013

1.	Title of the teaching subject	Cryptography			
2.	Code	CSE17E01			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First-cycle studies – compulsory course			
6.	Academic year/semester	Year	4	semester	VII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Ninoslav Marina, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives (Competencies)** By the end of the course, students will be able to: 1. Understand fundamental cryptographic concepts and their applications. 2. Explain basic cryptographic designs and algorithms. 3. Apply cryptographic algorithms in practical encryption, decryption, and authentication tasks. 4. Recognize and use basic authentication and integrity mechanisms. **Learning Outcomes** After completing the course, students will be able to: 1. Describe security threats and the role of cryptography. 2. Use and analyze classical ciphers. 3. Explain symmetric algorithms such as DES and AES. 4. Apply RSA, ElGamal, and Diffie–Hellman. 5. Understand elliptic curve cryptography.			

		6. Use hash functions and MACs for authentication. 7. Explain digital signatures and certificates. 8. Identify practical uses of cryptographic protocols (e.g., TLS, secure email). 9. Recognize cryptographic attacks and basic cryptanalysis concepts. 10. Understand quantum cryptography and post-quantum challenges.
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Unit 1: Introduction to Security and Cryptography** **Text Content:** Computer security, information security, network security; cryptography, cryptosystems, cryptanalysis; threats, attacks, security services, mechanisms. **Learning Outcomes:** Understand basic security concepts and explain the role of cryptography in protecting information. **Unit 2: Classical Cryptosystems** **Text Content:** Substitution ciphers (Caesar, monoalphabetic, Playfair, Hill, polyalphabetic), one-time pad; transposition ciphers such as Rail Fence. **Learning Outcomes:** Apply classical ciphers and recognize their weaknesses. **Unit 3: Symmetric Cryptography – Concepts and Algorithms** **Text Content:** Symmetric-key fundamentals; stream vs. block ciphers; DES structure; AES structure and operation. **Learning Outcomes:** Distinguish symmetric cipher types and describe DES and AES. **Unit 4: Public-Key Cryptography – Fundamentals** **Text Content:** Public-key principles; RSA algorithm; ElGamal encryption; key management basics. **Learning Outcomes:** Explain RSA and ElGamal and understand the importance of key management. **Unit 5: Key Exchange and Elliptic Curve Cryptography** **Text Content:** Diffie–Hellman key exchange; elliptic curve cryptography (ECC) concepts and applications. **Learning Outcomes:** Perform Diffie–Hellman key exchange and describe ECC benefits. **Unit 6: Authentication Requirements and Methods** **Text Content:** Authentication needs; MAC functions; hash functions; SHA-1, MD5; security of MACs and hashes. **Learning Outcomes:** Use hash and MAC functions and understand their security properties. **Unit 7: Authentication Protocols and Digital Signatures** **Text Content:** Authentication protocols; digital signatures; standards; certificates; PKI; PGP. **Learning Outcomes:** Explain digital signature mechanisms and apply certificate-based authentication. **Unit 8: Secure Protocols and Applications** **Text Content:** Use of cryptography in practice; TLS/SSL basics; secure email; secure storage; applied cryptographic primitives. **Learning Outcomes:** Identify real-world systems that rely on cryptography and analyze their components. **Unit 9: Cryptographic Attacks and Cryptanalysis Basics** **Text Content:** Attack types: brute force, statistical, chosen plaintext/ciphertext attacks; vulnerabilities of classical and modern systems.

		Learning Outcomes: Describe common cryptographic attacks and evaluate algorithm strength. **Unit 10: Quantum Cryptography and Post-Quantum Threats** **Text Content:** Quantum cryptography; Quantum Key Distribution (QKD); quantum computer impact on cryptanalysis; post-quantum considerations. **Learning Outcomes:** Understand QKD principles and assess how quantum computing affects classical cryptography.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	35 hours	
18	Conditions for Signature	Students should ensure regular attendance at classes according to the regulations of UINT			
19	Assessment Method 30+20+50				
	19.1.	Tests: Points		30 points	
	19.2.	Seminar paper/project, written and oral presentation: points		20 points	
	19.3.	Final exam: points		50 points	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching		Monitoring of UINT control procedures		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year

		1.	Douglas R Simson	Cryptography: Theory and Practice	CRC Press	2006
		2.	Menezes, Van Oorschot & Vanstone	Handbook of Applied Cryptography	CRC Press	2001
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	William Stallings	Cryptography and Network Security	Pearson Education	2006

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Communication Theory			
2.	Code	CSE14E04			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Ninoslav Marina, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Mathematics 1			
11.	Course Objectives (Competencies) and Learning Outcomes:	Course Objectives (Competencies): The objective of this course is to provide a comprehensive analysis of analog and digital information transmission from transmitter to receiver. By the end of the course, students will be able to understand: 1. The concepts of analog and digital communication systems and the methods of transmitting analog and digital signals through such systems; 2. The performance of communication systems in the presence of noise, based on appropriate evaluation methods; 3. Analog and digital modulation techniques applied to ensure more efficient and secure information transmission; 4. Fundamental properties and concepts from the field of information theory.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Course Content: 1. Communication Systems and Signals – A detailed overview of the analog and digital components of a communication system. Definition of analog and digital data and analog and digital signals, and their mutual conversion, depending on the specifications of the communication system. 2. Performance of Communication Systems – Definition of signal gain and loss during transmission through the system. Study of			

		various devices used to improve communication within the system with respect to the type of transmitted signal. Definition of different types of noise that degrade the signal at various stages of the communication system. Signal-to-noise ratio and its evaluation. Optimal utilization of bandwidth among multiple users. Different types of signal propagation and antenna types in wireless environments. 3. Modulation and Encoding Techniques – Modulation techniques based on amplitude, frequency, and phase for analog data transmitted using analog signals. Modulation and encoding techniques for digital data transmitted using analog signals. Encoding techniques for analog data transmitted using digital signals. Definition of spread spectrum techniques that provide increased transmission security by reducing the signal-to-noise ratio. 4. Fundamentals of Information Theory – Definition of information and its unit, entropy, uncertainty, and information rate of communication; redundancy; the relationship between system capacity and the information contained in a message; Shannon's theorem.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19	Assessment Method			
	19.1.	Tests: Points		45
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		45
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)

			from 61 to 70 points		7 (seven) (D)
			from 71 to 80 points		8 (eight) (C)
			from 81 to 90 points		9 (nine) (B)
			from 91 to 100 points		10 (ten) (A)
21.	Method for monitoring the quality of teaching		Following the quality control procedures of UIST		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Hancock J.C.	An Introduction to the Principles of Communication Theory	McGraw-Hill	1961
		2.	Simon Hay Kin	Communication Systems	Wiley, 4th Edition	2000
		3.	Singh.R.P. & Sapre. S.D	Communication Systems: Analog & Digital	3rd Edition, Tata McGraw-Hill	2012
	22.2.	Additional Literature			
		No.	Author	Title	Publisher	Year
		1.	Swartz	Information Transmission, Modulation and Noise	Mcgraw-Hill 4th Edition	1990
		2.	Taub & Schilling	Principals of Communication System	McGraw-Hill	1991
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Computer graphics			
2.	Code	CSE15E04			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering -			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle – elective subject from the unit			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Associate Prof. Aleksandar Karadimche, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Object-oriented programming, Mathematics 1			
11.	Course Objectives (Competencies) and Learning Outcomes:	Introduction to theoretical foundations and concepts of 2D and 3D computer graphics, geometric modeling, and basic transformations. Upon completion of the course, the student is expected to demonstrate knowledge of the theoretical foundations and concepts of 2D and 3D computer graphics, to use the OpenGL library and graphics software packages for practical implementation of computer graphics problems. Additionally, students will acquire the skills to fully understand what WebGL really is and how it really works.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Historical development and division of computer graphics. Elements of computer graphics. Hardware and software for geometric modeling. Two-dimensional graphics. Basic routines for drawing shapes. Matrix representation of objects and transformations. Geometric representation of points and lines; Homogeneous coordinates; Point transformation, translation, rotation, scaling, reflection; Fractal geometry; shading; Ray Tracing; GLUT basics; OpenGL Geometry, OpenGL Light and Material, Implementation of two-dimensional graphics. Three-dimensional graphics (3D). Introduction to WebGL, 3D graphics with WebGL, Application of computer graphics.			
13	Interconnection of Courses	/			
14.	Detailed Description of the Teaching and Working Methods for the Course	The course combines lectures, demonstrations, and hands-on laboratory sessions to provide a comprehensive understanding of computer graphics. Lectures introduce theoretical foundations, geometric modeling, 2D and 3D transformations, and shading			

		techniques, supported by historical context and practical examples. Laboratory sessions focus on applying concepts using OpenGL and graphics software, covering shape rendering, object transformations, lighting, materials, and ray tracing. Students gain practical experience implementing 2D and 3D graphics, exploring fractal geometry, and developing WebGL applications for interactive visualization. Problem-solving exercises, tutorials, and guided projects reinforce understanding of algorithms and computational techniques. Group discussions, case studies, and independent assignments encourage analytical thinking and creativity, enabling students to design, implement, and evaluate computer graphics solutions effectively in real-world contexts.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours	35 hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	45 hours	
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UINT regulations.			
19	Assessment Method 80 + 15 + 5				
	19.1.	Tests: Points		80 points	
	19.2.	Seminar paper/project, written and oral presentation: points		15 points	
	19.3.	Final exam: points		5 points	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Following the UINT quality control procedures			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year

		1.	David J. Eck	Introduction to Computer Graphics	Hobart and William Smith Colleges Geneva, NY Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License.	2021
		2.	John Kessenich, Graham Sellers, and Dave Shreiner	The OpenGL® Programming Guide (the "Red Book")	Addison-Wesley, 9th Edition	2016
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Lee Stemkoski and James Cona	Developing Graphics Frameworks with Java and OpenGL	CRC Press, 1st edition	2022
		2.	Steve Marschner and Peter Shirley	Fundamentals of computer graphics	CRC Press, 5th edition.	2021
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Computer Organization and Architecture			
2.	Code	CSE15M03			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First Cycle – Compulsory Course			
6.	Academic year / semester	Year	4	semester	V
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Atanas Hristov, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Discrete Mathematics			
11.	Course Objectives (Competencies) and Learning Outcomes:	Upon completion of the course, students will be able to: solve problems related to number systems, Boolean algebra, and computer arithmetic; learn the fundamentals of computer organization and its basic components, such as memory, processor, secondary storage, and cache memory. They will acquire knowledge of computer instructions and gain an understanding of instruction pipelining; the basics of superscalar architecture; multicore architectures; and basic-level parallelism. Additionally, students will develop a clear understanding of the differences between low-level and high-level programming, including their advantages and disadvantages. They will demonstrate knowledge of the fundamental relationships among components within computer architecture. Students will learn to write programs in Assembly language and integrate them into programs written in high-level languages. They will also learn how to install and use Linux on both physical and virtual computer machines.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Chapter 1:** Number Systems and Computer Arithmetic Content: Number systems, number representation, basic computer arithmetic. Learning Outcomes: Students will convert between number systems and apply basic arithmetic operations. **Chapter 2:** Computer Systems Organization Content: Evolution of computer systems and basic architectural components. Learning Outcomes:			

		Students will understand the structure and development of computer systems. **Chapter 3:** Memory and I/O Systems Content: Cache memory, main memory, secondary storage, and I/O organization. Learning Outcomes: Students will explain the memory hierarchy and I/O system roles. **Chapter 4:** Instruction Set Architecture Content: Instruction formats, addressing modes, and execution cycle. Learning Outcomes: Students will understand instruction structure and execution. **Chapter 5:** Processor Structure and Pipelining Content: Processor components and instruction pipelining concepts. Learning Outcomes: Students will describe processor organization and pipelining benefits. **Chapter 6**: Parallelism and Advanced Architectures Content: Instruction-level parallelism, superscalar and multicore architectures, Intel x86 overview. Learning Outcomes: Students will understand basic parallel execution concepts. **Chapter 7:** Control Unit and Assembly Programming Basics Content: Control unit fundamentals, NASM, Assembly basics, bitwise operations, subroutines. Learning Outcomes: Students will write simple Assembly programs and relate low-level to high-level programming.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	25
	Other forms of activities	17.1.	Project assignments: hours	20

17.		17.2.	Independent tasks: hours	30
		17.3.	Home study – tasks	30
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19	Assessment Method			
	19.1.	Tests: Points		40
	19.2.	Seminar paper/project, written and oral presentation: points		20
	19.3.	Final exam: points		40
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Following the quality control procedures of UIST	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	William Stallings	Computer Organization & Architecture	Prentice Hall	2019
2.	A. Carter	PC Assembly Language		2004
3.	Hennessy & Patterson	Computer Architecture: A Quantity Approach, 3rd ed	Morgan Kaufmann	2007

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	J.W. Lockwood	The art of assembly programming,	No Starch Press	2010
2.	Патерсон, Хенеси	Компјутерска организација и дизајн	Просветно дело, (Morgan Kaufmann)	2011

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Computer simulations in physics			
2.	Code	CSE11M04			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technology "St. Apostle Paul" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle – mandatory subject			
6.	Academic year / semester	Year	1	semester	I
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Associate Professor Rasim Salkoski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Upon completion of this course, students should: • Gain an understanding of the basic principles and concepts through simulations that govern classical mechanics (kinematics and dynamics) and acquire practical knowledge of their application in practical problems, • Demonstrate knowledge and understanding of: scientific phenomena, facts, laws, definitions, concepts, theories, scientific vocabulary, terminology, conventions, scientific quantities and their determination, goal-oriented assessments, scientific and technological applications, as well as their social, economic, and environmental consequences, • Demonstrate an understanding of physical reality through estimation, approximation, and mathematical modeling, and understand how a small number of fundamental physical principles underlie a vast variety of interconnected natural phenomena, • Think critically: naming something knowing that it is not something, • Handle precise and complex concepts to construct logical arguments, • Obtain relevant information from various sources and be think critically: naming something knowing that it is not that • manage precise and complex concepts to build logical arguments, • obtain relevant information from various sources and be able to communicate (both orally and in writing) scientific information in a clear, concise, and logical manner.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	This is an introductory physics calculation course, of course, with an emphasis on the fundamental concepts of Computer Simulation of Newtonian Mechanics and covers the following topics: • Physical Quantities and Vectors, • Computer Simulation of Kinematics in One and Two Dimensions, • Computer Simulation of Newton's Laws of Motion, •			

		Application of Newton's Laws, • Computer Simulation of Work and Kinetic Energy, • Computer Simulation of Potential Energy and Energy Conservation, • Computer Simulation of Momentum and Impulse and Rigid Body Rotation, • Elasticity and Fluids, • Computer Simulation of Newton's Theory of Gravitation, • Computer Simulation of Oscillations		
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 30 hours of lectures, supplemented with 30 hours of classroom exercises and 30 hours of laboratory exercises.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	30 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours lecture + 30 hours lab	
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments: hours	30 hours	
		17.2.	Independent tasks: hours	30 hours	
		17.3.	Home study – tasks	30 hours	
18	Conditions for Signature	Students should ensure regular attendance in classes according to the UINT regulations.			
19	Assessment Method				
	19.1.	Tests: Points		80 points	
	19.2.	Seminar paper/project, written and oral presentation: points		15 points	
	19.3.	Final exam: points		5 points	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Monitoring the procedures for UNIT control			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year

		1.	Randall Knight	Physics for Scientists and Engineers: A Strategic Approach	Pearson	2008
		2.	Martin Oliver Steinhauser	Computer Simulation in Physics and Engineering	Walter de Gruyter GmbH, Berlin	2013
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Serway and Jewett	Physics for Scientists and Engineers	Brooks/Cole	2008
		2.	Freedman and Young	Sears and Zemansky's University Physics	Pearson	2010
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Control theory			
2.	Code	CSE15E05			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering – FCSE			
5.	Degree (first, second, third cycle)	First cycle - optional subject from the unit			
6.	Academic year / semester	Year	3	semester	V
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Ninoslav Marina, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Students will be introduced to creating system controllers based on their mathematical model. In this course, they will learn how to use the MATLAB tool, as well as the auxiliary tool SIMULINK when creating and sketching the mathematical model. Interactive design of controllers with the Root-Locus method, as well as PI, PD, PID, Lead, Lag and Lead-Lag controllers.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Introduction to MATLAB. Introduction to Laplace and Inverse Laplace transform. Transfer function and model in state space. Creation of a mathematical model of electrical circuits, translational and rotational systems. Basic mathematical models of first and second order systems. Stationary errors. Stability in systems. Designing PID and Lead-Lag Compensator. Using SIMULINK to sketch the mathematical model of the system as well as its compensator.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures and 30 hours of exercises			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	35 hours	
18	Conditions for Signature	Students should attend classes regularly			

19	Assessment Method 10+10+80				
	19.1.	Tests: Points			10 points
	19.2.	Seminar paper/project, written and oral presentation: points			10 points
	19.3.	Final exam: points			80 points
20	Assessment criteria (points/grade)		up to 50 points		5 (five) (F)
			from 51 to 60 points		6 (six) (E)
			from 61 to 70 points		7 (seven) (D)
			from 71 to 80 points		8 (eight) (C)
			from 81 to 90 points		9 (nine) (B)
			from 91 to 100 points		10 (ten) (A)
21.	Method for monitoring the quality of teaching		Monitoring of UINT control procedures		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Norman Nise	Control Systems Engineering	Wiley & Sons	2011
		2.	Farid Golnaraghi	Automatic Control Sustems	Wiley	2009
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.				
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Creative Writing for Media			
2.	Code	ICS13U04			
3.	Study program	Computer Science and Engineering – 4 years / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First			
6.	Academic year / semester	Year	2	semester	III
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Ass. Prof. Mersiha Ismajloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	/			
11.	Course Objectives (Competencies) and Learning Outcomes:	The aim of this course is to demonstrate the significance of electronic media. Through this subject, students will have the opportunity to prepare for a successful career in media-related fields. The focus is placed on how media shape contemporary life.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Understanding the foundations of creative writing Exploring different forms of creative expression in the media Writing for television Writing for film Writing for radio Writing for online platforms Writing for journalism Exploring ethical challenges in media reporting Writing for advertising and marketing Understanding interactive storytelling and game narratives Creating branched stories and multiple possible endings for games Exploring the use of immersive storytelling in virtual reality and augmented reality Writing for social media			
13	Interconnection of Courses	/			
14.	Detailed Description of the Teaching and Working Methods for the Course	Method of oral presentation, method of independent work. Participation of experts in the field. Visits to institutions involved in media work.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours		45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours		30
		16.3.	Practical work: hours		35
	Other forms of activities	17.1.	Project assignments: hours		30

17.		17.2.	Independent tasks: hours	35
		17.3.	Home study – tasks	35
18	Conditions for Signature	Students are required to attend classes regularly in accordance with the UIST regulations.		
19	Assessment Method			
	19.1.	Tests: Points		2x40=80
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		10
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Compliance with UIST control procedures	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Norman J. Medoff, Barbara Kaye	Electronic Media: Then, Now, and Later	Routledge; 3rd edition	2017
2.	Natalie Fenton	New Media, Old News: Journalism And Democracy In The Digital Age	SAGE Publications Ltd; 1st edition	2009
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Lessig, Lawrence	Free Culture: How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity	The Penguin Press	2004
2.				
3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Creative Writing			
2.	Code	ICS16U04			
3.	Study program	Computer Science and Engineering – 4 years / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First			
6.	Academic year / semester	Year	3	semester	6
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Mersiha Ismajloska, PhD			
9.	Language of instruction	Macedonian and English			
10.	Prerequisites for Attending and Passing the Course	/			
11.	Course Objectives (Competencies) and Learning Outcomes:	An overview of the basic theories of story structure, followed by a structured set of exercises that enable students to develop fundamental story frameworks. The classes focus on dramatic action, conflict, character/characterization, and dialogue. The course will encourage students' creative potential and introduce them to creative writing techniques. It will also serve as an introduction to writing original poetry, short prose, and drama. As part of the course, students will read a selected corpus of literary works, which will acquaint them with literary conventions and practices. Students will learn to critically evaluate their own works and the works of other authors. They will also be introduced to opportunities for publishing their works and adapting them into computer games or animations. Students will become familiar with literary concepts, particularly the elements of poetry, prose, and drama. Students will use literary concepts to analyze texts by selected authors. Students will use literary concepts to write their own original manuscripts. By the end of the semester, students will have their own portfolio of texts. Students will apply literary concepts to critically evaluate the quality of their own manuscripts and those of others. Students will learn to assess texts according to criteria gained through creative writing workshops.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	What is creative writing as an academic discipline? Creative writing in the development of computer games and animations. Where do our own stories, poems, and writing goals fit? What is the personal, social, and political value of creative writing?			

		The difference between fiction and nonfiction. Study program / Portfolio Memoir / Short story Analysis of short stories / Summaries Short story writers / Workshop Introduction to writing poetry Introduction to writing fiction Introduction to dramatic writing "Reading" games – methods and practice of analyzing the formal components of games Approaches to analyzing games and players / Workshop Dramaturgy / Screenwriting Socio-cultural contexts – Analysis of social and cultural influences on games and animations Critical / creative writing Creative writing and the creative industries Working on a text for a computer game or animation Final portfolio		
13	Interconnection of Courses	/		
14.	Detailed Description of the Teaching and Working Methods for the Course	Short exercises and a combination of tasks to motivate students. Comparative–contrastive method. Creative writing exercises that use the adopted narrative concepts such as time, space, character, and ending. Lectures, workshops, guest lecturers.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	35
17.	Other forms of activities	17.1.	Project assignments: hours	30
		17.2.	Independent tasks: hours	35
		17.3.	Home study – tasks	35
18	Conditions for Signature	Students are required to attend classes regularly in accordance with the UIST regulations.		
19	Assessment Method			
	19.1.	Tests: Points		2x40=80
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		10
20	Assessment criteria (points/grade)		**up to 50 points**	**5 (five) (F)**
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)

<table>
<tr><td>21.</td><td colspan="3">Method for monitoring the quality of teaching</td><td colspan="3">Compliance with UIST control procedures</td></tr>
<tr><td rowspan="11">22.</td><td colspan="6">Literature</td></tr>
<tr><td rowspan="6">22.1.</td><td colspan="5">Mandatory Literature</td></tr>
<tr><td>No.</td><td>Author</td><td>Title</td><td>Publisher</td><td>Year</td></tr>
<tr><td>1.</td><td>Barthes, Roland</td><td>Introduction to the Structural Analysis of Narrative</td><td>Trans. Lionel Duisit. New Literary History: A Journal of Theory and Interpretation</td><td>1978</td></tr>
<tr><td>2.</td><td>Despain, Wends</td><td>Writing for Video Game Genres: From FPS to RPG</td><td>A K Peters/CRC Press.</td><td>2009</td></tr>
<tr><td>3.</td><td>Despain, Wendy</td><td>Professional Techniques for Video Game Writing</td><td>A K Peters/CRC Press</td><td>2008</td></tr>
<tr><td>4.</td><td>Ince, Steve</td><td>Writing for Video Games</td><td>Methuen Drama</td><td>2006</td></tr>
<tr><td rowspan="4">22.2.</td><td colspan="5">Additional Literature</td></tr>
<tr><td>No.</td><td>Author</td><td>Title</td><td>Publisher</td><td>Year</td></tr>
<tr><td>1.</td><td>Bal, Mieke</td><td>Narratology: Introduction to the Theory of Narrative</td><td>University of Toronto Press.</td><td>1985</td></tr>
<tr><td>2.</td><td>McCloud, Scott</td><td>Understanding Comics: The Invisible Art.</td><td>William Morrow.</td><td>1994</td></tr>
<tr><td>3.</td><td>Aristotle</td><td>Poetics</td><td>Penguin Classics</td><td>1997</td></tr>
</table>

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Cryptography			
2.	Code	CSE17E01			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First-cycle studies – compulsory course			
6.	Academic year/semester	Year	4	semester	VII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Ninoslav Marina, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives (Competencies)** By the end of the course, students will be able to: 1. Understand fundamental cryptographic concepts and their applications. 2. Explain basic cryptographic designs and algorithms. 3. Apply cryptographic algorithms in practical encryption, decryption, and authentication tasks. 4. Recognize and use basic authentication and integrity mechanisms. **Learning Outcomes** After completing the course, students will be able to: 1. Describe security threats and the role of cryptography. 2. Use and analyze classical ciphers. 3. Explain symmetric algorithms such as DES and AES. 4. Apply RSA, ElGamal, and Diffie–Hellman. 5. Understand elliptic curve cryptography. 6. Use hash functions and MACs for authentication. 7. Explain digital signatures and certificates. 8. Identify practical uses of cryptographic protocols (e.g., TLS, secure email). 9. Recognize cryptographic attacks and basic cryptanalysis concepts. 10. Understand quantum cryptography and post-quantum challenges.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Unit 1: Introduction to Security and Cryptography** **Text Content:** Computer security, information security, network security; cryptography, cryptosystems, cryptanalysis; threats, attacks, security services, mechanisms. **Learning Outcomes:** Understand basic security concepts and explain the role of cryptography in protecting information.			

		Unit 2: Classical Cryptosystems **Text Content:** Substitution ciphers (Caesar, monoalphabetic, Playfair, Hill, polyalphabetic), one-time pad; transposition ciphers such as Rail Fence. **Learning Outcomes:** Apply classical ciphers and recognize their weaknesses. **Unit 3: Symmetric Cryptography – Concepts and Algorithms** **Text Content:** Symmetric-key fundamentals; stream vs. block ciphers; DES structure; AES structure and operation. **Learning Outcomes:** Distinguish symmetric cipher types and describe DES and AES. **Unit 4: Public-Key Cryptography – Fundamentals** **Text Content:** Public-key principles; RSA algorithm; ElGamal encryption; key management basics. **Learning Outcomes:** Explain RSA and ElGamal and understand the importance of key management. **Unit 5: Key Exchange and Elliptic Curve Cryptography** **Text Content:** Diffie–Hellman key exchange; elliptic curve cryptography (ECC) concepts and applications. **Learning Outcomes:** Perform Diffie–Hellman key exchange and describe ECC benefits. **Unit 6: Authentication Requirements and Methods** **Text Content:** Authentication needs; MAC functions; hash functions; SHA-1, MD5; security of MACs and hashes. **Learning Outcomes:** Use hash and MAC functions and understand their security properties. **Unit 7: Authentication Protocols and Digital Signatures** **Text Content:** Authentication protocols; digital signatures; standards; certificates; PKI; PGP. **Learning Outcomes:** Explain digital signature mechanisms and apply certificate-based authentication. **Unit 8: Secure Protocols and Applications** **Text Content:** Use of cryptography in practice; TLS/SSL basics; secure email; secure storage; applied cryptographic primitives. **Learning Outcomes:** Identify real-world systems that rely on cryptography and analyze their components. **Unit 9: Cryptographic Attacks and Cryptanalysis Basics** **Text Content:** Attack types: brute force, statistical, chosen plaintext/ciphertext attacks; vulnerabilities of classical and modern systems. **Learning Outcomes:** Describe common cryptographic attacks and evaluate algorithm strength. **Unit 10: Quantum Cryptography and Post-Quantum Threats** **Text Content:** Quantum cryptography; Quantum Key Distribution (QKD); quantum computer impact on cryptanalysis; post-quantum considerations. **Learning Outcomes:** Understand QKD principles and assess how quantum computing affects classical cryptography.
13	Interconnection of Courses	
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours

16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students should ensure regular attendance at classes according to the regulations of UINT		
19	Assessment Method 30+20+50			
	19.1.	Tests: Points		30 points
	19.2.	Seminar paper/project, written and oral presentation: points		20 points
	19.3.	Final exam: points		50 points
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Monitoring of UINT control procedures		

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Douglas R Simson	Cryptography: Theory and Practice	CRC Press	2006
2.	Menezes, Van Oorschot & Vanstone	Handbook of Applied Cryptography	CRC Press	2001

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	William Stallings	Cryptography and Network Security	Pearson Education	2006

Attachment No. 3		Subject program from the first cycle of studies			
1.	Title of the teaching subject	Data engineering			
2.	Code	CSE13M04			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First Cycle – Compulsory Course			
6.	Academic year/semester	Year	2	semester	III
7	Course Workload Expressed in ECTS Credits	6 ECTS Credits			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Ljubinka Sandjakoska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	· Students will be introduced to the basic concepts, processes, and tools of data engineering. · To be trained in data collection and integration, modeling, preliminary data analysis, as well as effective communication in a company with data teams · Students will gain an understanding of the modern data ecosystem and the role that data engineers, data scientists, and data analysts play in this ecosystem (differences in roles and tasks of different data processing teams)			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. What is Data Engineering? - Definition and evolution of data engineering - Key players in data engineering - Responsibilities and skills of a data engineer 2. The Data Engineering Ecosystem - Overview of the Data Engineering Ecosystem - Data Types - Understanding Different Types of File Formats - Data Sources - Data Processing Languages - Working with Different Data Sources and Types - Overview of Data Repositories - Data Warehouses, Data Marts, and Data Lakes - ETL, ELT, and Data Pipelines - Data Integration Platforms - Foundations of Big Data and its Impact on Data Engineering - Basic Big Data Processing Tools: Hadoop, HDFS, Hive, and Spark.			

		3. Data Engineering Lifecycle - Data Platform Architecture - Factors for Selecting and Designing Data Warehouses - Security and the Importance of Data Security - How to Collect and Import Data - Data Wrangling and Data Wrangling Tools - Data Querying and Analysis - Performance Tuning and Troubleshooting - Governance and Compliance				
13	Interconnection of Courses	NA				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Tutorials: 30 hours; Independent preparation, projects, homework: 105 hours Total time 180 hours				
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours				
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 h		
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 h		
		16.3.	Practical work: hours			
17.	Other forms of activities	17.1.	Project assignments: hours	35 h		
		17.2.	Independent tasks: hours	35 h		
		17.3.	Home study – tasks	35 h		
18	Conditions for Signature	Students should attend classes regularly in accordance with the UIST regulations				
19	Assessment Method					
	19.1.	Tests: Points		80		
	19.2.	Seminar paper/project, written and oral presentation: points		20		
	19.3.	Final exam: points		100		
20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)			
		from 51 to 60 points	6 (six) (E)			
		from 61 to 70 points	7 (seven) (D)			
		from 71 to 80 points	8 (eight) (C)			
		from 81 to 90 points	9 (nine) (B)			
		from 91 to 100 points	10 (ten) (A)			
21.	Method for monitoring the quality of teaching	Follow UIST Quality Assurance Procedures				
22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Joe Reis, Matt Housley	Fundamentals of Data Engineering: Plan and Build Robust Data Systems, 1st Edition	O'Reilly Media	2022

		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.				
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Data Science			
2.	Code	CSE18M03			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First			
6.	Academic year/semester	Year	IV	semester	VIII
7	Course Workload Expressed in ECTS Credits	6 ECTS Credits			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Ljubinka Sandjakoska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	NA			
11.	Course Objectives (Competencies) and Learning Outcomes:	• Students to gain knowledge about what data science is and in which domains it is applicable. • Students to be competent in creating data models and analyzing them. • To enable students to process data to extract knowledge/value for a company. • To enable students to continue the concept of "data engineering" and to be able to make the difference between modern tasks of data engineering and data science.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Chapter 1: Introduction to Data Science** **Units** 1.1 **What Is Data Science?** • Definitions and scope • Interdiscip ry nature: statistics, computing, domain expertise 1.2 **The Data Science Lifecycle** • Problem definition • Data collection and preparation • Modeling and evaluation • Deployment and monitoring 1.3 **Roles in Data Science** • Data analyst, data engineer, data scientist • Skills and competencies 1.4 **Applications of Data Science** • Industry examples: finance, health, energy, marketing, social sciences **Learning Outcomes** • **LO1.1:** Define data science and explain its interdisciplinary character. • **LO1.2:** Describe the stages of the data science lifecycle. • **LO1.3:** Identify key roles and skills within data science teams.			

		• **LO1.4:** Recognize major application domains of data science. • amentals • Virtual environments and package management **Learning Outcomes** • **LO2.1:** Use standard data science programming languages and tools. • **LO2.2:** Work in notebook-based and IDE-based development environments. • **LO2.3:** Apply essential libraries for data manipulation, visualization, and modeling. • **LO2.4:** Use version control to manage and collaborate on data science projects. **Chapter 3: Descriptive Statistics in Data Science** **Units** 3.1 **Types of Data** • Numerical, categorical, ordinal 3.2 **Measures of Central Tendency and Spread** • Mean, median, mode • Variance, standard deviation, percentiles 3.3 **Exploring Data Distributions** • Histograms, boxplots, density plots • Shape of distributions (skewness, kurtosis) 3.4 **Summarizing Multivariate Data** • Covariance, correlation • Cross-tabulation **Learning Outcomes** • **LO3.1:** Identify data types and select appropriate descriptive measures. • **LO3.2:** Compute and interpret measures of central tendency and variability. • **LO3.3:** Visualize and describe data distributions. • **LO3.4:** Summarize relationships between multiple variables. **Chapter 4: Statistical Inference** **Units** 4.1 **Sampling and Sampling Distributions** • Random sampling, central limit theorem 4.2 **Confidence Intervals** • For means, proportions, and differences 4.3 **Hypothesis Testing** • Null and alternative hypotheses • p-values, significance levels, effect size 4.4 **Common Statistical Tests** • t-test, chi-squared test, ANOVA **Learning Outcomes** • **LO4.1:** Explain sampling concepts and the importance of sampling distributions. • **LO4.2:** Construct and interpret confidence intervals. • **LO4.3:** Formulate and test statistical hypotheses.

		• **LO4.4:** Apply and interpret standard inferential statistical tests. **Chapter 5: Unsupervised Learning** **Units** 5.1 **Clustering Methods** • k-means, hierarchical clustering, DBSCAN 5.2 **Dimensionality Reduction** • PCA (Principal Component Analysis) • t-SNE, UMAP 5.3 **Association Rule Learning** • Apriori, FP-growth • Market-basket analysis 5.4 **Evaluation of Unsupervised Models** • Silhouette score • Cluster validity indices **Learning Outcomes** • **LO5.1:** Apply clustering algorithms and interpret their outputs. • **LO5.2:** Use dimensionality reduction techniques to simplify high-dimensional data. • **LO5.3:** Discover associations and patterns using rule-learning methods. • **LO5.4:** Evaluate the quality of unsupervised learning models. **Chapter 6: Regression Analysis** **Units** 6.1 **Simple Linear Regression** • Model formulation • Parameter estimation 6.2 **Multiple Regression** • Multicollinearity • Feature selection 6.3 **Model Diagnostics** • Residual analysis • Overfitting, underfitting 6.4 **Advanced Regression Methods** • Regularization (Lasso, Ridge) • Polynomial regression **Learning Outcomes** • **LO6.1:** Build and interpret simple linear regression models. • **LO6.2:** Develop multiple regression models with appropriate predictors. • **LO6.3:** Diagnose regression models and evaluate their assumptions. • **LO6.4:** Apply regularization and advanced regression techniques. **Chapter 7: Supervised Learning** **Units** 7.1 **Classification Methods** • Logistic regression, k-NN • Decision trees, random forests • Support vector machines

		7.2 **Model Training and Validation** • Train/test split • Cross-validation • Performance metrics 7.3 **Neural Networks (Basic Concepts)** • Perceptrons • Activation functions 7.4 **Model Deployment Basics** • Saving and loading models • Simple workflow automation **Learning Outcomes** • **LO7.1:** Implement classification algorithms and evaluate their performance. • **LO7.2:** Use proper validation techniques to assess generalization. • **LO7.3:** Explain the basics of neural network classifiers. • **LO7.4:** Prepare trained models for deployment in simple applications. **Chapter 8: Network Analysis** **Units** 8.1 **Graph Theory Fundamentals** • Nodes, edges, adjacency matrices 8.2 **Network Measures** • Degree, centrality, clustering coefficient 8.3 **Community Detection** • Modularity-based methods • Spectral clustering 8.4 **Applications of Network Analysis** • Social networks • Biological networks • Knowledge graphs **Learning Outcomes** • **LO8.1:** Represent real-world systems using graphs. • **LO8.2:** Compute and interpret key network metrics. • **LO8.3:** Identify communities and structure within networks. • **LO8.4:** Apply network analysis methods to real-world datasets. **Chapter 9: Recommender Systems** **Units** 9.1 **Basics of Recommendation** • Content-based filtering • Collaborative filtering 9.2 **Similarity Measures** • Cosine similarity, Pearson correlation 9.3 **Matrix Factorization Methods** • SVD, latent factor models 9.4 **Evaluation of Recommender Systems** • Precision, recall • RMSE, MAE **Learning Outcomes** • **LO9.1:** Explain core concepts and types of recommender systems.

		• **LO9.2:** Compute similarity measures for item and user recommendations. • **LO9.3:** Apply matrix factorization for building recommendation models. • **LO9.4:** Evaluate recommender system performance using standard metrics.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Tutorials: 30 hours; Independent preparation, projects, homework: 105 hours Total time 180 hours			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments: hours	35	
		17.2.	Independent tasks: hours	35	
		17.3.	Home study – tasks	35	
18	Conditions for Signature	Students should attend classes regularly in accordance with the UIST regulations			
19	Assessment Method				
	19.1.	Tests: Points	80		
	19.2.	Seminar paper/project, written and oral presentation: points	20		
	19.3.	Final exam: points	100		
20	Assessment criteria (points/grade)	**up to 50 points**	**5 (five) (F)**		
		from 51 to 60 points	6 (six) (E)		
		from 61 to 70 points	7 (seven) (D)		
		from 71 to 80 points	8 (eight) (C)		
		from 81 to 90 points	9 (nine) (B)		
		from 91 to 100 points	10 (ten) (A)		
21.	Method for monitoring the quality of teaching	Follow UIST Quality Assurance Procedures			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher
		1.	Joel Grus	Data Science from Scratch, 2nd Edition	O'Reilly Media, Inc. ISBN: 9781492041085

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Data Visualization			
2.	Code	CSE16E05			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Dijana Capeska Bogatinoska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives (Competencies):** • Students will learn to program in R and use R for effective data analysis. • Students will learn to install and configure software necessary for statistical programming environment. • Students will learn statistical computing which includes programming in R, reading data in R, accessing R packages, writing R functions, debugging, profiling R code, and organizing and commenting R code. • Students will learn how to access and obtain data from the web, from APIs, from databases, etc. They will also learn the basics of data cleaning and how to make data "tidy". Tidy data significantly accelerates the data analysis process. The fundamentals needed for collecting, cleaning, and sharing data will be covered. • Students will study basic exploratory techniques for summarizing data. These techniques are typically applied before formal modeling begins and can help in developing more complex statistical models. Exploratory techniques are also important for eliminating or confirming potential hypotheses. • Students will learn in detail about visualization systems in R as well as some of the basic principles of constructing data graphics. Some common multivariate statistical techniques used for visualizing high-dimensional data will also be covered.			

		• Students will also learn the principles of data visualization, as well as visualization tools for presentation and publication.		
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course Content:** 1. Introduction. Covers the basics to get started with R. (Installing R, Writing code / Setting your working directory, R overview and history, data types, reading tabular data, subsetting, vectorized operations) 2. Programming with R – control structures and functions, Scoping Rules. 3. Loop functions (lapply, apply, mapply, tapply, split) and debugging tools in R. 4. Simulation and profiling - str function, Generating random numbers, Simulating a linear model, Random sampling. 5. Getting and cleaning data - finding data and reading different file types (raw and processed data, downloading files, reading local files, reading Excel files, reading XML, reading JSON, using data.table, reading data from the web). 6. Getting and cleaning data Part 2 (Subsetting and sorting, summarizing data, creating new variables). 7. Getting and cleaning data Part 3 (Reshaping data, managing Data Frames with dplyr, merging data, editing text variables, working with dates, data resources). 8. Exploratory data analysis Part 1 (Principles of analytical graphics, exploratory graphics, plotting systems in R, basic plotting system in R, Graphical devices in R). 9. Exploratory data analysis Part 2 (Graphical devices in R, Lattice plotting system, plotting with ggplot2). 10. Graphical representations of very high-dimensional data (clustering and dimension reduction techniques). 11. Case studies in exploratory data analysis. 12. Principles of data visualization. 13. Visualization for presentation and publication; visualization tools.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30

17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19	Assessment Method			
	19.1.	Tests: Points		45
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		45
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Following the quality control procedures of UIST	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Roger D. Peng	R Programming for Data Science	Lean Publishing	2019
2.	Roger D. Peng	Exploratory Data Analysis with R	Lean Publishing	2015
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	H. Wright	Introduction to Scientific Visualization	Springer	2007
2.				
3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Databases 1			
2.	Code	CSE13M03			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	2	semester	III
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Dijana Capeska Bogatinoska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Course Objectives (Competencies): • Students will become familiar with the basic concepts of working with databases, methods for their modeling and implementation. • Students will acquire knowledge about the nature of Database Management Systems (DBMSs), including their structure, design and evaluation. • Students will acquire knowledge about the normalization process of relational databases. • Students will acquire knowledge about the role of query languages (Structured Query Language (SQL)) standards in current and future development of DBMSs. • Students will be able to model databases and will know how to practically apply the SQL standard for creation, maintenance and manipulation of relational databases.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course Content:** 1. Introduction to databases, basic concepts of database systems, historical development. (What is a database? Database tables, records in tables, types of database management systems, relational database management systems) 2. Database Management Systems (DBMS) and architectures. 3. Real-world model, semantic modeling: Entity-Relationship model (E-R model (ER diagram modeling, entities, attributes, relationships, cardinality)), Extended Entity-Relationship model (EE-R model), UML object model (class diagram). 4. Relational database model (data models, levels of abstraction, relational model concepts, informal and formal			

		definitions, relation integrity constraints, referential integrity, keys, naming conventions, data normalization) 5. Relational database design, transformation of E-R and EER models into relational model. 6. Formal query languages: relational algebra and relational calculus. 7. Introduction to SQL (Structured Query Language). (What is SQL? Purpose of SQL, Who should learn SQL? What are the dialects of SQL? Data Definition Language, Data Manipulation Language, Data Control Language). 8. SQL syntax, Data types in SQL, SQL operators, SQL expressions. 9. SQL - Commands and operations for data manipulation. 10. SQL - Commands and operations for data definition. 11. SQL Views, SQL Queries and Sub Queries. 12. Constraints, triggers, stored procedures, indexes, analytical queries. 13. Normal forms: first, second, third, Boyce-Codd, fourth and fifth normal form. Normalization process. 14. Practical examples. 15. Relational databases versus NoSQL databases.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19	Assessment Method			
	19.1.	Tests: Points		45
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		45
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)

				from 61 to 70 points	7 (seven) (D)	
				from 71 to 80 points	8 (eight) (C)	
				from 81 to 90 points	9 (nine) (B)	
				from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching			Following the quality control procedures of UIST		
22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	R. Elmasri, S. Navathe	Fundamentals of Database Systems	Addison Wesley (7th Edition)	2011
		2.	Thomas M. Connolly and Carolyn E. Begg	Database Systems: A Practical Approach to Design, Implementation and Management	Addison Wesley (5th Edition)	2009
		3.	H. Garcia-Molina, J. Ullman, J. Widom	Database Systems: The Complete Book	Prentice Hall (2nd Edition)	2008
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Abraham Silberschatz, Henry Korth , S. Sudarshan	Database System Concepts	Fifth Edition, McGraw-Hill	2005
		2.	Raghu Ramakrishnan, Johannes Gehrke	Database Management Systems	McGraw-Hill, Science Engineering	2005
		3.	Carlos Coronel, Steven Morris and Peter Rob	Database Systems: Design, Implementation and Management	Course Technology; (9 edition)	2009

No. 63

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Databases 2			
2.	Code	CSE16M02			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Dijana Capeska Bogatinoska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives (Competencies):** This course explores NoSQL databases as a solution for modern big data challenges. Students will master MongoDB as the primary document-oriented database, including advanced querying, aggregation, indexing, replication, and sharding. The course also provides practical exposure to other NoSQL types (key-value, column-oriented, and graph databases), enabling students to understand when and why to use each type. Students will learn to make informed database selection decisions based on data structure, scalability needs, and specific use cases. **Competencies:** • Master MongoDB design, development, optimization, and deployment (replication and sharding) • Understand and apply basic operations in Redis, Cassandra, and Neo4j • Analyze and compare NoSQL databases with relational databases • Select appropriate database solutions for specific business requirements and use cases			

12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course Content:** 1. Introduction to NoSQL databases: History and evolution, Big Data challenges, NoSQL vs SQL comparison, Overview of NoSQL types (key-value, document, column-oriented, graph databases). CAP theorem, BASE vs ACID properties, Eventual consistency. 2. Introduction to MongoDB: MongoDB architecture and ecosystem, Installation and configuration, JSON/BSON documents, Collections and databases, MongoDB Compass and Shell, Document-oriented data model. 3. MongoDB CRUD Operations: Create operations (insertOne, insertMany), Read operations (find, findOne), Update operations (updateOne, updateMany, replaceOne), Delete operations (deleteOne, deleteMany), Working with embedded documents and arrays. 4. MongoDB Advanced Queries: Query operators (and, $or, $not, comparison operators), Array operators (all, elemMatch),Elementoperators(elemMatch), Element operators (elemMatch),Elementoperators(exists, $type), Regular expressions and text search, Projection and field selection, Sorting, limiting, and pagination. 5. MongoDB Aggregation Framework: Aggregation pipeline concept, Pipeline stages (match, $group, $project, $sort, $limit, $skip), Advanced stages (lookup, $unwind, $addFields, $facet), Aggregation operators and expressions, Practical analytics and reporting examples. 6. MongoDB Indexing and Performance Optimization: Index types (single field, compound, multikey, text, geospatial), Index creation and management, Query optimization with explain(), Covered queries, Index strategies and best practices, Performance monitoring. 7. MongoDB Replication: Replica sets architecture, Primary, secondary, and arbiter nodes, Automatic failover and election, Read preferences and write concerns, Replica set configuration and deployment, High availability patterns. 8. MongoDB Sharding: Horizontal scaling concepts, Shard keys selection and strategies, Chunks and distribution, Sharded cluster architecture (mongos, config servers, shards), Zone sharding, Configuration and management, When to shard. 9. Key-Value Databases: Introduction to key-value model and use cases, Redis architecture and installation, Redis data types (strings, lists, sets, hashes), Basic operations and commands, Caching and session management, Comparison with MongoDB, When to use key-value stores. 10. Column-Oriented Databases: Introduction to column-family model, Apache Cassandra architecture, CQL (Cassandra Query Language), Keyspaces and column families, Data modeling in Cassandra, Time-series and IoT applications, Comparison with MongoDB, When to use column-oriented databases. 11. Graph Databases: Introduction to graph model (nodes, edges, properties), Neo4j architecture and installation, Cypher query language, Creating nodes and relationships, Pattern matching and

		traversals, Social networks and recommendation systems, Comparison with MongoDB, When to use graph databases. 12. Distributed Computing and Advanced Concepts: Map-Reduce paradigm, Distributed computing principles, Partitioning strategies, Consistency models, Replication strategies across different NoSQL types, Backup and disaster recovery. 13. Database Selection and Best Practices: Decision framework for choosing databases, Comparative analysis matrix (data model, scalability, consistency, performance), Polyglot persistence patterns, Real-world case studies, Migration strategies, Security and monitoring best practices.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19	Assessment Method 30+20+50			
	19.1.	Tests: Points		30
	19.2.	Seminar paper/project, written and oral presentation: points		20
	19.3.	Final exam: points		50
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST		
22.	Literature			

	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Eric Redmond; Jim R. Wilson.	Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement.	Pragmatic Bookshelf.	2012
		2.	Shannon Bradshaw; Eoin Brazil; Kristina Chodorow	MongoDB: The Definitive Guide, 3rd Edition	O'Reilly Media	2019
		3.	Pramod J. Sadalage; Martin Fowler	NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence	Addison-Wesley Professional	2012
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Kyle Banker; Peter Bakkum; Shaun Verch; Douglas Garrett; Tim Hawkins	MongoDB in Action, 2nd Edition	Manning Publications	2016
		2.	Josiah L. Carlson	Redis in Action	Manning Publications	2013
		3.	Jeff Carpenter; Eben Hewitt	Cassandra: The Definitive Guide, 3rd Edition	O'Reilly Media	2020
		4.	Ian Robinson; Jim Webber; Emil Eifrem	Graph Databases, 2nd Edition	O'Reilly Media	2015

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Deep learning			
2.	Code	CSE18E01			
3.	Study program	Computer science and engineering 4 years studies, Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering, Faculty of Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First			
6.	Academic year/semester	Year	4	semester	VIII
7	Course Workload Expressed in ECTS Credits	6 ECTS Credits			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Ljubinka Sandjakoska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Machine learning			
11.	Course Objectives (Competencies) and Learning Outcomes:	Students will advance the concepts of machine learning and delve into the specifics of deep learning. The students will learn to create different types of deep learning architectures as well as master the ways of their optimization. Additionally, students should be able to solve practical problems by applying the methods applied in artificial neural networks with deep learning.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Overview of basic machine learning concepts; linear algebra and probability used for deep learning 2. Introduction to deep learning: where it starts, and what the trends are 3. Deep learning architectures • Deep Feedforward Networks • Convolutional Networks • Sequence Modeling: Recurrent and Recursive Nets • Autoencoders 4. Regularization 5. Optimization 6. Applications • Large-Scale Deep Learning • Computer vision • Speech Recognition • Natural Language Processing			
13	Interconnection of Courses				

14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Tutorials: 30 hours; Independent preparation, projects, homework: 105 hours Total time 180 hours			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 h	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 h	
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments: hours	35 h	
		17.2.	Independent tasks: hours	35 h	
		17.3.	Home study – tasks	35 h	
18	Conditions for Signature	Students should attend classes regularly in accordance with the UIST regulations			
19	Assessment Method				
	19.1.	Tests: Points		80	
	19.2.	Seminar paper/project, written and oral presentation: points		20	
	19.3.	Final exam: points		100	
20	Assessment criteria (points/grade)	**up to 50 points**	**5 (five) (F)**		
		from 51 to 60 points	6 (six) (E)		
		from 61 to 70 points	7 (seven) (D)		
		from 71 to 80 points	8 (eight) (C)		
		from 81 to 90 points	9 (nine) (B)		
		from 91 to 100 points	10 (ten) (A)		
21.	Method for monitoring the quality of teaching	Follow UIST Quality Assurance Procedures			

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Ian Goodfellow, Yoshua Bengio, Aaron Courville	Deep Learning	The MIT Press	2016
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Francois Chollet	Deep Learning with Python, Second Edition	Manning; 2nd edition	2021
		2.				

		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Democracy and technology			
2.	Code	MIR13U05			
3.	Study program	Computer Science and Engineering – 4 years / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	first			
6.	Academic year / semester	Year	2	semester	III
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Goran Shibakovski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	Students will be introduced to the concept of e-democracy, will be familiar with the models and the way in which the digital space opens up new opportunities for democratic participation. At the same time, they will be able to perceive the development of e-democracy in the world and recognize its challenges in the future. Also, students will acquire skills for implementing the tools for developing the concept of e-democracy in society.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Introduction to the subject. 2. Democracy and technology 3. Democratic eco-systems and models in the world. 4. Democracy and technology in Europe. Estonia as a model. 5. Effects and influence of ICT on the democratic process and development. 6. Participation and types of interaction in conditions of e-democracy. 7. Democracy, political organization and technology. 8. Democracy, state, society and technological changes. 9. Democracy and technology: security, privacy and trust. 10. Internet censorship and democracy. 11. Democracy and technology in developed and developing countries. 12. The state of democracy and technology in the Republic of Macedonia. 13. Challenges of democracy and development of technology in the world.			
13	Interconnection of Courses				

14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures and theoretical teaching, exercises, independent seminar work, teamwork in groups, project and independent assignments, home study, consultations.			
15.	Total Available Time Allocation	6 ECTS x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	35	
17.	Other forms of activities	17.1.	Project assignments: hours	35	
		17.2.	Independent tasks: hours	35	
		17.3.	Home study – tasks	35	
18	Conditions for Signature	Regular attendance at classes in accordance with UINT regulations			

19	Assessment Method		
	19.1.	Tests: Points	80
	19.2.	Seminar paper/project, written and oral presentation: points	20
	19.3.	Final exam: points	100

20	Assessment criteria (points/grade)	**up to 50 points**	**5 (five) (F)**
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Self-evaluation and mechanisms for monitoring the quality of teaching at UIST	

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Vaccari, Cristian; Augusto Valeriani	Ouside the Bubble: Social Media and Political Participation in Western Democracies	Oxford University Press	2021
		2.	Contucci, Perluigi, Andrea Omicini (Eds.)	The Future of Digital Democracy. An Interdisciplinary Approach.	Springer	2019
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year

		1.	Lindner, Ralf, Georg Aichholzer, Leonard Hennen	Prospects and Challenges of E-Publics, E-Participation and E-Voting.	Springer	2016
		2.	Vaccari, Cristian	Digital Politics in Western Democracies. A Comparative Study	Johns Hopkins University Press	2013
		3.				

1.	Title of the teaching subject	Digital Art			
2.	Code	CNS13U02			
3.	Study program	Computer Science and Engineering 4-year/Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" Ohrid			
5.	Degree (first, second, third cycle)	First cycle – elective course from the university list			
6.	Academic year / semester	Year	2	semester	III
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Yane Bakreski			
9.	Language of instruction	English, Macedonian			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	The aim of the course is to familiarize students with contemporary digital principles and practices applied in modern artistic production. The course focuses on digital photography, image editing, compositing and photomontage, vector graphics, and the basics of 3D modeling.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• Introduction to Digital Art o The artist and technology o Digital media and the new creative renaissance o Media specificity and the post-media condition o Categories in digital art • Digital Photography o Definition of the digital camera o Concepts and processes of photography o Seeing through the camera – content and composition • Image Editing o Introduction – digital image, image size, resolution, bit depth o Contrast and color o Compositing and photomontage • Vector Graphics o Basics of vector graphics o Introduction to the user interface and navigation of vector graphics software o Introduction to basic tools, creation of basic shapes and their modification o Advanced techniques for creating vector graphics (layers in vector graphics, use of brushes, use of the Pen Tool, use of alignment tools, use of color, gradients, and patterns)			

		○ Application of vector graphics in design • Basics of 3D Modeling ○ Introduction to the user interface and navigation of Autodesk Maya ○ Creation of basic geometric forms and their modification			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Exercises: 30 hours; Independent study, projects, homework: 105 hours = Total of 180 hours			
15.	Total Available Time Allocation				
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction		45 hours
		16.2.	Exercises (laboratory, auditory), seminars, and teamwork		30 hours
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments		35 hours
		17.2.	Independent tasks		35 hours
		17.3.	Home study – tasks		35 hours
18	Conditions for Signature	Students are required to ensure regular attendance in accordance with the UIST regulations.			

19	Assessment Method		
	19.1.	Tests	50 points
	19.2.	Seminar paper/project, written and oral presentation	40 points
	19.3.	Activity and participation	10 points

20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Compliance with UIST control procedures	

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Richard Lewis and James Luciana	Digital Media: An Introduction	Prentice Hall	2004
		2.	Christiane Paul	Digital Art	Thames & Hudson	2015
		3.	Barbara London, Jim Stone, and John Upton	Photography	Pearson	2016
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year

		1.	Les Pardew and Don Seegmiller	Mastering Digital 2D and 3D Art	Thomson Course Technology	2004
		2.	Andy Beane	3D Animation Essentials	John Wiley & Sons	2012
		3.				

Attachment No. 3	**First cycle study program**					
1.	Title of the course	Digital management				
2.	Code	CSE18E06				
3.	Study program / Faculty	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FKNI				
4.	Organizer of the study program (unit, i.e. institute, department, division)	University of Information Sciences and Technologies " St. Paul the Apostle " - Ohrid; Faculty of Computer Science and Engineering - FCNI				
5.	Degree (first, second, third cycle)	First cycle – elective subject from the unit				
6.	Academic year / semester	4/ VIII	7.	Number of ECTS credits	6	
8.	Teacher	Full Professor Dr. Ustiana Rechkoska-Shikoska				
9.	Prerequisites for enrolling in the course	Passed state matriculation examination				
10.	Objectives of the subject program (competencies): By completing this course, the student will have knowledge of the use of information systems in business settings (IT applications in business process management)					
11.	Course content: ● Management Information Systems ● Information and communication technologies and management strategies ● Database management systems ● Change management ● Information Technologies and Organization ● Architecture of information and communication systems ● Organizing and managing ICT functions ● ICT outsourcing management ● IT planning ● Knowledge management ● Risk management					
12.	Learning methods: This course is based on 45 hours of lectures, supplemented by 30 hours of exercises.					
13.	Total available fund on time	6 ECTS credits x 30 hours/credit = 180 hours				
14.	Allocation of available time	Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time of 180 hours				
15.	Forms of teaching activities	15.1.	Lectures - theoretical teaching	45 hours		
		15.2.	Exercises (laboratory, classroom), seminars, teamwork	30 hours		
16.	Other forms of activities	16.1.	Project tasks	35 hours		
		16.2.	Independent tasks	35 hours		

		16.3.	Home learning	35 hours
17.	Grading method 80 + 15 + 5			
	17.1.	Tests		80 points
	17.2.	Seminar paper/project (presentation: written and oral)		15 points
	17.3.	Activity and participation		5 points
18.	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
19.	Requirement for signature and passing the final exam		Students should ensure regular attendance at classes in accordance with the UINT regulations.	
20.	Language of instruction		English, Macedonian	
21.	Method of monitoring the quality of teaching		Monitoring UINT control procedures	

Literature

Required literature

	Serial number	Author	Title	Publisher	Year
22.1	1.	Kenneth Laudon, Jane Laudon	Management Information Systems: Managing the Digital Firm, (16 th Edition),	Pearson	20 20
		Carlos Coronel and Steven Morris	Database Systems: Design, Implementation, & Management", (13 th Edition)	Cengage Learning	2018

Additional literature

	Serial number	Author	Title	Publisher	Year
22.2	1.	Gregory Dess, Gerry McNamara, Alan Eisner, Seung-Hyun Lee	Strategic Management Text And Cases	McGraw-Hill Education	2020
	2.				
	3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Digital Music			
2.	Code	CSE17E10			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	4	semester	VII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Associate Prof. Atanas Hristov			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives (Competencies):** The objective of this course is to provide students with an understanding of all properties of sound and the various ways it can be manipulated and utilized. During the course, different sounds from the surrounding environment will be recorded, processed, and used to generate new electronic sounds (both analog and digital). The tasks include composing with these sounds, working with feedback, noise, and related elements using DSP, convolution, algorithms, simple mixing techniques, and more. The emphasis of the course is not primarily on technology, mathematics, or acoustics, although these aspects are explored to varying degrees. Instead, the main focus is on the sonic and compositional aspects.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course Content:** Concrete music, form, and content. Studio fundamentals, recording, musique concrète, representation, basics of Pro Tools software, and detailed structure. Feedback and continuity. Studio feedback, Pro Tools bussing, hardware and software delays, hardware filtering, software reverb, continuous/improvised structure. Noise and layering. Convolution, Peak software, noise generation, layering, software filters, noise reduction, other Pro Tools plug-ins, sound sculpting, and sound aesthetics. Synthesis, algorithms, and interaction (Max/MSP). Introduction to Max/MSP software – a graphical programming environment – algorithmic composition, sound synthesis, and interfaces for performance interaction. Sampling, remixing, and refinement. Borrowing sounds from other sources (or a single source, multiple sources, or personal compositions), using individual sounds to create new music or refine previous compositions. Serato and related applications.			

13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	30	
17.	Other forms of activities	17.1.	Project assignments: hours	25	
		17.2.	Independent tasks: hours	25	
		17.3.	Home study – tasks	25	
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST			
19	Assessment Method 80 + 15 + 5				
	19.1.	Tests: Points		80	
	19.2.	Seminar paper/project, written and oral presentation: points		15	
	19.3.	Attendance and participation		5	
20	Assessment criteria (points/grade)		**up to 50 points**	**5 (five) (F)**	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Hendrik Storstein Spilker	Digital Music Distribution: The Sociology of Online Music Streams	Routledge	2018
	22.2.	Additional Literature			
		No.	Author	Title	Publisher	Year

		1.	Alessandro Cipriani, Maurizio Giri	Electronic Music and Sound Design: Theory and Practice with Max/MSP - Vol. 1 2010	ConTempoNet	2010

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Digital signal and image processing			
2.	Code	CSE17E05			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technology "St. Apostle Paul" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective course from the unit			
6.	Academic year / semester	Year	4	semester	VII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Associate professor Rasim Salkoski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Upon completion of the course, the student is expected to master and use the basic methods and tools for signal and image processing.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Signal Presentation: overview of discrete-time signals in the time and frequency domain (Z-transform and Fourier representation, sampling and quantization, stochastic signals, and noise processing). Image Analysis: Introduction. Image processing. Image processing programs. Fundamentals of digital image processing. Image presentation. Image digitization. Programs for presenting digital images. Programs for image processing. Basic Matlab commands, elementary functions, variables, vectors, matrices. Image operations in Matlab. Supported image formats and their conversions. Processing, analysis, transformation, and visualization of images with Matlab. Statistical image processing. Basic operations for image processing. Image enhancement through filtering and segmentation. Fundamentals of image processing with Photoshop, main screen, basic tools, settings, resolutions, backgrounds, and units. Working with files. Tools for drawing, toning, focusing, and labeling. Transformations, effects, filters, and distortions. Color theory. Color models. Basic color correction. Creating special effects.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Tutorials: 30 hours; Independent study, projects, homework: 105 hours = total available time of 180 hours			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			

16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	40 hours
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students should ensure regular attendance in classes according to the UINT regulations.		

19	Assessment Method		
	19.1.	Tests: Points	80 points
	19.2.	Seminar paper/project, written and oral presentation: points	15 points
	19.3.	Final exam: points	5 points

20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Monitoring the procedures for UNIT control	

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Rafael Gonzalez and Richard Woods	Digital Image processing, 3rd edition	Prentice Hall	2008
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Chris Solomon, Toby Breckon	Fundamentals of Digital Image Processing:	A Practical Approach with Examples in Matlab Wiley	2011

		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Digital Signal Processing			
2.	Code	CSE15E02			
3.	Study program	Computer science and engineering 4 years studies, Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering, Faculty of Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – elective subject specific to faculty			
6.	Academic year / semester	Year	3	semester	V
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Ile Dimitrievski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Signals and Systems			
11.	Course Objectives (Competencies) and Learning Outcomes:	At the end of this course, the students will be able to understand the 1. Structures of Discrete time signals and systems. 2. Fast Fourier Transform Implementations, Frequency response and design of FIR and IIR filters. 3. Finite word length effect. 4. DSP Processor- TMS320C5X.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Overview of signals and systems – DFT–FFT using DIT and DIF algorithms – Inverse DFT-FFT using DIT and DIF algorithms – Applications – Circular convolution – MATLAB programs for DFT and FFT. 2. Design of analog filters using Butterworth and Chebyshev approximations – IIR digital filter design from analog filter using impulse invariance technique and bilinear transformations – MATLAB programs for IIR filters. 3. Linear phase response – Design techniques for FIR filters – Fourier series method and frequency sampling method – Design of Linear phase FIR filters using windows: Rectangular, Hanning and Hamming windows – Matlab programs for FIR filters. 4. Fixed point arithmetic – effect of quantization of the input data due to Finite word length. Product round off – need for scaling – Zero input limit cycle oscillations - Limit cycle oscillations due to overflow of adders – Table look up implementation to avoid multiplications. 5. Features of DSP processors – DSP processor packaging (Embodiments) – Fixed point Vs floating point DSP			

		processor data paths – Memory architecture of a DSP processor (Von Neumann – Harvard) – Addressing modes – pipelining – TMS320 family of DSPs (architecture of C5x).			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Tutorials: 30 hours; self - study, projects, homework assigments: 105 hours = Total time of 180 hours			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	30	
17.	Other forms of activities	17.1.	Project assignments: hours	25	
		17.2.	Independent tasks: hours	25	
		17.3.	Home study – tasks	25	
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UIST study rulebook.			
19	Assessment Method				
	19.1.	Tests: Points		90	
	19.2.	Seminar paper/project, written and oral presentation: points		10	
	19.3.	Final exam: points		90	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Follow UIST Quality Assurance Procedures			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	John G. Proakis and Dimitris C. Manolakis	Digital Signal Processing Principles, Algorithms and Applications	Pearson Education, Fourth edition,	2007

		2.	Alan V Oppenheim, Ronald W. Schafer	Discrete Time Signal Processing	Pearson education, 2nd edition	2007
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Hayes.M.H	Digital Signal Processing	Tata McGraw Hill, New Delhi, Edition	2009
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Diplomacy in modern times			
2.	Code	MIR14U08			
3.	Study program	Computer Science and Engineering – 4-year program / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	first			
6.	Academic year / semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Goran Shibakovski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	Diplomatic activities are increasingly supported by the Internet and information and communication technologies. This course focuses on the opportunities and challenges offered by digital tools for diplomatic activities. It also explores the policy implications inherent in these processes. Through this course, students will be equipped with the skills to review, describe and analyze the current and potential use of digital tools for diplomatic activities. Students will also be able to propose guidelines for the appropriate use of social media and other Internet tools in diplomatic activities, and in particular in the approximation of public diplomacy and the organization of effective diplomatic campaigns using such tools.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Introduction to the subject. 2. Research on diplomacy in modern times: emergence, actors, definitions and practices. 3. Diplomacy and problems in the Internet space. New topics and tools for diplomatic activities. 4. Diplomacy, security and policies in the Internet space. 5. Modern diplomacy: Political analysis and consular protection. 6. Modern diplomacy. Communication during a diplomatic crisis. Internet tools in negotiations. 7. The Internet and public diplomacy - Overview, algorithms and social media. 8. Internet management and information work. Data diplomacy. 9. Diplomacy and artificial intelligence. Understanding artificial intelligence. 10. Modern technologies, diplomats and the Ministry of Foreign Affairs. Diplomats in the Internet space. 11. Case studies of best practices of modern diplomacy in the world. 12. State, topics and challenges for the development of modern diplomacy in the Republic of Macedonia.			

		13. Diplomacy and international relations in modern times. Expansion of virtual space. Challenges facing diplomacy in modern times.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures and theoretical teaching, exercises, independent seminar work, teamwork in groups, project and independent assignments, home study, consultations.			
15.	Total Available Time Allocation	6 ECTS x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	35	
17.	Other forms of activities	17.1.	Project assignments: hours	35	
		17.2.	Independent tasks: hours	35	
		17.3.	Home study – tasks	35	
18	Conditions for Signature	Regular attendance at classes in accordance with UIST regulations			

19	Assessment Method			
	19.1.	Tests: Points	80	
	19.2.	Seminar paper/project, written and oral presentation: points	20	
	19.3.	Final exam: points	100	
20	Assessment criteria (points/grade)	**up to 50 points**	**5 (five) (F)**	
		from 51 to 60 points	6 (six) (E)	
		from 61 to 70 points	7 (seven) (D)	
		from 71 to 80 points	8 (eight) (C)	
		from 81 to 90 points	9 (nine) (B)	
		from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Self-evaluation and mechanisms for monitoring the quality of teaching at UIST		

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Marzouki, Meryem and Andrea Calderaro	Internet Diplomacy: Shaping the Global Politics of Cyberspace	Rowman & Littlefield	2022
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Manor, Ilan	The Digitalization of Public Diplomacy	Palgrave Macmillan	2019

		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Distributed Systems			
2.	Code	CSE17M01			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering -			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle - compulsory subject			
6.	Academic year / semester	Year	IV	semester	7
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Full Professor PhD Ustijana Rechkoska-Shikoska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Databases, Algorithms and Data Structures			
11.	Course Objectives (Competencies) and Learning Outcomes:	The student will acquire knowledge of Distributed Systems, Architectures of Distributed Systems; Processes, Communications; Naming, Synchronization; Distributed Databases – DDB, Distributed Database Management Systems – DDBMS, database design, object-oriented databases, UML language, transaction management and hybrid databases, and Security of Distributed Systems.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Object-oriented and service-oriented distributed systems; Objects, connectivity and databases. Relational database schema, redundancy, normalization, functional dependency. Distribution of data. Types of distributed databases – DDB. Distributed DBMS. Levels of working with distributed databases. Updating databases from multiple locations. Distributed information systems. Distributed transaction programs in information systems by locations. Threats in distributed systems. Characteristics and use of UML language. Logic and design of distributed databases. Object databases. Object-oriented database languages. Architecture and model of object databases. Operations over object databases. Deductive databases. Hybrid databases. Distributed algorithms. Data analysis and data mining, OLAP. Transact-SQL features in MS SQL Server, scalar and table-valued functions, stored procedures, triggers. Databases with management systems. LINQ to Entity Framework. Decentralized algorithms; Security of distributed systems; Authentication; Access control; DoS; Secure mobile code; Authorization management.			
13	Interconnection of Courses	/			
14.	Detailed Description of the Teaching and Working Methods for the Course	Oral presentation method, discussion method, independent work method, and method using technical teaching aids.			

15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	35 hours
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	45 hours
18	Conditions for Signature	Students should ensure regular attendance at classes in accordance with the UINT regulations.		

19	Assessment Method	80 + 10+ 0	
	19.1.	Tests: Points	80 points
	19.2.	Seminar paper/project, written and oral presentation: points	10 points
	19.3.	Final exam: points	10 points

20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the UINT quality control procedures	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Maarten van Steen, Andrew S. Tanenbaum	Distributed Systems, Third Edition, Version 3.01. 2017	CreateSpace Independent Publishing Platform	2017
2.	Garcia-Molina H., Ullman J. D., Widom., J.	Database Systems: The Complete Book	Prentice Hall	2009
3.	Ben-gan, I	Microsoft SQL Server 2008 T-SQL Fundamentals	Microsoft Press	2008

		4.	Calvert, C. ; Kulkarni, D.	Essential LINQ	Addison-Wesley	2009
	22.2.	No.	Author	Title	Publisher	Year
		1.	Satinder Bal Gupta, Aditya Mittal	Introduction to Database Management Systems" Second Edition	Typeset at Sukuvisa Enterprises, Delhi	2017
		2.				
		3.				

Appendix No. 3	**Undergraduate Program**				
1.	Course Title	Digital Music			
2.	Code	CSE17E10			
3.	Study Program / Faculty	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department, faculty)	University of Informatics and Technology "St. Apostle Paul" - Ohrid; Faculty of Computer Science and Engineering - FKNI			
5.	Level (first, second, third cycle)	First cycle – elective course from the unit			
6.	Academic Year / Semester	4/VIII	7.	Number of ECTS credits	6
8.	Instructor	Dr. Atanas Hristov			
9.	Prerequisites for enrollment in the course				
10.	Course Objectives (Competencies): The goal of this course is to familiarize students with all the properties of sound and everything we can do with it. During the course, various sounds from our environment will be recorded, these samples will be processed, and new electronic (both analog and digital) sounds will be generated. Tasks include composing with these sounds, feedback, noise, etc., using DSP, convolution, algorithms, simple mixing, etc. The emphasis of the course is not on technology, mathematics, or acoustics, although these are explored to varying depths. Instead, the focus is on the sonic and compositional aspects.				
11.	Course Content: • Studio basics, recording, representation, basics of music processing software. • Feedback and continuity. Hardware and software delays, hardware filtering, continuous/improvised structure. • Noise and layers. Convolution, Peak software, noise making, dense layering, software filters, noise reduction, sculptural sound, beautiful sounds. • Synthesis, algorithm, interaction (Max/MSP). Algorithmic composition, sound synthesis, (performance) interaction interfaces. • Sampling, remixing, polishing. Borrowing sounds from other sources (or a single source, a large number of sources, or own compositions), using individual sounds to create new music or to polish a previous composition.				
12.	Learning methods: This course is based on 45 hours of lectures, supplemented by 30 hours of labs.				
13.	Total available time fund	6 ECTS credits x 30 hours/credit = 180 hours			
14.	Allocation of available time	Lectures: 45 hours; Exercises: 30 hours; Independent study, projects, homework: 105 hours = Total of 180 hours			
15.	Forms of instructional activities	15.1.	Lectures - theoretical instruction	45 hours	
		15.2.	Exercises (laboratory, classroom), seminars, teamwork	30 hours	
16.	Other forms of activities	16.1.	Project assignments	35 hours	
		16.2.	Independent tasks	35 hours	

		16.3.	Home study	35 hours
17.	Grading Scale 80 + 15 + 5			
	17.1.	Tests		80 points
	17.2.	Seminar paper/project (presentation: written and oral)		15 points
	17.3.	Activity and participation		5 points
18.	Grading Criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
19.	Prerequisite for enrollment and final exam		Students are required to maintain regular attendance in accordance with the UNINT regulations.	
20.	Language of instruction		English, Macedonian	
21.	Method of monitoring the quality of teaching		Monitoring of UNINT control procedures	
	Literature			

	22.1	Required Reading				
		Run number	Author	Title	Publisher	Year
		1.	Hendrik Storstein Spilker	Digital Music Distribution: The Sociology of Online Music Streams	Routledge	2018
	22.2	Further Reading				
		Editorial number	Author	Title	Publisher	Year
			Alessandro Cipriani, Maurizio Giri	Electronic Music and Sound Design: Theory and Practice with Max/MSP - Vol. 1 2010	ConTempoNet	2010

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Economic analysis of business and financial operations			
2.	Code	CSE15U04			
3.	Study program	Computer science and engineering, 4 years			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering "St. Paul the Apostle" Ohrid Faculty for Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – university elective course			
6.	Academic year / semester	Year	3rd	semester	5th
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Jovanka Damoska Sekuloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	By the end of the course, students will be able to: - Analyze the aspects of financial operations within a company and evaluate their impact on performance. - Prepare and interpret financial statements (balance sheet, income statement, cash flow) and use them for planning. - Apply the concept of the time value of money in evaluating investment and financing decisions. - Use capital investment methods (NPV, IRR, payback period) to assess project feasibility. - Assess and calculate financial risk using quantitative and qualitative techniques. - Explain the fundamental characteristics of securities and evaluate their role in financial markets. - Perform valuation of securities using appropriate models and methods. - Integrate financial analysis into strategic decision-making to support business growth and sustainability.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Introduction to Business and Financial Operations - Basics of business processes and financial management. 2. Financial Statements - Structure and purpose of balance sheet, income statement, and cash flow. 3. Financial Analysis - Tools and techniques for evaluating company performance.			

		4. Financial Planning - Forecasting and budgeting for business decisions. 5. Operating and Financial Leverage - Impact of fixed costs and debt on profitability. 6. Time Value of Money - Present and future value concepts in finance. 7. Risk and Return - Relationship between uncertainty and expected gains. 8. Valuation of Securities - Methods for pricing stocks, bonds, and other instruments. 9. Capital Budgeting - Evaluating long-term investment projects. 10. Techniques of Capital Budgeting - NPV, IRR, payback period, and other methods. 11. Long-Term Financing - Equity, bonds, and other sources of capital. 12. Short-Term Financing - Working capital, credit lines, and short-term loans.		
13	Interconnection of Courses	No		
14.	Detailed Description of the Teaching and Working Methods for the Course	Teaching and working methods combine lectures, tutorials, and independent study with project-based learning. Lectures provide theoretical foundations, while tutorials emphasise practical application through case studies and financial analysis exercises. Independent preparation and projects encourage self-directed learning and research. Technology is integrated into teaching through spreadsheets, financial software, and databases. Continuous assessment ensures active participation and progressive development of analytical, technical, and communication skills.		
15.	Total Available Time Allocation	6 ECTS credits × 30 hours/credit = 180 hours. The course comprises 45 hours of lectures, 30 hours of exercises, and 105 hours of independent preparation, projects, and homework, resulting in a total workload of 180 hours (equivalent to 6 ECTS credits).		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	35
		17.2.	Independent tasks: hours	35
		17.3.	Home study – tasks	35
18	Conditions for Signature	Students must attend classes regularly in accordance with UIST regulations.		
19	Assessment Method 80+15+5			
	19.1.	Tests: Points		80
	19.2.	Seminar paper/project, written and oral presentation: points		15
	19.3	Activity and Participation in Class: Points		5

	19.3.	Final exam: points			100
20	Assessment criteria (points/grade)		up to 50 points		5 (five) (F)
			from 51 to 60 points		6 (six) (E)
			from 61 to 70 points		7 (seven) (D)
			from 71 to 80 points		8 (eight) (C)
			from 81 to 90 points		9 (nine) (B)
			from 91 to 100 points		10 (ten) (A)
21.	Method for monitoring the quality of teaching		Compliance with UIST quality control procedures		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Eugene F Brighman and Joel F. Houston	Fundamentals of Financial Management 14/ed	Cengage Learning	2016
		2.	Stanley B. Block, Geoffrey A. Hirt and Bartley R.Danielsen	Foundations of Financial Management 17/ed	McGraw Hill	2019
		3.	James C. Van Horne and John M. Wachowicz, Jr.	Fundamentals of Financial Management 13/ed	Pearson Education	2008
	22.2.	Additional Literature			
		No.	Author	Title	Publisher	Year
		1.	Stanley B. Block, Geoffrey A. Hirt	Foundations of Financial Management 13/ed	McGraw Hill	2009
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Economics of business processes and transactions			
2.	Code	CSE14U05			
3.	Study program	Computer science and engineering, 4 years			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering "St. Paul the Apostle" Ohrid Faculty for Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – university elective course			
6.	Academic year / semester	Year	2nd	semester	4th
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Jovanka Damoska Sekuloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	By the end of the course, students will be able to: - Identify and distribute economic information within a company to internal and external users for decision-making. - Explain how business information systems function in achieving organisational goals. - Analyse the flow of physical resources, documents, and financial transactions within business processes. - Evaluate internal control mechanisms and procedures in both traditional (manual) and computerised information systems. - Apply knowledge of transaction cost economics to assess efficiency and effectiveness in business processes. - Compare manual and digital information systems in terms of organization, infrastructure, and control. - Develop practical skills in managing and optimizing business processes through case studies and projects. - Critically assess risks and propose control strategies for ensuring transparency and accountability in transactions.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Economic Activities and Information in Companies - Nature of economic activities within organizations. - Identification, collection, and distribution of economic information. 2. Information System from an Economic Perspective - Role of information systems in supporting business decisions. - Integration of economic data into organizational processes. 3.Transaction Processes			

		- Types of business transactions (financial, operational, digital). - Transaction cost economics and efficiency analysis. 4. Ethical Aspects and Internal Control - Ethical standards in managing business information. - Internal control mechanisms for transparency and accountability. 5. Revenue Cycle - Processes related to sales, receivables, and cash inflows. - Economic implications of revenue management. 6. Cost Cycle I - Procurement and expenditure processes. - Flow of resources and cost allocation. 7. Cost Cycle II - Payroll, overhead, and other operating expenses. - Monitoring and controlling cost structures. 8. Conversion Cycle (Production) - Transformation of inputs into outputs. - Production economics and efficiency measures. 9. Systems of Financial and Management Reporting - Preparation of financial statements. - Use of management reports for strategic decision-making. 10. Management of the Data System - Organization, storage, and retrieval of economic data. - Data governance and quality assurance. 11. Approaches to Data Modeling - Conceptual, logical, and physical data models. - Application in business information systems. 12. ERP Systems - Enterprise Resource Planning platforms. - Integration of processes and transactions across departments.		
13	Interconnection of Courses	No		
14.	Detailed Description of the Teaching and Working Methods for the Course	Teaching and working methods combine lectures, tutorials, and independent study with project-based learning. Lectures provide theoretical foundations, while tutorials and exercises emphasise practical application through case studies and transaction analysis. Independent preparation and projects encourage self-directed learning and research. Technology is integrated into teaching through transaction cycles and ERP systems. Continuous assessment ensures active participation and progressive development of analytical, technical, and communication skills.		
15.	Total Available Time Allocation	6 ECTS credits × 30 hours/credit = 180 hours. The course comprises 45 hours of lectures, 30 hours of exercises, and 105 hours of independent preparation, projects, and homework, resulting in a total workload of 180 hours (equivalent to 6 ECTS credits).		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	35
		17.2.	Independent tasks: hours	35

		17.3.	Home study – tasks	35
18	Conditions for Signature	Students must attend classes regularly in accordance with UIST regulations.		
19	Assessment Method 80+15+5			
	19.1.	Tests: Points		80
	19.2.	Seminar paper/project, written and oral presentation: points		15
	19.3	Activity and Participation in Class: Points		5
	19.3.	Final exam: points		100
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Compliance with UIST quality control procedures	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	James A. Hall	Accounting Information Systems, 10/ed	Cengage Learning	2019
2.	Steven M. Bragg	Accounting Information Systems, 2/ed	Accounting Tools Inc	2021
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Marshall B. Romney, Paul John Steinbart, Scott L. Summers and David A. Wood	Accounting Information Systems 15/ed	Pearson Education	2021
2.				
3.				

No.75

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Economics of Digital Marketing			
2.	Code	CSE16U02			
3.	Study program	Computer science and engineering, 4 years			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering "St. Paul the Apostle" Ohrid Faculty for Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – university elective course			
6.	Academic year / semester	Year	3rd	semester	6th
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Jovanka Damoska Sekuloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	By the end of the course, students will be able to: - Identify and understand the economic aspects of the concept of digital marketing. - Develop comprehension of the principles of e-commerce and e-marketing. - Analyse and apply the concept of an integrated digital marketing strategy and evaluate alternative e-marketing strategies. - Understand and assess different marketing mixes and their implications in the context of the Internet. - Evaluate the impact of digital marketing on customer relationships and engagement. - Measure and critically assess the effectiveness of e-marketing campaigns using appropriate tools and metrics.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Introduction to Digital Marketing – Fundamentals of digital marketing concepts, scope, and economic relevance. 2. Digital Marketing Strategy and Performance Measurement – Strategic approaches to digital marketing and methods for evaluating effectiveness. 3. E-Marketing Planning – Processes of planning, budgeting, and implementing e-marketing campaigns. 4. Market Research			

		– Tools and techniques for analyzing digital markets and consumer trends. 5. Online Consumer Behavior – Understanding patterns, motivations, and decision-making processes of online buyers. 6. Segmentation, Targeting, Positioning, and Differentiation Strategies – Application of STP models in digital environments. 7. Online Offer – Designing and presenting products and services in digital marketplaces. 8. Online Value – Creating and communicating customer value through digital channels. 9. Internet Distribution – Models and platforms for delivering products and services online. 10. Digital Marketing Communication Tools – Use of email, search engines, display ads, and integrated communication strategies. 11. Social Media Marketing – Leveraging social networks for brand building, engagement, and sales. 12. Content Marketing – Creating, managing, and optimizing digital content to support marketing objectives.		
13	Interconnection of Courses	No		
14.	Detailed Description of the Teaching and Working Methods for the Course	Teaching and working methods combine lectures, tutorials, and independent study with project-based learning. Lectures provide theoretical foundations, while tutorials focus on practical applications through case studies and simulations. Independent projects foster self-directed learning and research into emerging trends. Technology integration ensures hands-on use of analytics tools, social media dashboards, SEO platforms, and digital advertising software. Collaborative group work develops communication and teamwork skills, while continuous assessment promotes active participation and progressive growth of analytical, technical, and strategic competencies.		
15.	Total Available Time Allocation	6 ECTS credits × 30 hours/credit = 180 hours. The course comprises 45 hours of lectures, 30 hours of exercises, and 105 hours of independent preparation, projects, and homework, resulting in a total workload of 180 hours (equivalent to 6 ECTS credits).		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	35
		17.2.	Independent tasks: hours	35
		17.3.	Home study – tasks	35
18	Conditions for Signature	Students must attend classes regularly in accordance with UIST regulations.		
19	Assessment Method 80+15+5			

	19.1.	Tests: Points		80
	19.2.	Seminar paper/project, written and oral presentation: points		15
	19.3	Activity and Participation in Class: Points		5
	19.3.	Final exam: points		100
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Compliance with UIST quality control procedures	

22.

Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Dave Chaffey and Fiona Ellis-Chadwick	Digital Marketing 7/ed	Pearson	2019
2.	Simon Kingsnorth	Digital Marketing Strategy: an integrated approach to online marketing 3/ed	Kogan Page Limited	2022
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Simon Kingsnorth	The Digital Marketing Handbook: Deliver powerful digital campaigns	Kogan Page Limited	2022
2.	Judy Strauss and Raymond Frost	E-Marketing 7/ed	Pearson	2014
3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Economics of electronic banking			
2.	Code	CSE14U04			
3.	Study program	Computer science and engineering, 4 years			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering "St. Paul the Apostle" Ohrid Faculty for Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – university elective course			
6.	Academic year / semester	Year	2nd	semester	4th
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Jovanka Damoska Sekuloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	By the end of the course, students will: • Gain a comprehensive understanding of modern banking, both in theory and practice. • Analyse contemporary developments and trends in electronic banking, including digital transformation and innovation. • Understand the economic aspects of e-banking, such as efficiency, costs, benefits, and market impact. • Examine the organisation and infrastructure of electronic banking systems, including technological platforms and regulatory frameworks. • Develop skills in designing and evaluating banking products and services within the digital environment. • Apply theoretical knowledge to practical case studies, preparing policy briefs, reports, or projects related to digital banking.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Introduction to Electronic Banking - Definition, scope, and importance in the modern financial system. - Differences between traditional and digital banking. 2. Evolution of Electronic Banking - Historical development and milestones. - Transition from physical branches to online and mobile platforms. 3. Products and Services in Electronic Banking - Online accounts, digital loans, e-payments, and investment services. - Innovations in customer service and personalisation. 4. Infrastructure of Electronic Banking - Technological platforms, networks, and software systems.			

		- Role of cloud computing, databases, and cybersecurity frameworks. 5. Economic Aspects of Electronic Banking - Cost reduction, efficiency gains, and market expansion. - Impact on financial inclusion and competition. 6. Risks in Electronic Banking - Operational, financial, and cybersecurity risks. - Fraud, identity theft, and systemic vulnerabilities. 7. Mechanisms and Tools for Protection in Electronic Banking - Encryption, authentication, and regulatory compliance. - Risk management strategies and consumer protection. 8. Mobile Banking - Apps, mobile wallets, and SMS banking. - Role in expanding access to financial services. 9. Electronic Payment Systems - Credit/debit cards, online transfers, and digital wallets. - International payment networks and settlement systems. 10. FinTech and Technological Trends in Banking - Blockchain, cryptocurrencies, and AI applications. - Emerging innovations and future directions in digital finance.		
13	Interconnection of Courses	No		
14.	Detailed Description of the Teaching and Working Methods for the Course	The course includes 45 hours of lectures, complemented by 30 hours of exercises. Teaching and working methods combine lectures, tutorials, and independent study with project-based learning. Lectures provide theoretical foundations, while tutorials and exercises emphasize practical application through case studies and data analysis. Independent preparation and projects encourage self-directed learning and research. Technology is integrated into teaching through digital banking platforms. Continuous assessment ensures active participation and progressive development of analytical, technical, and communication skills.		
15.	Total Available Time Allocation	6 ECTS credits × 30 hours/credit = 180 hours. The course comprises 45 hours of lectures, 30 hours of exercises, and 105 hours of independent preparation, projects, and homework, resulting in a total workload of 180 hours (equivalent to 6 ECTS credits).		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	35
		17.2.	Independent tasks: hours	35
		17.3.	Home study – tasks	35
18	Conditions for Signature	Students must attend classes regularly in accordance with UIST regulations.		
19	Assessment Method 80+15+5			
	19.1.	Tests: Points		80
	19.2.	Seminar paper/project, written and oral presentation: points		15

	19.3	Activity and Participation in Class: Points		5
	19.3.	Final exam: points		100
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Compliance with UIST quality control procedures	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Tim Walker and Lucian Morris	The Handbook of Banking Technology	Wiley	2021
2.	Mahmood Shah, Steve Clarke	E-Banking Management: Issues, Solutions and Strategies	IGI Global	2009
3.	Allen N. Berger, Philip Moyneaux and Jhon O.S Wilson	The Oxford Handbook of Banking	Oxford University Press	2010

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	M. Nakajima	Payment System Technologies and Functions: Innovations and Developments	IGI Global	2011
2.				
3.				

1.	Title of the teaching subject	Visual Arts and 3D Modeling				
2.	Code	CNS14U03				
3.	Study program	Computer Science and Engineering 4-year/Faculty of Computer Science and Engineering				
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology “St. Paul the Apostle” Ohrid				
5.	Degree (first, second, third cycle)	First cycle – elective course from the university list				
6.	Academic year / semester	Year	2	semester	IV	

7	Course Workload Expressed in ECTS Credits	6 ECTS
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Yane Bakreski
9.	Language of instruction	English, Macedonian
10.	Prerequisites for Attending and Passing the Course	
11.	Course Objectives (Competencies) and Learning Outcomes:	The aim of the course is to introduce the fundamental concepts and creative processes of 3D modeling and animation. Through instruction covering both the technical and artistic aspects of this field, and through active use of leading 3D modeling and animation software such as Autodesk Maya and Adobe Photoshop, students will acquire the knowledge and skills necessary to work in industries such as computer games, computer animation, design, advertising, and more.
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• Introduction to the User Interface and Navigation in Autodesk Maya • Creation and Modification of Basic Geometric Forms • Introduction to Different Types of Geometry for 3D Modeling in Autodesk Maya (Polygons, NURBS, and Subdivision Surfaces) and the Modeling Techniques Characteristic to Each • Modeling Three-Dimensional Objects and Environments • Texturing and Shading o Introduction to different types of shaders and their basic characteristics o Creating textures for virtual 3D models using images o Mapping o Preparing textures in Adobe Photoshop • Setting Up, Lighting, and Rendering a 3D Scene • Introduction to 3D Computer Animation (Keyframe Animation) o Modeling and preparing a character for 3D animation o Creating animation poses o Adding character motion – introduction to the Graph Editor and application of Disney principles for animation creation
13	Interconnection of Courses	
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Exercises: 30 hours; Independent study, projects, homework: 105 hours = Total of 180 hours
15.	Total Available Time Allocation	

16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, and teamwork	30 hours
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments	35 hours
		17.2.	Independent tasks	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students are required to ensure regular attendance in accordance with the UIST regulations.		
19	Assessment Method			
	19.1.	Tests		50 points
	19.2.	Seminar paper/project, written and oral presentation		40 points
	19.3.	Activity and participation		10 points
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Compliance with UIST control procedures	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Richard Lewis and James Luciana	Digital Media: An Introduction	Prentice Hall	2004
2.	Paul Naas	Autodesk Maya 2014 Essentials: Autodesk Official Press	Sybex	2013
3.	Andy Beane	3D Animation Essentials	John Wiley & Sons	2012

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	William Vaughan	Digital Modeling	New Riders Pub	2011
2.	Ollie Johnston and Frank Thomas	The Illusion of Life: Disney Animation	Disney Editions	1995
3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Economics of electronic commerce			
2.	Code	CSE15U03			
3.	Study program	Computer science and engineering, 4 years			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering "St. Paul the Apostle" Ohrid Faculty for Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – university elective course			
6.	Academic year / semester	Year	3rd	semester	5th
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Jovanka Damoska Sekuloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	By the end of the course, students will be able to: - Recognise the role of the Internet in business decision-making processes within firms. - Explain the opportunities and challenges of online operations as a new organisational strategy. - Analyse how e-commerce platforms and digital tools contribute to business efficiency and competitiveness. - Apply Internet-based strategies to create and sustain competitive advantages in different industries. - Evaluate business models in electronic commerce (B2B, B2C, C2C, etc.) and their economic implications. - Assess risks and security issues in online business operations and propose protective measures. - Compare traditional and electronic commerce systems in terms of infrastructure, costs, and market reach.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Foundations and Development of Electronic Commerce - Historical evolution, key milestones, and the role of digital technologies in shaping trade. 2. Introduction to E-Business, E-Commerce, and E-Marketplaces - Definitions, scope, and differences between e-business, e-commerce, and online markets. 3. Network Effects and Transaction Cost Theory - How network externalities and transaction cost economics influence e-commerce efficiency and competitiveness.			

		4. Mechanisms, Platforms, and Tools in E-Commerce - Online platforms, marketplaces, and technological tools that enable digital transactions. 5. E-Business Models - B2B, B2C, C2C, and emerging models; platform economies and digital ecosystems. 6. Digital Business Strategies - Strategic use of the Internet for growth, innovation, and competitive advantage. 7. Analysis of the E-Environment - External factors affecting e-commerce: market trends, regulations, and global digital economy. 8. Analysis of the Internal Environment: E-Business Competencies - Organisational readiness, digital skills, and resource capabilities for online operations. 9. Mobile Electronic Commerce - Mobile platforms, apps, and mobile payment systems; role in expanding access to trade. 10. Supplier Systems (E-SCM) - Electronic supply chain management, integration of suppliers, and logistics optimisation. 11. Marketing in E-Commerce - Digital marketing strategies, online consumer behaviour, and personalisation. 12. Payment Systems in Electronic Commerce - Online payment methods, digital wallets, security, and international transactions		
13	Interconnection of Courses	No		
14.	Detailed Description of the Teaching and Working Methods for the Course	Teaching and working methods combine lectures, tutorials, and independent study with project-based learning. Lectures provide theoretical foundations, while tutorials emphasise practical application through case studies and simulations. Independent preparation and projects encourage self-directed learning and research. Technology is integrated into teaching through e-commerce platforms, ERP systems, and online payment tools. Continuous assessment ensures active participation and progressive development of analytical, technical, and communication skills.		
15.	Total Available Time Allocation	6 ECTS credits × 30 hours/credit = 180 hours. The course comprises 45 hours of lectures, 30 hours of exercises, and 105 hours of independent preparation, projects, and homework, resulting in a total workload of 180 hours (equivalent to 6 ECTS credits).		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	35
		17.2.	Independent tasks: hours	35
		17.3.	Home study – tasks	35

18	Conditions for Signature	Students must attend classes regularly in accordance with UIST regulations.			
19	Assessment Method 80+15+5				
	19.1.	Tests: Points			80
	19.2.	Seminar paper/project, written and oral presentation: points			15
	19.3	Activity and Participation in Class: Points			5
	19.3.	Final exam: points			100
20	Assessment criteria (points/grade)		up to 50 points		5 (five) (F)
			from 51 to 60 points		6 (six) (E)
			from 61 to 70 points		7 (seven) (D)
			from 71 to 80 points		8 (eight) (C)
			from 81 to 90 points		9 (nine) (B)
			from 91 to 100 points		10 (ten) (A)
21.	Method for monitoring the quality of teaching		Compliance with UIST quality control procedures		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Dave Chaffey, Tanya Hemphill and David Edmundson-Bird	Digital business and e-commerce management 7th ed.	Pearson	2019
		2.	Kenneth C. Laudon and Carol Guercio Traver	E-commerce 2018: Business, Technology, Society 14/ed	Pearson	2018
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Turban, King, Lee, Ting-Peng Liang, Deborrah C. Turban	Electronic Commerce: A Managerial and Social Networks Perspective 8/ed	Springer	2015
		2.	Tawfik Jelassi and Albrecht Enders	Strategies for e-Business concepts and cases	Pearson	2011
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Economics of ERP systems			
2.	Code	CSE17E09			
3.	Study program	Computer science and engineering, 4 years			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering "St. Paul the Apostle" Ohrid Faculty for Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – university elective course			
6.	Academic year / semester	Year	4th	semester	7th
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Jovanka Damoska Sekuloska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	By the end of the course, students will be able to: - Recognize and understand business information systems, identify the main business functional units, and explain how they are interconnected. - Demonstrate how an integrated system supports enterprise goals by providing managers with accurate, timely, and consistent information. - Understand and evaluate how ERP systems are used to optimize company processes and increase operational efficiency.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Why ERP Systems? – Introduction to the role and importance of ERP in modern enterprises. 2. Economic Justification for Implementing ERP Systems – Cost-effectiveness and strategic benefits of ERP adoption. 3. Functioning of ERP Systems – Core principles, architecture, and operational mechanisms. 4. ERP Market Participants – Key vendors, providers, and stakeholders in the ERP ecosystem. 5. Phases in the ERP Life Cycle – Selection, implementation, maintenance, and evolution stages. 6. Analysis of Justification and Functionality of ERP – Evaluating suitability and performance of ERP solutions. 7. Risk Analysis – Identifying and managing risks in ERP implementation and operation.			

		8. Cost-Benefit Analysis – Assessing financial and operational returns from ERP investments. 9. ERP System Modules - Procurement support systems and processes - Marketing systems and sales processes - Production and supply chain systems - Accounting ERP systems - Human resource management processes 10. Process Modelling, Improvement, and ERP Implementation – Designing, optimising, and integrating business processes through ERP systems.		
13	Interconnection of Courses	No		
14.	Detailed Description of the Teaching and Working Methods for the Course	Teaching and working methods combine lectures, tutorials, and independent study with project-based learning. Lectures provide the theoretical foundations of ERP systems and their economic justification, while tutorials emphasise practical application through case studies, simulations, and analysis of ERP modules. Independent preparation and projects encourage self-directed learning, research, and process modelling. Technology is integrated into teaching through ERP platforms, e-commerce tools, and business process management software. Continuous assessment ensures active participation and progressive development of analytical, technical, and communication skills.		
15.	Total Available Time Allocation	6 ECTS credits × 30 hours/credit = 180 hours. The course comprises 45 hours of lectures, 30 hours of exercises, and 105 hours of independent preparation, projects, and homework, resulting in a total workload of 180 hours (equivalent to 6 ECTS credits).		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	35
		17.2.	Independent tasks: hours	35
		17.3.	Home study – tasks	35
18	Conditions for Signature	Students must attend classes regularly in accordance with UIST regulations.		
19	Assessment Method 80+15+5			
	19.1.	Tests: Points		80
	19.2.	Seminar paper/project, written and oral presentation: points		15
	19.3	Activity and Participation in Class: Points		5
	19.3.	Final exam: points		100
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)

			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching		Compliance with UIST quality control procedures		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Marianne Bradford	Modern ERP: Select, Implement & Use Today's advanced Business Systems 4/ed	Marianne Bradford	2020
		2.	Lineke Sneller	A Guide to ERP: Benefits, Implementation and Trends	bookboon,com	2014
		3.	Simha R. Magal and Jeffrey Word	Integrated Business Processes with ERP Systems 1/ed	Wiley	2011
	22.2.	Additional Literature			
		No.	Author	Title	Publisher	Year
		1.	Daniel E. O'Leary	Enterprise Resource Planning Systems: Systems, Life Cycle, Electronic Commerce and Risk	Cambridge University Press	2000
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Economics			
2.	Code	CSE13U01			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle – university elective course			
6.	Academic year / semester	Year	2nd	semester	III
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Jovanka Damoska Sekuloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	By the end of the course, students will be able to: - Explain fundamental economic concepts and apply them to the analysis of economic processes. - Analyze consumer and firm behavior using microeconomic principles. - Evaluate different market structures (perfect competition, monopoly, oligopoly, monopolistic competition) and their impact on decision-making. - Apply economic reasoning to real-world problems by identifying issues and proposing solutions within the economic environment. - Describe the functioning of the economy at the macro level, including GDP, inflation, unemployment, and fiscal/monetary policy. - Identify macroeconomic problems such as recession, inflation, or unemployment, and assess their causes and consequences. - Propose possible policies, measures, and instruments to address macroeconomic challenges, supported by theoretical and empirical evidence. - Develop critical thinking and analytical skills for interpreting economic data and evaluating policy effectiveness.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Introduction to Economics - Overview of basic principles, scarcity, choices, and the role of economics in society. 2. Demand, Supply, and Elasticity			

		- Market forces, equilibrium, and responsiveness of demand and supply to changes. 3. Theory of Consumption - Consumer preferences, utility, and decision-making in consumption. 4. Markets and Welfare - Efficiency of markets, welfare analysis, and the impact of policies. 5. Firm Behavior (Costs and Production) - Cost structures, production functions, and profit maximization. 6. Competitive Markets - Characteristics of perfect competition and outcomes for firms and consumers. 7. Monopoly, Monopolistic Competition, and Oligopoly - Market power, pricing strategies, and competition among few firms. 8. Markets for Factors of Production - Labor, capital, and land markets; income distribution. 9. Equity and Efficiency - Externalities, public goods, and redistributive policies of the state. 10. Measuring National Income - GDP and other indicators of economic performance. 11. Measuring the Cost of Living - Price indices, inflation, and purchasing power. 12. The Real Economy in the Long Run - Growth, productivity, and long-term determinants of output. 13. Money and Prices in the Long Run - Monetary system, inflation, and neutrality of money. 14. Basic Concepts of the Open Economy - Trade, capital flows, and exchange rates. 15. Short-Term Economic Fluctuations - Business cycles, aggregate demand and supply, and stabilization policies. 16. International Trade, Institutions, and Globalization - Benefits and challenges of trade, role of international organizations, and global integration.
13	Interconnection of Courses	No
14.	Detailed Description of the Teaching and Working Methods for the Course	The Economics course uses a blended teaching approach that combines lectures, tutorials, and applied problem-solving sessions. Lectures establish a foundation in economic theory and policy, supported by real-world data and case studies. Tutorials promote critical discussion of readings, quantitative analysis, and solving real economic problems. Students participate in independent study and project assignments. Ongoing assessment through assignments, exams, and project presentations encourages active engagement and the gradual development of analytical and communication skills.
15.	Total Available Time Allocation	6 ECTS credits × 30 hours/credit = 180 hours. The course comprises 45 hours of lectures, 30 hours of exercises, and 105 hours of independent preparation, projects, and homework, resulting in a total workload of 180 hours (equivalent to 6 ECTS credits).

16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	35
		17.2.	Independent tasks: hours	35
		17.3.	Home study – tasks	35
18	Conditions for Signature	Students must attend classes regularly in accordance with UIST regulations.		

19	Assessment Method 80+15+5		
	19.1.	Tests: Points	80
	19.2.	Seminar paper/project, written and oral presentation: points	15
	19.3	Activity and Participation in Class: Points	5
	19.3.	Final exam: points	100

20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Compliance with UIST quality control procedures	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Gregory Mankiew	Principles of Economics 9/ed	Cengage Learning	2020
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Samuelson P. and Nordhaus W.	Economics 19th ed.	McGraw Hill International Edition	2010
2.	Stephen Ison and Stuart Wall	Economics 4th ed.	Pearson Education Limited	2007

		3.	Ivana Barković Bojanić, Aleksandar Erceg, Jovanka Damoska Sekuloska	Silver Economy	Josip Juraj Strossmayer University of Osijek, Faculty of Economics and Business in Osijek University of Information Science and Technology “St. Paul the Apostle”, Ohrid, Faculty for computer science and engineering	2025

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Elections, electoral systems and technology			
2.	Code	MIR15U09			
3.	Study program	Computer Science and Engineering – 4 years / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	first			
6.	Academic year / semester	Year	3	semester	V
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Goran Shibakovski, PhD			
9.	Language of instruction	English / Macedonian			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	Students will be introduced to the basics, potential and challenges of electronic elections and electronic voting in countries around the world. Special emphasis is placed on an overview of the past, present and future of electoral technologies, as well as research into the intersections of new technologies with electoral systems, the human factor, political processes, etc. Students will be able to distinguish between basic electoral systems and electoral technologies, as well as be able to develop a concept for the application of electronic electoral technologies and the organization of electronic elections.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Introduction to the subject. 2. Fundamentals of elections, electoral systems and electoral technologies. Similarities and differences. 3. Electoral systems and remote voting in the world. 4. Historical development and legal and political aspects of elections and electoral technologies. The experience of Switzerland, Norway and Estonia. 5. Elections and remote voting in Europe. The Estonian eco-system as a model. 6. Diffusion of remote voting and elections. The experience of Estonia 2005 – 2015. 7. Mobilization. Remote voting and costs of participation in elections. "Stickiness" of remote voting. 8. Verification and trust. Political neutrality of remote voting and elections. 9. Certification of ICT in conditions of remote elections. 10. New technology, the human factor and remote elections. 11. Comparative aspects of remote elections in developed and developing countries. 12. The topic of remote elections in the Republic of Macedonia. Opportunities and challenges.			

		13. Potential and challenges of remote elections and voting in the world.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures and theoretical teaching, exercises, independent seminar work, teamwork in groups, project and independent assignments, home study, consultations.			
15.	Total Available Time Allocation	6 ECTS x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	4 5	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	3 0	
		16.3.	Practical work: hours	3 5	
17.	Other forms of activities	17.1.	Project assignments: hours	3 5	
		17.2.	Independent tasks: hours	3 5	
		17.3.	Home study – tasks	3 5	
18	Conditions for Signature	Regular attendance at classes in accordance with UIST regulations			
19	Assessment Method				
	19.1.	Tests: Points		80	
	19.2.	Seminar paper/project, written and oral presentation: points		20	
	19.3.	Final exam: points		100	
20	Assessment criteria (points/grade)	**up to 50 points**		**5 (five) (F)**	
		from 51 to 60 points		6 (six) (E)	
		from 61 to 70 points		7 (seven) (D)	
		from 71 to 80 points		8 (eight) (C)	
		from 81 to 90 points		9 (nine) (B)	
		from 91 to 100 points		10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Self-evaluation and mechanisms for monitoring the quality of teaching at UIST			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Hao, Feng, Peter Y. A. Ryan	Real-World Electronic Voting: Design, Analysis and Development	CRC Press, Taylor & Francis Group	2017
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year

		1.	Solvak, Mikhel & Kristijan Vassil	E-voting in Estonia: Technological Diffusion and Other Developments Over Ten Years (2005-2015)	University of Tartu	2016
		2.				
		3.				

Attachment No.3		**Subject program from first cycle of studies**			
1.	Title of the teaching subject	English for Academic Purposes			
2.	Course code	CSE18E08			
3.	Study program	Computer Science and Engineering 4-year / Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid Faculty of Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – Elective course of the faculty			
6.	Academic year/semester	Year	4	semester	VIII
7.	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	MSc Lina Miloshevska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Course Objectives (Competencies): • Demonstrate and apply knowledge of basic essay structures, including introduction, body, and conclusion; • Apply the various stages of the writing process, including prewriting, writing, and rewriting • Apply descriptive, narrative, and expository styles • Ability to write for academic audiences • Demonstrate an understanding of the principles of effective paragraphs and their application • Write concise sentences; • Apply quotation, paraphrasing, and summarizing;Introduce position and integrate source material into the composition of an essay; • Recognize and correct basic grammatical errors, especially errors of subject/verb type, verb tense, pronoun agreement, and use of prepositions and articles • Improve academic, professional, and idiomatic vocabulary; • Apply socially appropriate language • Read, analyze, and respond to assigned reading materials with an understanding of structure and mechanics; • Identifying effective writing techniques in one's own work and in the written work of peers. • Applying correct MLA or APA rules, including citation in quotation marks, in the text, and in the list of works cited.			

		• Evaluating sources used for relevance and reliability • Avoiding plagiarism
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Week 1 — Course Introduction and Diagnostic Focus: What is academic discourse? Expectations and baseline assessment. Learning objectives • Understand course aims, assessment, and academic communication norms. • Produce a diagnostic writing sample and set learning goals. In-class • Needs analysis survey; discussion of "academic vs everyday English" • Diagnostic essay (30–40 minutes): short response to a prompt • Introduction to the course learning platform and portfolio requirements Homework • Reflective learning plan (250–300 words): strengths, challenges, goals • Create an academic vocabulary journal template (digital or notebook) Week 2 — Academic Reading Skills I: Strategies and Text Structure Focus: Reading efficiently; recognising structure (IMRaD, problem–solution, argument). Learning objectives • Apply skimming and scanning. • Identify thesis/purpose, topic sentences, and macro-structure. In-class • Guided reading of one short academic article (annotation practice) • Text mapping: headings, claims, evidence, conclusion • Vocabulary: academic word families, collocations Homework • Reading log #1 (article summary + key vocabulary + reflections) • Bring one article from your discipline (approved source) Week 3 — Academic Reading Skills II: Critical Reading and Evaluating Sources Focus: Credibility, relevance, bias, and evidence quality. Learning objectives • Evaluate author credibility, publication type, and methodological claims. • Distinguish fact, interpretation, and opinion. In-class

		• CRAAP/SIFT-style source evaluation (adapted for academic use) • Compare an academic source vs a popular source on the same topic • Seminar discussion practice: agreeing/disagreeing politely Homework • Source evaluation worksheet for 2 sources (1 academic, 1 non-academic) • Reading log #2 Week 4 — Academic Writing Foundations: Paragraph Structure and Cohesion Focus: Paragraph unity; topic sentences; cohesive devices. Learning objectives • Write well-developed paragraphs with clear logic. • Use cohesion (reference, substitution, linking, lexical cohesion). In-class • Paragraph surgery: identify problems and revise • Mini-lesson: cohesion devices and common overuse/misuse • Timed paragraph writing + peer feedback checklist Homework • Paragraph set (2 paragraphs): one explanatory + one argumentative • Vocabulary journal: 25 new items with collocations and example sentences Week 5 — Academic Style: Tone, Formality, and Precision Focus: Academic register, avoiding informality, clarity, and precision. Learning objectives • Edit writing for academic tone and concision. • Use nominalisation and precise verbs appropriately. In-class • Editing workshop: informal → academic rewrite • Language focus: hedging (may, might, suggests), cautious claims • Sentence-level clarity: avoiding wordiness and ambiguity Homework • Revised paragraphs from Week 4 (submit as Draft 2) • Short style exercise: rewrite 10 sentences into academic register Week 6 — Summarising and Paraphrasing Focus: Accurate source restatement without plagiarism. Learning objectives • Produce accurate summaries and paraphrases. • Maintain meaning while changing structure and vocabulary. In-class

		• Summary vs paraphrase vs quotation (rules and examples) • Paraphrase strategies: synonymy + restructuring + change of voice • Practice with short excerpts; immediate feedback Homework • Assessment task: Summary + paraphrase assignment (800–1000 words total) • Academic integrity self-check (paraphrase comparison and citation) Week 7 — Integrating Sources: Quotation, Citation, and Referencing Focus: In-text citation conventions; reference list; signal phrases. Learning objectives • Integrate evidence smoothly using reporting verbs and citation. • Produce accurate reference entries in the required style. In-class • Reporting verbs (argues, claims, demonstrates) + stance control • Citation mechanics (author-date / numeric systems, depending on programme) • Reference list workshop (common errors) Homework • Build a reference list of 6 sources on a chosen topic • Prepare for Source Use & Referencing Test (practice set provided) Week 8 — Argumentation I: Thesis, Claims, and Evidence Focus: Building a strong argument; logic and relevance. Learning objectives • Formulate a clear thesis and defensible claims. • Select evidence and explain its relevance. In-class • Argument structure: claim–reason–evidence–warrant • Identifying weak evidence and logical fallacies (basic level) • Outline practice: turning a question into a thesis and plan homework • Argument essay outline (introduction + 3 body paragraphs plan) • Annotated bibliography entries for 4 sources (brief + evaluative) Week 9 — Argumentation II: Counterarguments and Academic Positioning

		Focus: Balanced argument; refutation; hedging and stance. Learning objectives • Address counterarguments fairly and respond critically. • Use hedging and boosters appropriately in-class • Models of counterargument paragraphs • Language focus: concession (although, while) and refutation moves • Peer review of outlines homework • Argument Essay Draft 1 (1000–1200 words) • Peer review assignment: give feedback to one partner using rubric Week 10 — Revision and Editing Workshop (Process Writing) Focus: Revising for structure, coherence, and language accuracy. Learning objectives • Revise content and organisation (macro-level) before editing (micro-level). • Apply feedback and self-editing strategies in-class • Revision checklist: thesis alignment, paragraph function, evidence commentary • Editing stations: grammar, vocabulary, cohesion, referencing • Conference-style feedback (short individual consultations) Homework • Argument Essay Final Version (submit with reflection: 200–250 words) • Update writing portfolio with tracked changes or revision notes Week 11 — Academic Listening and Seminar Participation Focus: Note-taking; asking questions; discussion etiquette. Learning objectives • Extract key points from a lecture excerpt and take structured notes. • Use seminar language for turn-taking, clarifying, and challenging ideas. In-class • Listening task (short lecture or academic talk) + Cornell notes

		• Discussion roles (chair, summariser, challenger) in small groups Homework • Seminar reflection: participation + language targets • Prepare topic proposal for mini research project (research question + rationale) Week 12 — Research Literacy: Developing a Research Question and Planning Focus: From topic to researchable question; scope and feasibility. Learning objectives • Create a focused research question and define key terms. • Plan a small-scale literature-based investigation. In-class • Refining questions (too broad vs manageable) • Keywording and search strategy (database searching basics) • Planning a mini research report structure Homework • Submit mini research plan: o research question o 6–8 credible sources shortlist o tentative outline (sections + purpose) Week 13 — Writing a Mini Research Report: Structure and Synthesis Focus: Synthesis writing, literature-based discussion, signposting. Learning objectives • Synthesise multiple sources into a coherent narrative. • Use signposting and paragraph functions (definition, comparison, evaluation). **In-class** • Synthesis matrix activity (themes across sources) • Model analysis: how authors synthesise rather than list sources • Workshop: writing a literature-based section (one theme paragraph) **Homework** • Mini research report Draft 1 (at least 60% complete)

		• Prepare presentation slides draft (outline + visual plan) Week 14 — Academic Presentations and Visuals + Rehearsals Focus: Presentation structure, delivery, slides, and Q&A. Learning objectives • Present clearly with academic signposting and appropriate pace. • Design readable slides and handle questions professionally. **In-class** • Slide design principles (clarity, minimal text, visual support) • Signposting language practice (overview, transitions, emphasis) • Rehearsals in groups + feedback on delivery and slides **Homework** • Finalise presentation slides • Finalise mini research report (prepare final submission package) Week 15 — Student Presentations and Final Project Submission Focus: Summative speaking + submission and reflection. Learning objectives • Deliver an academic presentation and respond to audience questions. • Submit a complete final project with evidence of ethical source use. **In-class** • Presentations + Q&A • Course wrap-up: progress review and next-step skills planning **Homework** • Submit Mini Research Report (final) + appendices (sources, drafts, reflection) • Final reflection (300–400 words): skills gained, challenges, action plan
13.	Interconnection of Courses	
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours

		Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of teaching activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study - tasks	25
18.	Conditions for signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19.	Assessment method			
	19.1.	Tests: Points		45
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		45
20.	Assessment criteria (points/grade)		Up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			From 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			From 81 to 90 points	9 (nine) (B)
			From 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST		
	Literature			

22.

22.1 Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Adrian Wallwork & Anna Southern	100 Tips to Avoid Mistakes in Academic Writing and Presenting	Springer	2020
2.	Roslyn Petelin	How Writing Works 2nd Edition	Routledge	2022

22.2 Additional Literature

No.	Author	Title	Publisher	Year
1.	Irobilko Chimezie Kingsley	How to Write Professional Academic Research Proposals: + Sample Copies in Different Disciplines.	Lambert Academic Publishing	2020
3.				

Appendix No.3		**Study program first cycle studies**			
1.	Title of the teaching subject	English for Special Purposes			
2.	Code	ISVMA16U07			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid Faculty of Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – Elective course of university list			
6.	Academic year/semester	Year 3	3	semester	IV
7.	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	MSc Lina Miloshevska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Course Objectives (Competencies): By the end of the course, students will be able to: 1. Identify typical communication situations, genres, and expectations in a chosen professional field. 2. Use field-specific terminology accurately and appropriately, including common collocations and fixed phrases. 3. Write clear professional emails and short messages with suitable tone, structure, and politeness. 4. Produce workplace documents relevant to the field (e.g., reports, incident logs, proposals, project updates, SOPs). 5. Summarise and explain domain-related information from charts, instructions, policies, or technical texts. 6. Participate effectively in workplace interactions: meetings, briefings, interviews, negotiations, and client support. 7. Deliver an informative or persuasive professional presentation using visuals and appropriate signposting. 8. Apply intercultural communication principles (formality, directness, role relations) in professional contexts. 9. Demonstrate professional accuracy (numbers, dates, units, procedures), and use clarification strategies to prevent misunderstanding. 10. Compile an ESP portfolio showing improved written and spoken performance for the chosen field.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Week 1 — Introduction to ESP + Needs Analysis** **Theme/skills:** ESP vs General English; professional goals; diagnostic tasks **Objectives** • Identify professional communication needs and target situations. • Establish baseline writing and speaking performance. **In-class**			

		• Needs analysis questionnaire and interviews • Diagnostic email writing (short workplace scenario) • Diagnostic speaking: 2-minute "professional profile" (recorded) • Introduce vocabulary log and portfolio requirements **Homework** • Learning contract (250–350 words): goals, target genres, improvement plan • Start vocabulary log (minimum 15 items from your field) **Week 2 — Professional Communication: Register, Tone, and Politeness** **Theme/skills:** Formality, politeness strategies, intercultural expectations **Objectives** • Control tone and directness appropriately. • Use polite requests, hedging, and softening strategies. **In-class** • Comparing email tones (too informal vs too direct vs professional) • Language focus: requests, follow-ups, apologies, refusals • Role-play: requesting information from a colleague/client **Homework** • Rewrite task: improve tone in 2 short messages • Vocabulary log + collocations (minimum 20 items cumulative) **Week 3 — Core Genre 1: Professional Emails and Messaging** **Theme/skills:** Email structure; subject lines; action-oriented clarity **Objectives** • Write effective emails for common functions: requesting, informing, scheduling. • Use concise structure: purpose → key info → action. **In-class** • Email anatomy workshop (subject, opening, purpose, action, closing) • Common functional phrases (attach, confirm, clarify, schedule, follow up) • Peer review using an email checklist **Homework** • **Portfolio Writing Task 1:** Email set (3 emails for different functions) • Vocabulary log (focus: email phrases and field terms) **Week 4 — Reading in the Field: Documents, Forms, and Instructions** **Theme/skills:** Reading strategies for workplace texts; extracting key information **Objectives**

		• Identify purpose, audience, and critical details in professional documents. • Interpret forms, policies, instructions, and short technical descriptions. **In-class** • Scanning for deadlines, requirements, risks, responsibilities • Interpreting charts/tables relevant to the track • Mini task: complete a form or checklist accurately **Homework** • Reading task: summary of a field document (150–200 words) • Vocabulary log (word formation: noun/verb/adjective forms) **Week 5 — Speaking at Work I: Introductions, Small Talk, and Networking** **Theme/skills:** Professional introductions; relationship-building language **Objectives** • Introduce yourself and your role clearly. • Use appropriate small talk and networking moves. **In-class** • Elevator pitch practice (30–45 seconds) • Role-play: meeting a partner organisation / conference networking • Pronunciation focus: clarity for names, numbers, and key terms **Homework** • Record a 1–2 minute professional introduction (submit) • Vocabulary log: roles, departments, responsibilities, key verbs **Week 6 — Meetings I: Participating, Clarifying, and Taking Turns** **Theme/skills:** Meeting language; clarification and repair strategies **Objectives** • Ask for clarification, confirm understanding, and summarise decisions. • Use turn-taking and polite interruption strategies. **In-class** • Meeting phrases: agreeing, disagreeing, suggesting, summarising • Simulation: short team meeting with roles and agenda • Note-taking practice (action points) **Homework** • Write meeting minutes (150–250 words) based on a recorded meeting segment • Prepare for midterm (functional language review) **Week 7 — Midterm Assessment + Feedback Workshop**

		Theme/skills: Functional language + comprehension in professional contexts **Objectives** • Demonstrate comprehension of a workplace text/audio. • Apply appropriate functional language in context. **In-class** • **Midterm test** (listening/reading + language use) • Feedback session: common errors and improvement targets • Portfolio progress check **Homework** • Individual improvement plan (based on feedback): 5 specific targets • Vocabulary log: error correction and replacement phrases **Week 8 — Core Genre 2: Reports and Updates (Field-Adapted)** **Theme/skills:** Short reports; progress updates; incident reporting (by track) **Objectives** • Write a structured report with clear headings and factual language. • Use time markers, sequencing, and objective tone. **In-class** • Report structure: background → issue → action → outcome → recommendation • Language focus: passive voice, objective reporting verbs, quantifiers • Analyse sample reports from different fields **Homework** • **Portfolio Writing Task 2:** Field-specific report (400–600 words) o *Track options:* incident report (healthcare), bug report (IT), site report (engineering), service report (tourism), lesson observation report (education) **Week 9 — Data Commentary: Describing Trends, Results, and Performance** **Theme/skills:** Charts, KPIs, project metrics, results summaries **Objectives** • Describe trends and compare figures accurately. • Use caution and interpretation language (appears to, suggests, may indicate). **In-class** • Vocabulary: increase/decrease, stability, fluctuations, projections • Practice: short data commentary from track-relevant visuals • Peer feedback: clarity and accuracy of numbers/units **Homework**

		• Data commentary task (250–350 words) using provided chart/table • Vocabulary log: numbers, units, frequent collocations **Week 10 — Workplace Interaction: Client/Patient/Customer Communication** **Theme/skills:** Service encounters; empathy; handling problems and complaints **Objectives** • Manage professional interactions with appropriate politeness and empathy. • Ask questions, gather information, and propose solutions. **In-class** • Role-play scenarios (track adapted) • Language focus: questioning techniques; de-escalation phrases; confirming details • Listening practice: identifying needs and key information **Homework** • Write a follow-up email after a difficult interaction (200–250 words) • Prepare for Speaking Performance Task (meeting simulation) **Week 11 — Speaking Performance Task 1: Meeting Simulation (Assessed)** **Theme/skills:** Meeting participation + action points **Objectives** • Contribute effectively to a structured meeting. • Demonstrate clarification, summarising, and decision-making language. **In-class** • **Assessed meeting simulation** (groups with assigned roles) • Self- and peer-evaluation using rubric **Homework** • Submit individual reflection (200–250 words) + vocabulary recycling evidence **Week 12 — Core Genre 3: Proposals, Recommendations, and Persuasion** **Theme/skills:** Proposals; recommending solutions; persuasive professional writing **Objectives** • Present a problem and propose feasible solutions with justification. • Use persuasive language while maintaining professionalism. **In-class** • Proposal structure: situation → problem → options → recommendation → benefits → timeline • Language focus: modality, benefits framing, risk language

		• Mini workshop: writing strong recommendations **Homework** • **Portfolio Writing Task 3 (Document):** mini proposal (500–700 words) ○ *Track options:* project proposal (IT/engineering), service improvement proposal (tourism), training proposal (education), policy recommendation (public administration) **Week 13 — Career Communication: CVs, Cover Letters, and Interviews (ESP-Adapted)** **Theme/skills:** Job application documents + interview language **Objectives** • Produce a targeted CV and short cover letter aligned with a role. • Answer interview questions using structured responses (STAR method). **In-class** • CV clinic: action verbs, quantifying achievements, tailoring to job ads • Cover letter structure and tone • Interview practice in pairs (common questions by field) **Homework** • Submit updated CV + cover letter (1 page each) • Prepare 6 interview answers (bullet points) for your target role **Week 14 — Professional Presentations: Briefings, Demonstrations, and Q&A** **Theme/skills:** Presentation structure; visuals; explaining processes **Objectives** • Deliver a clear field-specific presentation with effective slides. • Handle Q&A politely and confidently. **In-class** • Signposting language (overview, transitions, emphasis, conclusion) • Slide design principles (clarity, minimal text, visuals) • Rehearsals with timed feedback **Homework** • Finalise capstone presentation slides • Finalise capstone portfolio package (draft) **Week 15 — Capstone Presentations + Portfolio Submission** **Theme/skills:** Summative performance and submission **Objectives** • Present a field-specific project professionally and respond to questions. • Submit an ESP portfolio demonstrating competence across genres. **In-class** • **Capstone presentations** (6–8 minutes + Q&A)

		• Course wrap-up: progress review and next steps for continued development **Homework** • **Final submission:** ESP portfolio (emails + report + proposal + reflections + vocabulary log)			
13.	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours			
16.	Forms of teaching activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	30	
17.	Other forms of activities	17.1.	Project assignments: hours	25	
		17.2.	Independent tasks: hours	25	
		17.3.	Home study – tasks	25	
18.	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST			

19.	Assessment method			
	19.1.	Tests: Points		45
	17.2.	Seminar paper/project, written and oral presentation: points		10
	17.3.	Final exam: points		45
18.	Assessment criteria (points/grade)		Up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			From 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			From 81 to 90 points	9 (nine) (B)
			From 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST		

22.	Literature					
	22.1	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Lawrence Antony	Introducing English for Specific Purposes	Routledge	2018
		2.	Sunny Hyon	Introducing Genre and English for Specific Purposes	Routledge	2017
		3.				

	22.2	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	James Dean Brown	Introducing Needs Analysis and English for Specific Purposes	Routledge	2016
		2.				
		3.				

Appendix No.3	**Study program first cycle studies**	**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	English for Technical Communication I			
2.	Code	CSE11M05			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid Faculty of Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – core course			
6.	Academic year/semester	Year	1	semester	I
7.	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	MSc Lina Miloshevska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Upon completion of this course, students should: 1. Demonstrate skills in efficient and accurate document writing 2. Be familiar with the rules of technical communication and with standards of good style and organization 3. Proofread and edit written documents for accuracy, clarity, conciseness, and appropriateness 4. Demonstrate skills in oral presentations 5. Become thoroughly familiar with the standard forms and rules of different types of written technical documents			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Week 1: Introduction to Technical Communication • Topics: What technical communication is; workplace expectations; genres; ethics overview • Workshop: Diagnostic writing (short email + paragraph); baseline formatting skills • Deliverable: Learning plan + diagnostic reflection (250–300 words) • Reading: Textbook Ch. 1 (intro / workplace communication) Week 2: Audience, Purpose, Context; Communication Models • Topics: Stakeholders, user vs decision-maker; constraints; selecting genre and channel • Workshop: Audience profile + purpose statement; "You-attitude" and tone			

		• Deliverable: Audience analysis worksheet (for a chosen scenario) • Reading: Textbook Ch. 2 (audience & purpose) Week 3: Clarity and Style: Plain Language, Concision, Correctness • Topics: Plain language; sentence economy; ambiguity; active/passive; terminology control • Workshop: Editing lab (before/after); error patterns; readability checklist • Quiz 1: Style and clarity fundamentals • Reading: Textbook Ch. 10 (style) Week 4 — Technical Grammar and Mechanics for Professional Writing • Topics: Punctuation for clarity; parallelism; lists; definitions; consistency; numbers/units • Workshop: Micro-editing stations; building a personal error log • Deliverable: Edited diagnostic (revised version + reflection) • Reading: Textbook Appendix A & B (grammar/mechanics) + instructor handout Week 5 — Document Design I: Layout, Headings, Chunking, Accessibility • Topics: Information design; hierarchy; headings; whitespace; alignment; accessibility basics • Workshop: Redesign a poorly formatted document; apply template standards • Deliverable: 1-page redesigned document with rationale (150–200 words) • Reading: Textbook Ch. 12, 13 (document design) Week 6 — Professional Correspondence I: Emails That Work • Topics: Subject lines; purpose-first structure; action requests; tone; follow-ups • Workshop: Email case scenarios (request, update, problem, apology) • Deliverable (Portfolio item): Email set (3–4 emails) draft • Reading: Textbook Ch. 14 (correspondence) Week 7 — Professional Correspondence II: Memos, Letters, and Internal Updates • Topics: Memo conventions; short internal reports; meeting follow-ups; minutes basics • Workshop: Memo writing + peer review using rubric • Deliverable (Portfolio item): Memo (1–2 pages) + revised email set • Reading: Textbook Ch. 15 (memos/letters) Week 8 — Visual Communication: Tables, Figures, Captions, Ethics of Data • Topics: Choosing visuals; labeling; captions; integrating visuals in text; misleading graphs

		• Workshop: Turn raw data into a table + simple chart; write captions and commentary • Quiz 2: Visuals and document design • Deliverable: Visual integration mini-task (table/figure + 200-word explanation) • Reading: Textbook Ch. 12 (visuals) Week 9 — Instructions and Procedures I: Structure and Safety • Topics: Task analysis; step structure; imperatives; prerequisites; warnings/cautions; troubleshooting • Workshop: Write a micro-procedure (10–12 steps) and test in class • Deliverable: Instructions Draft 1 (for usability test) • Reading: Textbook Ch. 19 (instructions) Week 10 — Instructions and Procedures II: Usability Testing and Revision • Topics: Usability basics; test protocol; observing users; revising for clarity • Workshop: Conduct mini usability tests (pairs/groups); compile findings • Deliverable: Final Instructions document + usability memo (1 page) • Reading: Textbook Ch. 11 (usability / revision) Week 11 — Short Technical Reports I: Types and Structures • Topics: Incident, progress, field/lab, recommendation reports; headings; executive summary basics • Workshop: Report planning + outline; evidence and objectivity • Deliverable: Report proposal (topic + audience + outline + data plan) • Reading: Textbook Ch. 20 (reports) Week 12 — Short Technical Reports II: Writing with Evidence • Topics: Integrating findings; paraphrase and citation (as required by department); limitations • Workshop: Drafting lab; peer review on coherence and design • Deliverable: Report Draft 1 • Reading: Textbook Ch. 21 (research/evidence) Week 13 — Revision, Editing, and Quality Control • Topics: Global vs local revision; proofreading systems; checklists; versioning conventions • Workshop: Editing circles; formatting to template; final QA checklist • Deliverable: Final Short Technical Report • Reading: Textbook Ch. 11 (editing/revising) Week 14 — Technical Presentations I: Structure and Slides • Topics: Audience-focused talks; signposting; slide design; speaking with visuals; Q&A • Workshop: Presentation rehearsals + feedback • Deliverable: Slides + speaker notes (draft)

		• Reading: Textbook Ch. 23 (presentations) Week 15 — Presentations and Portfolio Submission • In-class: Assessed presentations + Q&A • Final deliverables: Portfolio Part I (emails + memo + revisions + reflections) • Course wrap-up: Skills map for TC II			
13.	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours			
16.	Forms of teaching activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	30	
17.	Other forms of activities	17.1.	Project assignments: hours	25	
		17.2.	Independent tasks: hours	25	
		17.3.	Home study – tasks	25	
18.	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST			
19.	Assessment method				
	19.1.	Tests: Points		45	
	17.2.	Seminar paper/project, written and oral presentation: points		10	
	17.3.	Final exam: points		45	
20.	Assessment criteria (points/grade)		Up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			From 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			From 81 to 90 points	9 (nine) (B)	
			From 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST			
22.	Literature				
	22.1	Mandatory Literature			
		No.	Author	Title	Publisher	Year

		1.	John Lannon & Laura Gurak	Technical Communication, 14th Edition	Pearson	2017
		2.	Brian R. Holloway	Fundamentals of Technical Writing, 4th ed.	Pearson	2014
		3.				
	22.2	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Richard Johnson-Sheehan	Technical Communication Strategies for Today, Global Edition, 2nd ed.	Pearson	2015
		2.				
		3.				

Appendix No.3		**Study program first cycle studies**			
1.	Title of the teaching subject	English for Technical Communication II			
2.	Code	CSE12M03			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid Faculty of Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – core course			
6.	Academic year / semester	Year	1	semester	II
7.	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	MSc Lina Miloshevska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Upon completion of this course, students should: 1. Identify the skills, processes, and products that are considered typical technical writing 2. Develop and use technical writing skills to gain expertise in their application in a professional context 3. Learn to work collaboratively as well as individually so that students can contribute to successful professional communication 4. Effectively use technology to support analysis, planning, and revision of written academic and technical documents 5. Develop a professional, responsible, and ethical attitude toward business communication 6. Provide students with the knowledge and skills in writing, presentations, and other forms of technical communication that are expected of them in their future roles as scientific and technological professionals			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Week 1: Transition from TC I; Advanced Expectations and Project Brief • Topics: Advanced genres; scope; portfolio standards; selecting a capstone topic • Workshop: Project pitch clinic; forming teams (if applicable) • Deliverable: Capstone topic proposal (audience + problem + intended deliverables) • Reading: Textbook Ch. 22 (advanced projects / planning) Week 2: Research for Technical Communication: Methods and Ethics • Topics: Primary vs secondary research; consent; data handling; credibility			

		• Workshop: Create research instruments (interview questions / survey) • Deliverable: Research plan + instruments • Reading: Textbook Ch. 7 (research methods) Week 3: Information Architecture and Content Strategy • Topics: Chunking at scale; navigation; headings systems; findability; reuse • Workshop: Build a doc map (site map / TOC + cross-links) • Deliverable: IA blueprint for capstone (TOC + page templates) • Reading: Textbook Ch. 8 (IA / document design advanced) Week 4: Writing Definitions, Specifications, and Requirements • Topics: Defining terms; controlled language; specs/requirements (where relevant); ambiguity avoidance • Workshop: Rewrite ambiguous requirements; produce definition set + glossary entries • Quiz 1: Precision writing and requirements clarity • Deliverable: Glossary + terminology guide (initial) • Reading: Textbook Ch. 17 (definitions/specifications) Week 5: Proposals: Persuasion, Feasibility, and Planning • Topics: Proposal structure; benefits, costs, risks; schedule; resources; deliverables • Workshop: Draft proposal sections; peer review for persuasiveness and clarity • Deliverable: Capstone Proposal Draft • Reading: Textbook Ch. 3 (proposals) Week 6: Project Management for Documentation • Topics: Milestones; roles; revision cycles; change logs; version control conventions • Workshop: Create project schedule (Gantt-style) + responsibility matrix • Deliverable: Final capstone proposal + project plan • Reading: Textbook Ch. 5 (collaboration / managing projects) Week 7: Long Reports / White Papers I: Structure and Evidence • Topics: Executive summary; background; methods; findings; discussion; recommendations • Workshop: Outline a long report; integrate evidence responsibly • Deliverable: Long report outline + source list • Reading: Textbook Ch. 21 (long reports) Week 8: Long Reports / White Papers II: Data Commentary and Visual Argument • Topics: Visual rhetoric; interpreting results; uncertainty and limitations; ethical claims • Workshop: Improve figures and captions; write results commentary • Deliverable: Long report Draft 1 (partial or full)

		• Reading: Textbook Ch. 13 (visuals advanced) Week 9: User Documentation I: User Analysis and Task-Based Docs • Topics: Personas; user journeys; task analysis; quick-start guides; onboarding docs • Workshop: Draft quick start / setup guide aligned to IA blueprint • Deliverable: User doc Draft 1 (Quick Start) • Reading: Textbook Ch. 13 (user documentation) Week 10: User Documentation II: Troubleshooting, FAQs, Release Notes • Topics: Troubleshooting logic; error messages; FAQ patterns; maintenance notes • Workshop: Build troubleshooting tree; write error-based entries • Deliverable: User documentation set (v1): Quick Start + Troubleshooting + FAQ/Release Notes • Reading: Textbook Ch. 24 (support documentation) Week 11: Usability Testing at Scale: Protocols, Findings, Revisions • Topics: Task scenarios; success criteria; observation; reporting findings • Workshop: Run usability tests on user docs; collect and synthesise results • Deliverable: Usability test report + revision plan • Reading: Textbook Ch. 25 (usability) Week 12: Policy/SOP and Risk Communication (Field-Adapted) • Topics: SOP structure; compliance tone; risk and safety language; incident communication • Workshop: Draft SOP/policy section relevant to capstone or discipline • Quiz 2: Ethics, risk, and compliance writing • Deliverable: SOP/policy document (or section integrated into capstone) • Reading: Textbook Ch. 4 (policies/ethics) Week 13: Finalising the Long Report / White Paper; Professional Editing • Topics: Cohesion at scale; front matter/back matter; references; appendices; QA • Workshop: Editing lab with checklists; formatting to template • Deliverable: Final long report/white paper • Reading: Textbook Ch. 11 (editing/style advanced) Week 14: Capstone Briefing Presentations and Stakeholder Communication • Topics: Presenting complex projects to mixed audiences; executive briefing; Q&A strategies • Workshop: Rehearsals + peer evaluation • Deliverable: Slides + executive briefing memo (1 page) • Reading: Textbook Ch. 23 (presentations)

		Week 15: Capstone Submission and Portfolio Defense • In-class: Capstone presentations/defense + showcase • Final deliverables: o Capstone documentation package (proposal + deliverables + usability results + revision evidence) o Professional portfolio (selected best work from both semesters) o Final reflection (400–600 words)			
13.	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours			
16.	Forms of teaching activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	30	
17.	Other forms of activities	17.1.	Project assignments: hours	25	
		17.2.	Independent tasks: hours	25	
		17.3.	Home study – tasks	25	
18.	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST			
19.	Assessment method				
	19.1.	Tests: Points		45	
	17.2.	Seminar paper/project, written and oral presentation: points		10	
	17.3.	Final exam: points		45	
18.	Assessment criteria (points/grade)	Up to 50 points		5 (five) (F)	
		from 51 to 60 points		6 (six) (E)	
		From 61 to 70 points		7 (seven) (D)	
		from 71 to 80 points		8 (eight) (C)	
		From 81 to 90 points		9 (nine) (B)	
		From 91 to 100 points		10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST			
22.	Literature				

	Mandatory Literature				
22.1	No.	Author	Title	Publisher	Year
	1.	John Lannon & Laura Gurak	Technical Communication, 14th Edition	Pearson	2017

		2.	Brian R. Holloway	Fundamentals of Technical Writing, 4th ed.	Pearson	2014
		3.				
	22.2	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Richard Johnson-Sheehan	Technical Communication Strategies for Today, Global Edition, 2nd ed.	Pearson	2015
		2.				
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Entrepreneurship			
2.	Code	CSE18M01			
3.	Study program	Computer science and engineering, 4 years			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Engineering "St. Paul the Apostle" Ohrid Faculty for Computer Science and Engineering			
5.	Degree (first, second, third cycle)	First cycle – mandatory course			
6.	Academic year / semester	Year	4th	semester	8th
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Jovanka Damoska Sekuloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	No			
11.	Course Objectives (Competencies) and Learning Outcomes:	By the end of the course, students will be able to: - Recognize and understand the fundamental concepts and aspects of entrepreneurship. - Identify and analyze the essential elements and processes involved in creating and developing a new start-up business. - Develop entrepreneurial skills and perspectives through practical discussions and exposure to the real-world practice of entrepreneurship.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. Decision to Become an Entrepreneur 1.1 Introduction to entrepreneurship 2. Development of Successful Business Ideas 2.1Identifying opportunities and generating ideas 2.2 Feasibility analysis 2.3 Developing an effective business model 2.4 Industry and competition analysis 2.5 Writing a business plan 3. From Idea to Entrepreneurial Firm 3.1 Ethical and legal foundations 3.2 Assessing financing opportunities 3.3 Building a team 4. Managing and Developing an Entrepreneurial Firm 4.1 Creating a unique marketing strategy 4.2 Importance of intellectual property			

		4.3 Evaluating challenges and growth 4.4 Strategies for firm growth		
13	Interconnection of Courses	No		
14.	Detailed Description of the Teaching and Working Methods for the Course	Teaching and working methods combine lectures, tutorials, and independent study with project-based learning. Lectures provide theoretical foundations of entrepreneurship, while tutorials emphasize practical application through case studies, simulations, and business plan development. Independent preparation and projects encourage self-directed learning, creativity, and research into real-world entrepreneurial practices. Technology is integrated into teaching through business modeling tools, startup simulations, and online collaboration platforms. Continuous assessment ensures active participation and progressive development of analytical, technical, and communication skills.		
15.	Total Available Time Allocation	6 ECTS credits × 30 hours/credit = 180 hours. The course comprises 45 hours of lectures, 30 hours of exercises, and 105 hours of independent preparation, projects, and homework, resulting in a total workload of 180 hours (equivalent to 6 ECTS credits).		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	35
		17.2.	Independent tasks: hours	35
		17.3.	Home study – tasks	35
18	Conditions for Signature	Students must attend classes regularly in accordance with UIST regulations.		
19	Assessment Method 80+15+5			
	19.1.	Tests: Points		80
	19.2.	Seminar paper/project, written and oral presentation: points		15
	19.3	Activity and Participation in Class: Points		5
	19.3.	Final exam: points		100
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)

21.	Method for monitoring the quality of teaching		Compliance with UIST quality control procedures		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Bruce R. Barringer an R. Duane Ireland	Entrepreneurship: Successfully Launching New Ventures Updated 6e	Pearson	2022
		2.	Robert Hisrich, Michael Peters and Dean Shepherd	Entrepreneurship 11/ed.	McGraw-Hill	2020
		3.				
	22.2.	Additional Literature			
		No.	Author	Title	Publisher	Year
		1.	Heidi M. Neck, Christopher P.Neck and Emma L. Murray	Entrepreneurship: the practice and mindset	SAGE	2021
		2.	Dafna Kariv	Entrepreneurship: An International Introduction	Routledge	2011
		3.	Ivana Barković Bojanić, Aleksandar Erceg, Jovanka Damoska Sekuloska	Silver Economy	Josip Juraj Strossmayer University of Osijek, Faculty of Economics and Business in Osijek, and University of Information Science and Technology “St. Paul the Apostle”, Ohrid, Faculty for computer science and engineering	2025

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Ethics of Electronic Literature			
2.	Code	ICS13U03			
3.	Study program	Computer Science and Engineering – 4 years / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First			
6.	Academic year / semester	Year	2	semester	III
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Mersiha Ismajloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	/			
11.	Course Objectives (Competencies) and Learning Outcomes:	Students will acquire the basic terminology of ethics as a fundamental philosophical discipline, including its subject matter, methods, and core teachings, the categories of ethics and essential ethical values, as well as the role of reason and emotion in the ethical sphere, and contemporary manifestations of morality and ethics. Analysis of ethical consequences: Students will critically analyze the ethical implications arising from the creation, distribution, and consumption of digital literature. They will explore various ethical issues such as cultural representation, privacy concerns, digital accessibility, and intellectual property rights. Examination of cultural and social impact: Students will explore how digital literature influences culture and society. The aim of the course is to encourage discussions on how digital literature shapes collective values, beliefs, and perspectives, and how it affects the dissemination of ideas in the digital world. Support for inclusivity and accessibility: Students will investigate the importance of inclusivity and accessibility in digital literature. The goal of the course is to raise awareness of the barriers faced by different user groups and to encourage students to create digital literary works that are accessible to all.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Introduction to Electronic Literature Definition and characteristics of electronic literature Introduction to major ethical theories Analysis of ethical challenges in cultural representation within electronic literature Understanding copyright rules and usage rights in the digital context			

		Understanding the importance of accessibility in electronic literature for diverse user groups Ethical challenges related to AI-generated content Addressing issues of content moderation and combating disinformation Analyzing the role of digital platforms in shaping the visibility and accessibility of content			
13	Interconnection of Courses	/			
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures and discussions, analysis of concrete cases in the field of e-ethics, examples from science-fiction literature, and connections with theories in electronic ethics. Method: oral presentation, lecture method, and independent work.			
15.	Total Available Time Allocation	6 ECTS credits × 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30	
		16.3.	Practical work: hours	35	
17.	Other forms of activities	17.1.	Project assignments: hours	30	
		17.2.	Independent tasks: hours	35	
		17.3.	Home study – tasks	35	
18	Conditions for Signature	Students are required to attend classes regularly in accordance with the UIST regulations.			
19	Assessment Method				
	19.1.	Tests: Points		2x40=80	
	19.2.	Seminar paper/project, written and oral presentation: points		10	
	19.3.	Final exam: points		10	
20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)		
		from 51 to 60 points	6 (six) (E)		
		from 61 to 70 points	7 (seven) (D)		
		from 71 to 80 points	8 (eight) (C)		
		from 81 to 90 points	9 (nine) (B)		
		from 91 to 100 points	10 (ten) (A)		
21.	Method for monitoring the quality of teaching	Following the control procedures of UIST			

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Singer Piter	Practical Ethics	Cambridge University Press; 3rd edition	2011
2.	Scott Rettberg	Electronic Literature	Polity Press	2018

		3.	Stuart Russell, Peter Norvig	Artificial Intelligence: A Modern Approach 3rd Edition	Pearson; 3rd edition	2009
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Immanuel Kant, Abbott Thomas Kingsmill	Critique of Practical Reason (Dover Philosophical Classics)	Dover Publications; 1st Pub 2004 edition	2004
		2.	John Cayley	Grammalepsy: Essays on Digital Language Art	Bloomsbury Publishing	2018
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Graph Theory			
2.	Code	CSE14E02			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First			
6.	Academic year / semester	Year	IV	semester	VII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Elena Hadzieva, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	Discrete Mathematics			
11.	Course Objectives (Competencies) and Learning Outcomes:	The course aims to introduce students to fundamental concepts, structures, and methods in graph theory and to develop competencies that enable them to: Understand and apply key graph-theoretical concepts, including adjacency, degree, walks, paths, connectivity, trees, and cycles; Analyze and model real-world problems using graph structures such as networks, routing maps, communication systems, and optimization tasks; Recognize and classify different types of graphs, including planar graphs, trees, digraphs, and special classes such as Kuratowski graphs; Apply classical graph-theoretical algorithms, including Kruskal's, Prim's, and Dijkstra's algorithms; Understand and evaluate computational aspects of graph algorithms and their complexity; Use matrix representations (adjacency matrix, incidence matrix) to describe and analyze graphs; Investigate advanced topics, such as graph coloring, chromatic numbers, and famous problems like the Four-Color Problem and the Traveling Salesman Problem; Use Python tools and libraries to implement graph algorithms and perform graph-theoretical computations; Communicate mathematical reasoning clearly, using precise definitions, theorems, and proofs when appropriate.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Motivation for studying and applying graphs. Finite and infinite graphs. Adjacency and degree of a vertex. Isomorphism. Subgraphs. Walks, paths, and circuits in a graph. Connected and disconnected graphs. Components of a graph. Eulerian path. Operations on graphs. Hamiltonian path and Hamiltonian cycle. The Traveling Salesman Problem. Trees and their properties. Vertices and distances in trees.			

		Spanning trees. Planar graphs. Different representations of planar graphs. Kuratowski graphs. Matrix representations of graphs. Graph coloring. Chromatic number. The Four-Color Problem. Directed graphs (digraphs). Graph algorithms: Kruskal's algorithm, Prim's algorithm, Dijkstra's algorithm. Exercises in Python.			
13	Interconnection of Courses	This course is interconnected with Discrete Mathematics, and all courses that use algorithms on graphs.			
14.	Detailed Description of the Teaching and Working Methods for the Course	Interactive teaching – 45 hours and interactive tutorials – 30 hours, individual work through projects.			
15.	Total Available Time Allocation	Lectures: 45 hours; Tutorials: 30 hours; Individual work, homework and projects: 105 hours.			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours	15 hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	40 hours	
18	Conditions for Signature	Regular attendance, in accordance with the UIST Rulebook			
19	Assessment Method				
	19.1.	Tests: Points		5	
	19.2.	Seminar paper/project, written and oral presentation: points		10	
	19.3.	Final exam: points		85	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	In accordance with the university procedures and quality control methods			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Narsingh Deo	Graph Theory with Applications to Engineering and Computer Science	Dover Publications	2016
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year

		1.	Robin J. Wilson	Introduction to Graph Theory, 4th edition	Addison Wesley Longman Limited, Essex, England	1998
		2.	Shardav Bhatt	Graph Theory and Its Applications Using Python	Presentation on a Webinar, DOI:10.13140/RG.2.2.22213.68327	2020
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Human-computer interaction			
2.	Code	CSE15E07			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Sciences and Technology "St. Apostle Paul" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective course from the unit			
6.	Academic year / semester	Year	3	semester	V
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Associate Professor Rasim Salkoski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Upon completion of this course, students will be able to produce usable and safe systems, as well as functional systems, keeping the user in mind. Students will understand the factors that characterize human use of technology, and will develop tools and techniques for building appropriate systems that achieve efficient, effective, and safe interaction.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	1. What is interactive design? 2. Understanding and conceptualizing interaction 3. Cognitive aspects 4. Social interaction 5. Emotional interaction 6. Interfaces 7. Data collection 8. Data analysis, interpretation, and presentation 9. The interactive design process 10. Defining requirements 11. Design, prototypes, and construction 12. Interactive design in practice 13. Introduction to evaluation 14. Evaluation: testing, analysis, and models I 15. Evaluation: testing, analysis, and models II.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours	
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours	
		17.2.	Independent tasks: hours	35 hours	
		17.3.	Home study – tasks	35 hours	
18	Conditions for Signature	Students should ensure regular attendance in classes according to the UINT regulations.			

19	Assessment Method				
	19.1.	Tests: Points			80 points
	19.2.	Seminar paper/project, written and oral presentation: points			15 points
	19.3.	Final exam: points			5 points
20	Assessment criteria (points/grade)			up to 50 points	5 (five) (F)
				from 51 to 60 points	6 (six) (E)
				from 61 to 70 points	7 (seven) (D)
				from 71 to 80 points	8 (eight) (C)
				from 81 to 90 points	9 (nine) (B)
				from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching			Monitoring the procedures for UNIT control	
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	H Sharp, Y. Rogers, & J Preece	Interaction design: Beyond human-computer interaction. Revised 4th edition.	Wiley	2015
		2.				
		3.				
	22.2.	Additional Literature			
		No.	Author	Title	Publisher	Year
		1.	Ben Shneiderman & Catherine Plaisant	Designing the User Interface. 5th edition.	Pearson	2006
		2.	A Dix, JE Finley, GD Abowd, R Beale	Human-computer interaction. 3rd edition.	Pearson	2004
		3.				

No. 65

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Information Theory			
2.	Code	CSE16E01			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First-cycle studies – compulsory course			
6.	Academic year/semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Ninoslav Marina, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Aims (Learning Outcomes / Competencies)** Upon successful completion of this course, students will be able to: 1. Demonstrate knowledge and understanding of the fundamental principles of Information Theory. 2. Recognize and appreciate the fundamental limits of communication systems and, more generally, all systems that process information. 3. Develop deeper insight into the structure and operation of communication systems. 4. Apply Information Theory concepts across different disciplines and information sciences, including computing, communications, and data analysis.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Unit 1: Introduction to Information Theory** Text Content: Information, uncertainty, randomness, applications. Learning Outcomes: Explain the purpose of information theory and identify major applications. **Unit 2: Measures of Information** Text Content: Self-information, average information, independent/dependent sources. Learning Outcomes: Compute basic information measures and distinguish source types. **Unit 3: Entropy and Information Rate** Text Content: Entropy, joint/conditional entropy, information rate. Learning Outcomes: Calculate entropy and compare information rates. **Unit 4: Fundamentals of Source Coding** Text Content: Uniquely decodable codes, prefix codes, Kraft–McMillan inequality. Learning Outcomes: Validate and construct simple source coding schemes.			

		Unit 5: Shannon's Source Coding Theorem Text Content: Optimal code limits, Shannon coding, compression bounds. Learning Outcomes: Apply Shannon's theorem and evaluate code efficiency. **Unit 6: Huffman and Compression Codes** Text Content: Huffman coding, optimality, alternative compression methods. Learning Outcomes: Construct Huffman codes and compare compression techniques. **Unit 7: Communication Channels** Text Content: Discrete memoryless channels, transition probabilities, basic models. Learning Outcomes: Model communication channels and analyze their behavior. **Unit 8: Mutual Information and Channel Capacity** Text Content: Mutual information, capacity of discrete and continuous channels. Learning Outcomes: Compute mutual information and determine channel capacity. **Unit 9: Channel Coding Theorem** Text Content: Shannon's channel coding theorem, differential entropy, and continuous channel limits. Learning Outcomes: Interpret channel coding limits and analyze continuous channel capacities. **Unit 10: Error-Control Coding** Text Content: Linear block codes, cyclic codes, RS and Golay codes, burst and convolutional codes. Learning Outcomes: Explain error-correction principles and apply basic decoding techniques.

13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students should ensure regular attendance at classes according to the regulations of UINT		
19	Assessment Method 30+20+50			
	19.1.	Tests: Points		30 points
	19.2.	Seminar paper/project, written and oral presentation: points		20 points

	19.3.	Final exam: points			50 points
20	Assessment criteria (points/grade)			up to 50 points	5 (five) (F)
				from 51 to 60 points	6 (six) (E)
				from 61 to 70 points	7 (seven) (D)
				from 71 to 80 points	8 (eight) (C)
				from 81 to 90 points	9 (nine) (B)
				from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Monitoring of UINT control procedures		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Todd K. Moon	Error Correction Coding: Mathematical Methods and Algorithms	Wiley-Interscience	2005
		2.	Shu Lin, Daniel J. Costello	Error Control Coding: Fundamentals and Applications	Pearson	2004
	22.2.	Additional Literature			
		No.	Author	Title	Publisher	Year
		1.	Thomas M. Cover, Joy A. Thomas	Elements of Information Theory	Wiley	2006
		2.	R. Bose	Information Theory, Coding and Cryptography	TMH	2007

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Internet of Things			
2.	Code	CSE17E08			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First cycle – elective course from the unit			
6.	Academic year/semester	Year	4	semester	VII
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Daniela Mechkaroska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives** By the end of the course, students will be able to: • Understand the fundamental concepts, architecture, and ecosystem of the Internet of Things (IoT). • Learn the hardware and software components used in IoT systems. • Explore IoT communication protocols, networking technologies, and security challenges. • Gain practical experience in designing, programming, and deploying IoT applications. • Learn cloud integration and basic data analysis techniques for IoT platforms.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Unit 1: Introduction to IoT** **Text Content:** Basic concepts, components, applications, and IoT evolution. **Learning Outcomes:** Understand IoT fundamentals and identify key application areas. **Unit 2: IoT Hardware and Physical Design** **Text Content:** IoT devices, sensors, actuators, and hardware structure. **Learning Outcomes:** Recognize main IoT hardware elements and their functions. **Unit 3: Enabling Technologies for IoT** **Text Content:** RFID, GPS, cloud, edge, and fog computing. **Learning Outcomes:** Describe essential technologies that support IoT systems. **Unit 4: IoT Architecture and System Design** **Text Content:** IoT architectural models, system layers, communication flow.			

		Learning Outcomes: Explain IoT architecture and design basic IoT systems. **Unit 5: Smart Objects and Interfaces** **Text Content:** Smart devices, digital/analog I/O, user interaction. **Learning Outcomes:** Configure and operate smart objects and I/O interfaces. **Unit 6: Sensors, Actuators, and Data Acquisition** **Text Content:** Sensing, actuation, sensor networks, data collection. **Learning Outcomes:** Use sensors/actuators and understand data acquisition basics. **Unit 7: IoT Networking Fundamentals** **Text Content:** Networking basics, wireless technologies, topologies. **Learning Outcomes:** Describe IoT networking concepts and set up simple networks. **Unit 8: IoT Wireless & Application Protocols** **Text Content:** LoRaWAN, ZigBee, BLE, MQTT, CoAP. **Learning Outcomes:** Compare IoT protocols and use MQTT/CoAP in applications. **Unit 9: IoT Software Development & Python** **Text Content:** IoT platform design, Python basics, logical system design. **Learning Outcomes:** Develop simple IoT programs using Python. **Unit 10: IoT Security and Blockchain** **Text Content:** IoT threats, security issues, blockchain applications. **Learning Outcomes:** Identify IoT security challenges and explain blockchain use. **Unit 11: IoT Devices & Raspberry Pi Setup** **Text Content:** Device configuration, Raspberry Pi, Linux basics. **Learning Outcomes:** Configure Raspberry Pi and operate Linux for IoT tasks. **Unit 12: Final IoT System Development** **Text Content:** Building complete IoT systems, integration, testing, deployment. **Learning Outcomes:** Develop and present a working IoT project.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students should ensure regular attendance at classes according to the regulations of UINT		

19	Assessment Method 10+10+80				
	19.1.	Tests: Points			10 points
	19.2.	Seminar paper/project, written and oral presentation: points			10 points
	19.3.	Final exam: points			80 points
20	Assessment criteria (points/grade)			up to 50 points	5 (five) (F)
				from 51 to 60 points	6 (six) (E)
				from 61 to 70 points	7 (seven) (D)
				from 71 to 80 points	8 (eight) (C)
				from 81 to 90 points	9 (nine) (B)
				from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching			Monitoring of UINT control procedures	
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	R. Buyya, A.V. Dastjerdi	Internet of Things: Principles and Paradigms	Morgan Kaufmann	2016
		2.	Arshdeep Bahga, Vijay Madisetti	Internet of Things_ A Hands-On Approach	Universities Press	2015
	22.2.	Additional Literature			
		No.	Author	Title	Publisher	Year
		1.	Peter Waher	Learning Internet of Things	Packt Publishing	2015

Attachment No. 3		Subject program from the first cycle of studies			
1.	Title of the teaching subject	Internet Programming			
2.	Code	CSE16M01			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First Cycle – Mandatory Course			
6.	Academic year/semester	3/VI	7.	Number of ECTS credits	6
8.	Teacher	Prof. Dr. Ustijana Rechkoska Shikoska			
9.	Prerequisites for course enrollment	Introduction to Programming, Object-Oriented Programming, Web Design			
10.	Course Programme Objectives (Competences): Students will become more familiar with the concepts of object-oriented programming. The course will cover object reuse, the use of protected members from inherited objects, the introduction and use of interfaces, static variables, functions and classes, as well as the definition and use of abstract classes. Students will also learn how to handle run-time errors through the concept of exceptions, including try, catch and finally blocks. The course includes object casting, detailed use of the String object, an introduction to ArrayList, defining and using threads, Java applets, and coding with HTML, CSS and JavaScript.				
11.	Course Programme Content: Polymorphism; Interfaces; Object Persistence and Storage; Exception Handling; Strings in Java; Input/Output (I/O) Operations; Multithreading; Java Applets; HTML, CSS, and JavaScript Programming; Development of Complete Web Applications.				
12.	Teaching Methods: This course is based on 45 hours of lectures, supplemented by 30 hours of practical exercises.				
13.	Total available workload hours	6 ECTS credits × 30 hours/credit = 180 hours.			
14.	Distribution of the available workload hours	Lectures: 45 hours; Practical Exercises: 30 hours; Independent Study, Projects, and Homework Assignments: 105 hours; Total Workload: 180 hours.			
15.	Forms of Teaching Activities	15.1.	Lectures – Theoretical Instruction	45 часови	
		15.2.	Practical Exercises (Laboratory and Classroom Exercises), Seminars, Teamwork	30 часови	
16.	Other Forms of Activities	16.1.	Project Assignments	35 часови	

		16.2.	Individual Assignments.	35 часови
		16.3.	Self-study at home	35 часови
17.	Assessment: 80% Exams + 15% Projects + 5% Participation and Activities.			
	17.1.	Examinations / Tests.		80 бодови
	17.2.	Seminar Paper / Project Work (Presentation: Written and Oral)		15 бодови
	17.3.	Activity and Participation		5 points
18.	Assessment Criteria (Points / Grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
19.	Requirements for Course Completion and Final Exam Eligibility.		Students are required to ensure regular attendance in accordance with the UIST regulations.	
20.	Language of Instruction		English, Macedonian	
21.	Method of Monitoring Teaching Quality		Monitoring the procedures for quality control at UIST	

Literature

Mandatory literature

No.	Author	Title	Publisher	Year
1.	Robert W. Sebesta	Programming the World Wide Web 8th edition	Pearson	2014
2.	Eric T. Freeman, Elisabeth Robson	Head First JavaScript Programming	O'Reilly Media	2014
3.	Marijn Haverbeke	Eloquent JavaScript, 3rd Edition: A Modern Introduction to Programming	No Starch Press	2018

Additional Literature

No.	Author	Title	Publisher	Year
1.	Herbert Schildt	Java: A Beginner's Guide, Ninth Edition	McGraw Hill	2022
2.				
3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Internet Programming			
2.	Code	CSE16M01			
3.	Study program	Computer Science and Engineering 4 years / Faculty of Computer Science and Engineering - FCSE			
4.	Organizer of the study program (unit, i.e., institute, department)	University of Information Sciences and Technologies "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - FCSE			
5.	Degree (first, second, third cycle)	First Cycle – Mandatory Course			
6.	Academic year/semester	Year	3	semester	VI
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Asst. Prof. Daniela Mechkaroska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives** Students will be able to: 1. Understand core web technologies and internet concepts. 2. Use JavaScript for dynamic web development. 3. Build frontend interfaces with React or Vue.js. 4. Develop backend services using Node.js and Express. 5. Work with databases and perform CRUD operations. 6. Apply basic web security and deploy full-stack applications. **Learning Outcomes** Students will be able to: 1. Explain how the web works and use browser tools. 2. Write JavaScript using modern ES6+ features. 3. Build UI components and manage state in a frontend framework. 4. Create backend APIs with Node.js and Express. 5. Connect applications to databases. 6. Implement authentication and secure API endpoints. 7. Deploy web applications to cloud platforms.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Unit 1: Introduction to Internet Programming** Text Content: Web technologies, client–server model, HTTP/HTTPS, browser tools. Learning Outcomes**:** Understand how the web works and use developer tools. **Unit 2: JavaScript Fundamentals** Text Content: Variables, data types, operators, conditions, loops, array methods. Learning Outcomes: Write basic JavaScript and use control structures.			

		Unit 3: Functions & Scope (ES6+) Text Content: Functions, arrow functions, higher-order functions, closures, destructuring. Learning Outcomes**:** Apply ES6 functions and explain scope/closures. **Units 4–5: Advanced JavaScript & Async Programming** Text Content: Classes, prototypes, modules, callbacks, promises, async/await, Fetch API. Learning Outcomes: Use OOP concepts and handle asynchronous operations. **Units 6–7: Frontend Development (React/Vue)** Text Content: Components, props, state, data fetching, CSS frameworks. Learning Outcomes**:** Build UI components and manage state in a modern framework. **Units 8–9: Backend Development (Node.js & Express)** Text Content: Node.js setup, Express routing/middleware, MongoDB/MySQL, CRUD operations. Learning Outcomes: Develop backend APIs and connect to databases. **Units 10–11: Web Security & Deployment** Text Content: Authentication (JWT/OAuth), API security, deployment platforms. Learning Outcomes: Implement secure APIs and deploy full-stack apps.		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented by 30 hours of exercises		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45 hours
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30 hours
		16.3.	Practical work: hours	
17.	Other forms of activities	17.1.	Project assignments: hours	35 hours
		17.2.	Independent tasks: hours	35 hours
		17.3.	Home study – tasks	35 hours
18	Conditions for Signature	Students should ensure regular attendance at classes according to the regulations of UINT		
19	Assessment Method 10+10+80			
	19.1.	Tests: Points		40 points
	19.2.	Seminar paper/project, written and oral presentation: points		20 points
	19.3.	Final exam: points		40 points
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)

21.	Method for monitoring the quality of teaching			Monitoring of UINT control procedures		
22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Marijn Haverbeke	Eloquent JavaScript	No Starch Press	2018
		2.	Robin Wieruch	The Road to React	Self-published	2020
		3.	Evan M. Hahn	Express in Action	Manning Publications	
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Mario Casciaro	Node.js Design Patterns	Packt Publishing	2020
		2.	Alex Banks & Eve Porcello	Learning React	O'Reilly Media	2020

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Intertextuality and Hypertextuality in E-Gaming			
2.	Code	ICS15U07			
3.	Study program	Computer Science and Engineering – 4 years / Faculty of Computer Science and Engineering – CSE			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" – Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First			
6.	Academic year / semester	Year	3	semester	6
7	Course Workload Expressed in ECTS Credits	6 (six)			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Mersiha Ismajloska, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course	/			
11.	Course Objectives (Competencies) and Learning Outcomes:	To understand and apply the terms intertextuality and hypertextuality. An introduction to game theory and strategic thinking. Literary models for designing and analyzing games are presented, along with various modern computer games. Students are introduced to the history of video games, narratives and interactivity in games, uncertainty, and the virtual economy within games.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	The significance of games. A literary approach to games. Games as a cultural system. Interactivity in games. Defining games. Defining digital games. Defining rules. Rules for games. Games as a system of uncertainty. Defining culture. Recognizing literary codes in games.			
13	Interconnection of Courses	/			
14.	Detailed Description of the Teaching and Working Methods for the Course	Method of oral presentation, lecture method, method of independent work, and use of technical aids.			
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours			
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours		45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours		30
		16.3.	Practical work: hours		35
	Other forms of activities	17.1.	Project assignments: hours		30

17.		17.2.	Independent tasks: hours	35
		17.3.	Home study – tasks	35
18	Conditions for Signature	Students are required to attend classes regularly in accordance with the UIST regulations.		
19	Assessment Method			
	19.1.	Tests: Points		2x40=80
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		10
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching		Compliance with UIST control procedures	

22. Literature

22.1. Mandatory Literature

No.	Author	Title	Publisher	Year
1.	Katie Salen Tekinbas and Eric Zimmerman	Rules of Play: Game Design Fundamentals (The MIT Press)	The MIT Press	2003
2.	Richard Rouse III	Game Design: Theory and Practice (2nd Edition) (Wordware Game Developer's Library)	Jones & Bartlett Learning; 2nd edition	2004
3.				

22.2. Additional Literature

No.	Author	Title	Publisher	Year
1.	Prajit K. Dutta	Strategies and Games: Theory and Practice	The MIT Press; Illustrated edition	1999
2.	Martin J. Osborne	An Introduction to Game Theory	Oxford University Press; 1st edition	2003
3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Introduction to Mechatronics			
2.	Code	CSE15E09			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering – CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	3	semester	V
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Dijana Capeska Bogatinoska			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	**Course Objectives (Competencies):** Familiarizing students with the basic principles of mechatronics, as an introduction to advanced courses in the field of mechatronic systems. Upon completion of this course, students should be able to understand the general principles of mechatronics, recognize the basic components of mechatronic systems, including actuators, sensors, electronics and controllers. To realize and understand their practical application in applications from the field of manufacturing, automotive systems, robotics, etc.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	**Course Content:** Introduction to mechatronics. Application of electronic components in the process of designing simple circuits. Digital electronics: number systems; logic gates, sequential logic. Microprocessor systems; microcontrollers and their programming, programmable logic controllers. Sensors (proximity, speed and motion, force and torque, pressure, temperature, light). Connecting sensors with controllers and data acquisition cards (interface). Electric actuators (solenoids; DC motors and drives, AC motors and drives, stepper motors), mechanical actuators (pneumatic and hydraulic). Their application in mechatronic systems. Connecting actuators with controllers. **Module 1: Introductory Concepts** Topic 1: What is mechatronics? Topic 2: Introduction to microcontroller technology **Module 2: Electric Circuits and Electrical Components**			

		Topic 1: Basic concepts of electric circuits Topic 2: Semiconductor circuit elements Topic 3: Example of electric circuits for mechatronic devices **Module 3: Microcontroller Fundamentals** Topic 1: Number systems Topic 2: C programming for microcontrollers Topic 3: General purpose input-output Topic 4: Interrupt-driven programming Topic 5: Timers **Module 4: Motors and Servo Motors** Topic 1: Actuators for mechatronic systems Topic 2: DC motors Topic 3: Pulse width modulation and servo control **Module 5: Sensor and Microcontroller Interface** Topic 1: Sensors for mechatronic systems Topic 2: Analog-to-digital conversion Topic 3: Universal Asynchronous Receiver-Transmitter (UART) Topic 4: I2C and Serial Peripheral Interface (SPI) Topic 5: Examples of sensor-microcontroller integration		
13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		
19	Assessment Method			
	19.1.	Tests: Points		45
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		45
20	Assessment criteria (points/grade)		**up to 50 points**	**5 (five) (F)**
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)

			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching		Following the quality control procedures of UIST		
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Musa Jouaneh	Fundamentals of Mechatronics	Cengage Learning;	2012
		2.				
		3.				
	22.2.	Additional Literature			
		No.	Author	Title	Publisher	Year
		1.	Bolton, W.	Mechatronics : Electronic Control Systems in Mechanical Engineering, 4th Edition	Pearson	2008
		2.	Silva, C.	Mechatronics: An Integrated Approach	CRC Press	2004
		3.				

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Introduction to New Media Art			
2.	Code	CNS15U02			
3.	Study program	Computer Science and Engineering 4-year/Faculty of Computer Science and Engineering			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" Ohrid			
5.	Degree (first, second, third cycle)	First cycle – elective course from the university list			
6.	Academic year / semester	Year	3	semester	V
7	Course Workload Expressed in ECTS Credits	6 ECTS			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Assoc. Prof. Yane Bakreski			
9.	Language of instruction	English, Macedonian			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Digital technology undoubtedly influences the way we create art today. The digital era offers us a vast array of creative tools and countless artistic forms for expression. Furthermore, new technology has introduced new media that challenge traditional notions of medium, artwork, artist, and audience, while critically impacting older, non-technological media such as painting, drawing, and sculpture. The aim of the course is to provide an overview of the many forms of digital art and new media, their essential aesthetic characteristics, and their technological and art-historical evolution.			

12.	Detailed course content by chapters and units, with learning outcomes for each chapter	• History of Technology and Art
		  ○ The artist and technology in the past
		  ○ Medium specificity
		  ○ Digital media and the new creative renaissance
		  ○ Hypertext and hypermedia
		  ○ Information space and interface, bitmap mapping, graphical window, and direct manipulation via computer mouse
		  ○ The influence of modernist art movements on digital arts
		  ○ Streaming media and interactivity
		• Digital Visualization (Digital Technology as a Tool)
		  ○ Forms generated from mathematical functions
		  ○ Compositing and collaging – recontextualization and assimilation of artistic ideas
		  ○ Image manipulation
		  ○ Advertising
		  ○ Alternative forms of reality			

		○ Transcending naturalism and computer-generated nature ○ Visualizing processes – translating and encoding visual information ○ Creating images with computer assistance • Digital Technology as a Medium ○ Forms of digital art ○ Digital installation ○ Internet art, networked art, and software art ○ Virtual reality ○ Changes in optical perception and consciousness			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	Lectures: 45 hours; Exercises: 30 hours; Independent study, projects, homework: 105 hours = Total of 180 hours			
15.	Total Available Time Allocation				
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction	45 hours	
		16.2.	Exercises (laboratory, auditory), seminars, and teamwork	30 hours	
		16.3.	Practical work: hours		
17.	Other forms of activities	17.1.	Project assignments	35 hours	
		17.2.	Independent tasks	35 hours	
		17.3.	Home study – tasks	35 hours	
18	Conditions for Signature	Students are required to ensure regular attendance in accordance with the UIST regulations.			
19	Assessment Method				
	19.1.	Tests		50 points	
	19.2.	Seminar paper/project, written and oral presentation		40 points	
	19.3.	Activity and participation		10 points	
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	
			from 51 to 60 points	6 (six) (E)	
			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
21.	Method for monitoring the quality of teaching	Compliance with UIST control procedures			
22.	Literature				
	22.1.	Mandatory Literature			
		No.	Author	Title	Publisher	Year
		1.	Christiane Paul	Digital Art	Thames & Hudson	2015

		2.	Christiane Paul	A Companion to Digital Art	John Wiley & Sons	2016
		3.	Richard Lewis and James Luciana	Digital Media: An Introduction	Prentice Hall	2004
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	Hugh Honour and John Fleming	The Visual Arts: A History	Pearson	2010
		2.	Peter Weibel	The post-media condition	Mute	2012
		3.	Lev Manovich	Post-Media Aesthetics	Manovich	2001

No.1

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Introduction to Programming			
2.	Code	CSE11M01			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle			
6.	Academic year / semester	Year	1	semester	I
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Atanas Hristov, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	Course Objectives (Competencies): This course represents the first course in the area of programming techniques and the C programming language. Through this course, students will be introduced to the fundamentals of program development using ANSI C, one of the most widely used programming languages, as well as to basic techniques for designing, developing, and testing algorithms, along with techniques for debugging and correcting them. .			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Course Content: Upon completion of this course, students should be able to: • understand the basic concepts of formal grammars and syntax, and recognize ambiguous grammars; • understand the fundamental constructs of ANSI C, such as *if–then–else*, *while*, *for*, and basic variable types; • become familiar with function declarations and the programming technique of recursion; • know how to work with pointers (at a basic level), arrays, and strings, together with key input/output libraries and basic string operations; • demonstrate, at a conceptual level, the correctness of a program with respect to a given specification, using a formal (mathematical) approach; • solve simple programming problems.			
13	Interconnection of Courses				
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.			

15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 30 hours; Tutorials: 30 hours; Labs: 30 hours. Independent preparation, projects, homework: 90 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	30
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	30
		17.2.	Independent tasks: hours	30
		17.3.	Home study – tasks	30
18	Conditions for Signature	The student must ensure regular attendance of classes according to the regulations of UIST		

19	Assessment Method		
	19.1.	Tests: Points	45
	19.2.	Seminar paper/project, written and oral presentation: points	10
	19.3.	Final exam: points	45

20	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST	

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.	Atanas Hristov, Naum Tuntev, Ninoslav Marina	Introduction to Programming by Examples	UIST	2022
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.	K.A. Barclay	ANSI C: Problem Solving and Programming	Prentice Hall	1991

		2.	Kernigan, Ritchie	The C Programming Language	Prentice Hall	1978

Attachment No. 3		**Subject program from the first cycle of studies**			
1.	Title of the teaching subject	Introduction to robotics			
2.	Code	CSE14E05			
3.	Study program	Computer Science and Engineering, 4 years / Faculty of Computer Science and Engineering (CSE)			
4.	Organizer of the study program (unit, i.e. institute, department)	University of Information Science and Technology "St. Paul the Apostle" - Ohrid; Faculty of Computer Science and Engineering - CSE			
5.	Degree (first, second, third cycle)	First cycle – elective course from the unit			
6.	Academic year / semester	Year	2	semester	IV
7	Course Workload Expressed in ECTS Credits	6			
8.	Teacher (in case of multiple teachers, the responsible instructor is designated)	Prof. Anis Sefidanoski, PhD			
9.	Language of instruction	English			
10.	Prerequisites for Attending and Passing the Course				
11.	Course Objectives (Competencies) and Learning Outcomes:	The objectives of this course program are to master the procedures for the design and construction of single-actuated robotic systems for process automation and solving simple tasks.			
12.	Detailed course content by chapters and units, with learning outcomes for each chapter	Historical overview of robotics, basic concepts and elements of robots, classification and application of robots. Construction and characteristics of the basic modules of a robot. Transformation of coordinate systems in robots. Kinematics of rotational motion, Denavit-Hartenberg notation, Euler angles, Euler parameters, quaternions; direct kinematics, transformation between two adjacent coordinate systems; inverse kinematics. Dynamics of translational motion of a rigid body, forces, moments, dynamics of rotational motion of a rigid body, Newton-Euler equations of a robot, Lagrangian dynamics of a robot. Concepts of open and closed control systems of robots, basic control structures, actuators and sensors in robot control systems. Modeling and simulation of robots using virtual environments.			

13	Interconnection of Courses			
14.	Detailed Description of the Teaching and Working Methods for the Course	This course is based on 45 hours of lectures, supplemented with 30 hours of exercises.		
15.	Total Available Time Allocation	6 ECTS credits x 30 hours/credit = 180 hours Lectures: 45 hours; Exercises: 30 hours; Independent preparation, projects, homework: 105 hours = Total time 180 hours		
16.	Forms of Teaching Activities	16.1.	Lectures – theoretical instruction, hours	45
		16.2.	Exercises (laboratory, auditory), seminars, teamwork: hours	30
		16.3.	Practical work: hours	30
17.	Other forms of activities	17.1.	Project assignments: hours	25
		17.2.	Independent tasks: hours	25
		17.3.	Home study – tasks	25
18	Conditions for Signature	The student must ensure regular attendance at classes according to the regulations of UIST		
19	Assessment Method			
	19.1.	Tests: Points		45
	19.2.	Seminar paper/project, written and oral presentation: points		10
	19.3.	Final exam: points		45
20	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)
			from 51 to 60 points	6 (six) (E)
			from 61 to 70 points	7 (seven) (D)
			from 71 to 80 points	8 (eight) (C)
			from 81 to 90 points	9 (nine) (B)
			from 91 to 100 points	10 (ten) (A)
21.	Method for monitoring the quality of teaching	Following the quality control procedures of UIST		

22.	Literature					
	22.1.	Mandatory Literature				
		No.	Author	Title	Publisher	Year
		1.		Introduction to Robotics - Analysis, Control Applications	Wiley; 3rd edition	2020
		2.				
		3.				
	22.2.	Additional Literature				
		No.	Author	Title	Publisher	Year
		1.				
		2.				
		3.				