

PARTISH

*Development of part-time and short cycle studies
In higher education in Bosnia and Herzegovina*

5.1. Developed curricula and course syllabi at UNSA

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Abstract	University of Sarajevo developed curricula for 4 SCHE programs. These curricula are line with deliverables 2.5 and 2.6. For each course a syllabus is specified.
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1. SC program: Business and Information Technology (BIT)

The BIT program is thus an essential development, poised to prepare students for the dynamic changes in the job market driven by rapid technological advancements. Governments in developed nations are increasingly investing in education to cultivate the skills necessary for the digital economy, and with this program, our School is at the forefront of preparing our students for these global shifts.

Through the BIT program, the School of Economics and Business in Sarajevo aims to establish a close collaboration with the business community by analyzing employer needs for specific skills. The program also seeks to work in conjunction with employment agencies to assess labor market demands for specific types of professionals, as well as with governmental institutions. Importantly, this academic program aligns fully with the strategic educational goals and reform initiatives of the Sarajevo Canton.

1.1 Intended Learning Outcomes

The intended learning outcomes of the BIT program are summarized in text below.

1.1.1 Knowledge and understanding

Upon completion of the study program, students will be able to:

- understand and be able to explain basic terms, principles and concepts from the field of business administration and IT, with an emphasis on the banking sector.
- understand the relationship between the business and IT side of the company, which implies understanding both sides.
- understand information flows in business systems.
- understand the company's IT environment and basic architecture development methods.
- understand the methods and tools of business analysis.
- understand the basics of project management.
- understands the basics of databases and their protection.
- understand the concept of security of information systems.
- understand the basics of project management and agile methods.
- understand the process of implementing information systems and the life cycle of system development.
- understand the functioning of the bank as a financial institution and credit risk management processes in the bank, as well as credit risk models.

1.1.2 Skills

Upon completion of the study program, students will be able to:

- apply business principles and IT tools to a range of issues and business problems.

- analyze analytically and draw conclusions about specific business problems, and evaluate the proposed solution.
- identify and apply IT tools in the business information system.
- design and work with databases (SQL).
- they use different IT tools, such as: MySQL, Microsoft Visual Studio, Statistica Datamining, R-studio, etc.
- use software tools that are widely used in the manipulation of databases and the development of statistical models for risk assessment (SAS, SQL).
- carry out risk analyzes of the information system.
- formulate and explain arguments in expert debates and discussions and written works.
- effectively communicate analysis results and ideas orally and in writing.

1.1.3 Competences

Upon completion of the study program, students will be able to apply knowledge and skills in a practical way, as follows:

- can reflect the main theories of business administration and their application.
- can use different IT tools in business analysis and reporting.
- can propose and critically evaluate solutions to specific business problems.
- can communicate effectively in oral and written form.
- can perform risk analysis in the information system.
- can assess credit risks.
- can work in a team and lead others.
- have acquired knowledge and skills necessary for employment and further education in the field of business.

1.2 Developed curricula and course syllabi

1.2.1 Curriculum overview

The Business and Information Technology (BIT) program is a two-year curriculum designed to equip students with the necessary skills to excel in the intersection of business processes and information technology, particularly emphasizing the banking sector. The curriculum is structured to balance theoretical knowledge with practical skills through direct engagement in the business environment.

1.2.2 Curriculum structure

The program is segmented into four semesters, each offering a combination of required and elective courses tailored to provide a comprehensive understanding of business and IT. Below is a table that outlines the courses offered each semester, including ECTS credits and contact hours.

Table 1. BIT Program Course Structure

Semester	Course Name	ECTS	Contact Hours
1st	Fundamentals of Economics	6	45
	Fundamentals of Management	6	45
	Basics of Financial Analysis	6	45
	Business Informatics	6	45
	Business Statistics	6	45
2nd	Managerial Economics	5	45
	Enterprise Valuation and ERM	5	45
	Enterprise Architecture	10	75
	Elective: Advanced Credit Risk Management or Business IT	10	75
3rd	Financial Mathematics	5	45
	Management Information Systems	5	45
	Business Analysis	10	75
	Elective: Database Management or Information & Cyber Security	10	75
4th	Data Mining	5	45
	IT Tools for Business Analysis	5	45
	Software Development - SDLC	10	75
	Elective: Integrated Risk Management in Banking or Project Management and Agile Practices	10	75

1.2.3 Course syllabi

Each course in the curriculum is designed to meet specific learning outcomes and prepare students for practical challenges in the field. Below is a summary of the syllabi for each course:

Table 2. Summary of syllabi

Course	Description
1. Fundamentals of Economics	Understanding basic economic principles, supply and demand analysis, market structures, and the macroeconomic environment.
2. Fundamentals of Management	Introduction to management theories, principles of organization, leadership, and strategic planning.
3. Basics of Financial Analysis	Techniques in financial statement analysis, financial ratios, and financial decision-making processes.
4. Business Informatics	Overview of information systems in business, including database management, systems analysis, and design.
5. Business Statistics	Statistical methods in business, including descriptive statistics, probability, and inferential statistics.
6. Managerial Economics	Advanced economic concepts applied to managerial decision-making.
7. Enterprise Valuation and ERM	Methods of business valuation and essentials of enterprise risk management.

8. Enterprise Architecture	Designing business processes and IT architecture to align with business strategy.
9. Electives: Advanced Credit Risk Management or Business IT	Focus on advanced techniques in managing credit risks or integrating IT solutions in business strategies.
10. Financial Mathematics	Mathematical models in finance, including derivatives and risk models.
11. Management Information Systems	Strategic use of information systems for business operations and decision-making.
12. Business Analysis	Tools and techniques for effective business analysis, including data modeling and requirements analysis.
13. Electives: Database Management or Information & Cyber Security	Skills in managing database systems or understanding the fundamentals of cyber security and data protection.
14. Data Mining	Techniques and tools for extracting information from large datasets to support decision-making.
15. IT Tools for Business Analysis	Application of various IT tools in the analysis, design, and implementation of business solutions.
16. Software Development - SDLC	Comprehensive study of software development life cycle phases, methodologies, and project management.
17. Electives: Integrated Risk Management in Banking or Project Management and Agile Practices	Specialized focus on either risk management in the banking sector or modern project management methodologies including Agile.

1.3 Developed materials

In developing the curriculum for the BIT program, significant effort has been invested in creating and customizing learning materials that cater to both online and onsite modes of delivery. This approach ensures that the educational offerings are flexible, inclusive, and responsive to the diverse needs of our student body.

1.3.1 Onsite and online instructional materials

The program features a blend of onsite and online instruction, designed to leverage the strengths of both traditional and digital learning environments. For onsite learning, the university has equipped a state-of-the-art computer lab that serves as the primary venue for hands-on training and real-time collaboration among students and instructors. This facility is integral for courses that require specialized software and hardware to perform complex simulations and analyses.

Parallely, the online components of the program are delivered through Moodle, a robust learning management system that supports an interactive and engaging learning experience. Moodle facilitates access to a wide array of digital resources, including:

- Interactive modules: These are designed to provide students with a hands-on approach to learning key concepts, allowing them to engage with the material actively.
- PDF Documents: Comprehensive course materials are available in PDF format for students who prefer or need offline study options.
- Presentations: Lectures from experienced faculty members are accessible to provide flexibility in learning, allowing students to study at their own pace and revisit complex topics as needed.
- Quizzes and assessments: Online quizzes and assessments are integrated to evaluate student understanding and provide immediate feedback.

1.3.2 Tailored learning materials

Each course within the BIT program has been meticulously developed with detailed educational materials to support both the theoretical and practical aspects of the curriculum. These materials are structured to be adaptable, catering to varying student preferences and learning speeds. The content is continually updated to reflect the latest trends and practices in the field of business and information technology, ensuring that the students receive the most current and relevant education.

1.3.3 Collaboration with Raiffeisen Bank (RZB)

A significant portion of the program involves practical training at Raiffeisen Bank (RZB). This collaboration allows students to apply their theoretical knowledge in a real-world business environment. The teaching at RZB is supported by custom-developed materials that align closely with the bank's operational needs and the program's learning objectives. These materials include case studies, project work, and scenario-based learning exercises designed to enhance the students' practical skills and prepare them for the complexities of the business world.

1.4 Operational eLearning portal

The eLearning portal at the School of Economics and Business, University of Sarajevo, plays a critical role in the delivery and management of the BIT program. Leveraging Moodle as the core platform, the portal integrates advanced eLearning technologies and custom-developed elements to provide a tailored and comprehensive learning experience for students. This section elaborates on the technical and functional aspects of the eLearning portal, highlighting its significant features and operational mechanics.

1.4.1 Technical foundation and integration

The eLearning portal is based on Moodle, an open-source LMS renowned for its robustness and flexibility. Moodle's open-source nature allows for extensive customization to meet specific

educational needs and integrate seamlessly with various software components. Key integrations include:

- Open-source software components - Moodle's architecture supports a wide range of open-source plugins and modules, enhancing its functionality and adaptability. These components allow for the inclusion of interactive content, advanced assessment tools, and comprehensive course management features.
- Custom-developed elements - to further personalize the learning experience, custom-developed elements such as specialized plugins and themes have been integrated. These elements are designed to enhance the user interface and improve the usability of the portal, making it more intuitive and engaging for students.



Figure 1. Moodle on SEBS – program

Course organization varies according to the preferences of the instructor and typically follows either a **weekly structure** or a **thematic structure**. Each course features an introduction section that includes the syllabus and a forum for student interaction, as well as an announcements forum to keep students informed. This structured yet flexible organization facilitates a tailored and engaging learning experience for students and instructors alike.

Through its comprehensive adoption, tailored training, and thoughtful organization, the eLearning platform represents a cornerstone of the university's approach to digital education, fostering an environment of accessibility, interaction, and continuous learning.

Poslovne informacione tehnologije

Home / Courses / I Ciklus studija / Stručni studij – Poslovanje i Informacione tehnologije / PIT-PIT

Turn editing on

Announcements

Prisustvo

Online nastava

Baze podataka

Osnovne operacije MySQL

Lesson 1: Create and query database objects

Figure 2. Moodle on SEBS – one course

Intro

Hidden from students

edavanja i konsultacije

Predavanja

Hidden from students

Rezultati

Hidden from students

Predavanja

Rezultati - 2022/2023

Hidden from students

REDAVANJA

Informacioni sistemu savremenom poslovanju

edavanja

All Activities Resources

Assignment	Attendance	BigBlueButton	Book	Chat	Choice
Custom certificate	Database	External tool	Feedback	File	Folder
Forum	Glossary	Group choice	H5P	IMS content package	Interactive Content
Label	Lesson	Page	Questionnaire	Quiz	SCORM package
Survey	URL	Wiki	Workshop		

Figure 3. Resources and activities that can be added to course page (SEBS)

Poslovna informatika

[Home](#) / [Courses](#) / [I Ciklus studija](#) / [Stručni studij – Poslovanje i Informacione tehnologije](#) / [PIT-PI](#) / [Aktivnosti studenata](#) / [Upload aktivnost - OS](#)

Upload aktivnost - OS

Grading summary

Hidden from students	No
Participants	31
Submitted	0
Needs grading	0
Due date	Thursday, 3 November 2022, 4:15 PM
Time remaining	Assignment is due

[View all submissions](#)

[Grade](#)

Figure 4. Submission option

Poslovna informatika

[Home](#) / [Courses](#) / [I Ciklus studija](#) / [Stručni studij – Poslovanje i Informacione tehnologije](#) / [PIT-PI](#) / [Ispiti](#) / [Finalni test](#) / [Preview](#)

Question 1

Not yet answered

Marked out of 1.00

1* Flag question

[Edit question](#)

Oblak koji dijeli infrastrukturu između nekoliko organizacija koje imaju zajedničke poslove, bilo da se njima upravlja iznutra ili od strane treće osobe, naziva se:

Select one:

☐ a. Javni oblak

☐ b. Privatni oblak

☐ c. Društveni oblak

Question 2

Not yet answered

Marked out of 1.00

1* Flag question

[Edit](#)

Grana matematike koja se bavi nelizjesnošću tako što simulira procese ljudskog razmišljanja/rezonovanja se naziva:

Select one:

☐ a. Grid

☐ b. HTML

☐ c. Fuzzy logika

Quiz navigation

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17							

Finish attempt ...

Time left 0:29:55

[Start a new preview](#)

Figure 5. Quiz interface

Moodle provides a comprehensive suite of learning and evaluation tools designed to enhance the educational experience for both teachers and students. These tools are at the core of Moodle's functionality, offering a range of resources and activities that cater to different learning styles and objectives.

Evaluation tools are:

- Gradebook - Central place where all grades for quizzes, assignments, and other graded activities are stored and calculated.
- Scales - Custom grading scales that can be used for non-numeric evaluation.
- Outcomes - Statements describing the knowledge or skills students should acquire.
- Rubrics and Marking Guides - Advanced grading methods for detailed feedback and evaluation.

Moodle provides various reports to track course and student activity, including logs, activity reports, and participation reports. These tools help teachers monitor progress, identify students who may need additional support, and gather data for improving course content.

Poslovna informatika: Setup: Gradebook setup

Home / Courses / I Ciklus studija / Študijski studij – Poslovanje I Informacione tehnologije / PIT-PI / Grades / Grade administration / Setup / Gradebook setup

Gradebook setup

View Setup Scales Letters Import Export

Gradebook setup Course grade settings Preferences: Grader report

Name	Weights	Max grade	Actions
Poslovna Informatika		-	Edit ▾
Course total		600.00	Edit ▾
Upload zadaće I	☐ 16.66%	100.00	Edit ▾
Parcijalni test	☐ 4.167	25.00	Edit ▾
Parcijalni test - 24.11.2022.	☐ 4.167	25.00	Edit ▾

Figure 6. Gradebook setup at SEBS for one course

1.4.2 Personalization and management of learning objects

One of the primary strengths of the eLearning portal is its ability to offer personalized learning journeys through sophisticated management of learning objects. These objects include interactive modules, multimedia content, and various assessment types, all of which can be tailored to the individual learning paths of students. Key features include:

- Adaptive learning paths - the portal utilizes Moodle's conditional activities and course completion features to create adaptive learning paths that respond to the progress and performance of students, offering a more personalized learning experience.
- Interactive learning materials - leveraging Moodle's vast range of resource types, from SCORM packages to interactive videos and simulations, the portal delivers diverse and engaging content that satisfies different learning preferences.
- Advanced assessment tools - Moodle's array of assessment tools, including quizzes, assignments, and workshops, are utilized to cater to various evaluation needs, supporting formative and summative assessments that are integral to student learning and progress monitoring.

1.4.3 Enhancing the eLearning experience

The operational eLearning portal, designed to deliver and enhance the educational content for the extends far beyond a mere distribution tool. It is an active participant in the education process, fostering an engaging and collaborative learning environment. The portal seamlessly integrates forums, wikis, and collaborative databases, encouraging a dynamic interaction among students and

faculty. This interactive setting not only supports cooperative learning but also enriches the educational experience by promoting a community-centric approach to education.

Accessibility and mobility are central to the portal's design, ensuring that students can engage with their coursework effectively from any device. This responsiveness is crucial in supporting mobile learning and providing students the flexibility to study from locations convenient to them, thereby removing barriers to access and participation.

Serving as the central hub for all educational activities within the BIT program, the eLearning portal provides comprehensive services critical to educational administration and support. It facilitates course registration and management, allowing students to register for courses, track their educational progress, and access all necessary materials through a centralized dashboard. This centralization simplifies the educational journey for students, making management of their learning both intuitive and accessible.

The portal ensures that all learning materials, available for both online and offline use, are readily accessible to students. This uninterrupted access is essential for ensuring that students can learn at their own pace and according to their individual schedules. Moreover, the portal is equipped with built-in support systems and feedback mechanisms that enable students to receive timely help and academic feedback. These features are fundamental in creating a supportive learning environment that responds promptly to the needs of students, thereby enhancing their overall educational experience and success in the program.

2. SC program: Information Technologies

2.1. Introduction

The professional study lasts four semesters, with 16 compulsory subjects, Industrial Practice, and a Final Project, thus achieving a minimum of 120 ECTS credits. Each semester is 15 weeks long. Candidates for admission to this study program must have completed a four-year high school. The standards and norms for higher education in the Canton of Sarajevo define the size of the groups.

Students are granted the flexibility to progress to the next year of study within one study cycle, with a maximum of 12 ECTS study points or a maximum of two failed subjects, regardless of evaluation. This is provided that the failed subject that is carried forward to the next study year is not a prerequisite for taking the subject in that study year.

This program study is meticulously designed to nurture the professional development and training of staff (programmers) for real-world IT needs. It offers two-year professional training with the potential for students to pass the 1st cycle of studies in the direction of Theoretical Computer Science. By the end of this program, you will be armed with the practical skills and knowledge necessary to thrive in the IT industry, paving the way for a plethora of career opportunities.

2.2. Intended Learning Outcomes

Upon completion of this study program, candidates will gain the following skills:

- Effective use of operating systems and computer applications for word processing, spreadsheet calculations, business graphics, and algebraic computer packages.
- Analysis of problem-solving possibilities and methods with the assistance of computers.
- Development of programming solutions in various programming languages, including object-oriented and generic techniques.
- Utilization and implementation of standard algorithmic techniques and data structures.
- Creation and implementation of websites.
- Creation, implementation, and maintenance of various databases.

2.3. Developed Curricula and Course Syllabi

This curriculum is designed to build upon foundational knowledge and skills systematically, gradually introducing more advanced concepts and real-world applications. Emphasis is placed on practical problem-solving, software design, and the ability to adapt to evolving technologies and methodologies. Throughout the program, students develop strong communication skills and a sense of environmental responsibility in software development.

This curriculum ensures that each semester is worth 30 ECTS credits while maintaining the progression of knowledge, skills, and competencies outlined in the initial objectives.

Code	Course Title	Semester I	ECTS
IT 110	Programming I	2+2+2	8
IT 120	Web Programming I	2+0+2	8
IT 130	Computer Systems	3+3+0	6
IT 140	Mathematics	3+3+0	8
Code	Course Title	Semester II	ECTS
IT 160	Programming II	3+2+2	9
IT 170	Computer Networks	2+0+2	7
IT 180	Statistics	2+1+2	7
IT 190	Discrete Mathematics	2+2+0	7
Code	Course Title	Semester III	ECTS
IT 210	Data Structures and Algorithms	3+2+2	7
IT 220	Databases	3+0+2	6



IT 230	Software Development	3+0+2	6
IT 240	Selected Topics in Information Technology	2+0+2	5
IT 250	Linear Algebra and Analytic Geometry	3+3+0	6
Code	Course Title	Semester IV	ECTS
IT 260	Comparative Analysis of Programming Languages	3+0+2	5
IT 270	Web Programming II	2+0+2	5
IT 280	Mobile Application Development	2+0+2	5
IT 290	Industrial Practice	0+0+6	5
IT 295	Final Project	0+0+6	10

Program	Level		Schort cycle	
	Name of the program		Infomation Technologies	
COURSE				
Course title	Web Programming I			
Course code	Semeste r	Course status	ECTS	Contact hours (L+AE+LE)
IT 120	I	Mandatory course	8	2+0+2
Lecturer				
Cilj predmeta	Define the basics in web design and Define the principle of Web page design. Recognize the elements of HTML. Introduce basics concept and developpe of CSS.			
Learning Outcomes	Basic knowledge in HTML tags, CSS and JavaScript & skill of creating web pages should be known.			
COURSE CONTENT				
HTML Foundations, Managing Information with Lists and Tables, Making Connections with Links, Adding Images, Creating Forms, Styling With CSS, Styling Text Selectors, Class, and Style, Borders and Backgrounds Building Floating Page Layouts, Styling Lists and Menus Client-Side Programming with JavaScript Making Decisions with Conditions, Loops and Debugging Functions, Arrays, and Objects Getting Valid Input, Animating Your Pages				
LITERATURE				
[1] MobiPocket; Elizabeth Castro, HTML, XHTML, and CSS: Visual Quick Start Guide; 2006. [2] Ian Lloyd , Build Your Own Web Site The Right Way Using HTML &CSS, 2nd Edition; 2008. [3] Thomas A. Powell, HTML &CSS: The Complete Reference, Fifth Edition, McGraw-Hill Osborne Media; 2010. [4] Dan Thompson, BASIC HTML - A STEP-BY-STEP Guide on How to Creating Your First Website from Begining to End, 2010. [5] Learning Web Design: A Beginner's Guide to (X)HTML, StyleSheets, and Web Graphics; Jennifer Niederst Robbins; Aaron Gustafson; 2007. [6] Chuck Musciano and Bill Kennedy , HTML &XHTML: The Definitive Guide; O'Reilly; 2009.				



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- [8] Laura Lemay; Rafe Colburn ,Sams Teach Yourself Web Publishing with HTML and CSS in One Hour a Day: Includes New HTML5 Coverage (6th Edition); 2010.
- [9] David Flanagan , JavaScript, O'Reilly, 2006.
- [10] HTML, XHTML, & CSS, by Andy Harris, Wiley Publishing, Inc. 2011

STUDENT WORKLOAD (hours in a semester)

Lectures	30	Exercises	30	Individual work	65	T o t a l	125
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GRADING

REMARKS

Criterion	Maximum points	Minimum points	
Midterm exams	5	3	
Homework	5	3	
Projects	40	21	
Seminar	5	3	
Final exam	45	25	
T o t a l	100	55	

Program	Level		Schort cycle	
	Name of the program		Infomation Technologies	
COURSE				
Course title	Computer Systems			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
IT 130	I	Mandatory course	6	3+3+0
Lecturer				
Course Goals	The course aims to acquaint students with the basic terms and concepts of computer science and to introduce the basic concepts of digital technology that are necessary for understanding the operation of a computer as a programmable digital machine. In addition, students will be introduced to the structure of computer systems, the basic concepts of computer communications, the principles of algorithmic thinking, the methodology of solving problems using computers, and the basic concepts of advanced programming languages.			
Learning Outcomes	By the end of the course, the students will understand the work of all components of the computer system, the basic principles of computer operation as an information processing tool, the basic principles of digital data processing, the organization of data in the computer memory, the connection between logical algebra and digital techniques, advanced methods of Boolean algebra for the analysis and synthesis of more superficial digital structures, the relationship between hardware and software, the basic concepts related to high-level programming languages.			
COURSE CONTENT				
- Hardware structure of modern computers. Organization of data in the computer memory. The basic concepts of BooleanAlgebra. Bits, data types, and operations. - The transformation and minimization of Boolean functions using Karnaugh maps. Logical gates. Combinatorial logical circuits. The synthesis of combinatorial circuits. - Coder. Decoder. Multiplexer (MUX). Demultiplexer (DMUX). The applications of muxes and demuxes. Synthesis with muxes and demuxes. Half Adder. Full Adder. The Programmable Logic Array(PLA).Logical Completeness.The equations for the finite automata and sequential networks.				

- Basic storage elements. R-S Latch. D latch. The sequential logic circuits. Elementary automata (flip-flops). Memory organization. The Addressability of memory. Registers. Counters.
- The processing unit is a sequential circuit. Machine instructions and machine language. Machine programming. Assembly Language. Assembly programming.
- The processor types and addressing modes. Input-output connectors and external memory.
- Operating system and system software. The concept of the algorithm. Higher programming languages and their classification.
- Introduction to programming in C. Variables and operators. Control structures. Functions. Testing and Debugging. Pointers and arrays. Recursion. Input-Output in C.

LITERATURE

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STUDENT WORKLOAD (hours in a semester)

Lectures	45	Exercises	45	Individual work	60	Total	150
GRADING				REMARKS			
Criterion		Maximum points	Minimum points				
Midterm exams		45	25				
Assignments		10	5				
Final exam		45	25				
Total		100	55				

Program	Level		Schort cycle	
	Name of the program		Infomation Technologies	
COURSE				
Course title	Mathematics			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
IT 140	I	Mandatory course	8	3+3+0
Lecturer				
Course Goals	The main goal of this course is to: - learn the notation of the limit value of a real function, - learn notation of continuity, - learn differential calculus of a real function of one variable and its application. - learn integral calculus and its applications. -learn the basic concept of the real functions of two real variables.			
Learning Outcomes	After the course, the student will: - know the basic techniques of the differential calculus of functions of a real variable, - through examples, feel the potential of the differential calculus when solving			



	problems, - know the techniques of finding the indefinite integral						
COURSE CONTENT							
Real numbers; Sequences; Limit ; Geomerica sequence; monotone sequence; number e, - Real functions of one real variable; limit of the real functions; continuity of monotone functions; overview of elementary functions, - Differential calculus; concept of derivatives and differentials; basic rules of differentiation; derivative of a complex function; derivative of the inverse function; table of derivatives of basic elementary functions; L'Hospital's rule; Taylor's formula; examination of the properties of functions: monotonicity, extrema, convexity, turning points, asymptotes, - Sketching graphs of functions; selected examples of application of differential calculus, - Primitive function and indefinite integral; table of integrals of elementary functions, Integration methods; partial integration; method of substitution, - Integrals that cannot be expressed by elementary functions; integration of rational functions; integration of trigonometric functions; - Definite integral; partial integration in a definite integral; change of variable in a definite integral; - Applications of the definite integral; volumes of rotating bodies; arc length of the curve; area of the rotating body. - Differential equations of the first order. The concept of a function of several variables. Extremes values.							
LITERATURE							
[1] V. A. Zorich, Mathematical analysis I, Universitext, Springer, Berlin, 2003. [2] B.P. Demidovič: Zadaci i riješeni primjeri iz više matematike s primjenom na tehničke nauke, Tehnička knjiga, Zagreb, 1980 [3] Ljaško i dr., Zbirka zadataka iz matematičke analize, IBC '98, 2002. [4] B.P. Demidovič: Zadaci i riješeni primjeri iz više matematike s primjenom na tehničke nauke, Tehnička knjiga, Zagreb, 1980.							
STUDENT WORKLOAD (hours in a semester)							
Lectures	45	Tutorial	30	Individual work	75	T o t a l	175
GRADING				REMARKS			
Criterion		Maximu m points	Minimu m points	Midterm exam: only once in semester (end of November or first week of December). Students altogether write 120 minutes long test. This test is evaluated by max 50 points. The minimal score of the test is 25 points. Final exam: Students who do not reach the midterm exam minimal score must take the entire course in the final exam. In this case, the final exam is evaluated by max 100 points. The final exam's minimal score is 55 points. Students who reach the midterm exam minimal score take only the part of the final exam that is not covered by the midterm test. In this case, the final exam is evaluated by max 50 points. The minimal score is 30 points.			
Midterm exams		50	25				
Homework assignment		-	-				
Project		-	-				
Laboratory assignments		-	-				
Final exam		50	30				
T o t a l		100	55				

Program	Level	Short cycle
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	Name of the program		Information Technologies			
COURSE						
Course title	Programming II					
Course code	Semester	Course status		ECTS	Contact hours	(L+AE+LE)
IT 160	II	Mandatory course		9	3+2+2	
Lecturer						
Course Goals	This course represents an advanced course in computer programming. The objectives of the module are to familiarize students with the modern approach to software development - designing and writing programs using object-oriented and generic techniques. The focus is on understanding the basic principles of modularity and abstraction in different contexts.					
Learning Outcomes	By the end of the course, the students will be able to: • Understand the basic concepts of object-oriented programming such as data abstraction, encapsulation, inheritance, and polymorphism; • Implement abstract data types (ADT) by using classes; • Understand the concepts of generic data types; • Designing a modular software system by using object-oriented methods; • Systematically to perform the testing of programs as well as systems.					
COURSE CONTENT						
- Structures and classes. - Constructors. - Overloading operators. - Dynamic memory allocation. - Separate compilation. - Inheritance. - Polymorphism. - Generic data types. - Exceptions. - STL standard library. - Advanced techniques.						
LITERATURE						
[1] W. Sawitch, Absolute C++, 5th Ed., 2013. [2] M. Weisfeld, The Object-Oriented Thought Process, 4th Ed., 2013. [3] R. Lafore, Object-Oriented Programming in C++, 4th Ed., 2001. [4] B. Stroustrup, The C++ programming language, 2013.						
STUDENT WORKLOAD (hours in a semester)						
Lectures	45	Exercises	60	Individual work	120	Total 225
GRADING				REMARKS		
Criterion	Maximum points	Minimum points				
Laboratory assignments	25					
Exams during semester	30					
Project	10					

Final exam	35		
Total	100	55	

Program	Level		Short cycle	
	Name of the program		Information Technologies	
COURSE				
Course title	Computer Networks			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
IT 170	II	Mandatory course	7	2+0+2
Lecturer				
Course Goals	At the end of the course, the students will be able to: - Build an understanding of the fundamental concepts of computer networking. - Familiarize the student with the basic taxonomy and terminology of the computer networking area.			
Learning Outcomes	After completing this course the student must demonstrate the knowledge and ability to: - Independently understand basic computer network technology. - Understand and explain Data Communications System and its components. - Identify the different types of network topologies and protocols. - Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer. - Identify the different types of network devices and their functions within a network - Understand and build the skills of subnetting and routing mechanisms. - Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.			
COURSE CONTENT				
- Data transfer; Serial and parallel transmission; Synchronous and asynchronous transmission; Modulation and demodulation; Modems; - Communication networks; Network architecture; Commutation; Multiplexing. - Local and global area networks; Topology of local computer networks; Communication in local computer networks - the structure of global computer networks; Network protocols; TCP / IP protocol and IP addresses; Network services - ISO-OSI reference model; Service and protocol concept; Functionality of layers; Layer interactions and service primitives - Physical layer; Communication media; Weakness and distortion. Signal propagation; Synchronization problem - Data Layer Layer; Error Control; Selective repetition protocol; Go Back N protocol; HDLC protocol - Network layer; Network topology and metrics; Routing table; Routing algorithms - Transport layer; Functionality of the layer; TCP / IP protocol - Session layer; Presentation layer; Application layer. - Standard network and telecommunication equipment; Configuring computer networks - Structure of Internet; Internet protocols; Internet services - Network operating systems; Configuring network servers - Overview of advanced computer network technologies				
LITERATURE				

[1]	A. Tanenbaum: “Computer Networks (5th edition)”, Prentice Hall, 2010.						
[2]	D. E. Comer, R. E. Droms, Computer Networks and Internets, 4th edition, Prentice Hall, 2003.						
[3]	William Stallings, Data & Computer Communications; (10th edition)”, 2013						
[4]	Halsall, F., Data Communications, Computer networks and OSI. Addison-Wesley, 1988.						
STUDENT WORKLOAD (hours in a semester)							
Lectures	30	Exercises	30	Individual work	65	T o t a l	125
GRADING				REMARKS			
Criterion		Maximum points	Minimum points				
Practical work		20	10				
Midterm exams		40	20				
Final exam		40	20				
T o t a l		100	55				

Program	Level		Short cycle	
	Name of the program		Information Technologies	
COURSE				
Course title	Statistics			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
IT 180	II	Mandatory course	7	2+1+2
Lecturer				
Course Goals	An introduction to statistics			
Learning Outcomes	Application of statistics			
COURSE CONTENT				
- Classical definitions of probability, - Space of elementary events, - Conditional probability, total probability formula and Bayes formula, - Discrete random variables, - Examples of important discrete distributions, - Mathematical expectation of discrete random variables, - Non-parametric tests; Sign test; Rank Test; Mann-Whitney-Wilcoxon test; Runs test, - χ^2-test, - Kolmogorov-Smirnov test, - Analysis of variance; Kruskal-Wallis and Friedman test, - Linear regression model, - Inferential statistical analysis of the linear regression model, - Multiple linear regression model, - Analysis of the multiple linear regression model, - Software support in regression models.				
LITERATURE				
[1] Sheldon Ross, A first course in probability, Prentice Hall, 2013				
[2] Šošić, I.: Primijenjena statistika, Školska knjiga, Zagreb, 2004				
[3] Šošić, I., Serdar, V.: Uvod u statistiku, Školska knjiga, Zagreb, 2002				

**Recommended:**

- [1] Fikret Čunjalo, Uvod u teoriju vjerovatnoće sa riješenim zadacima, PMF Sarajevo, 2013.
- [2] Ash B.Robert, Basic Probability Theory, Dover Publications Inc. Mineola, New York, 2008.
- [3] R.Christensen, Advanced Linear Modeling, Springer Verlag, 2001.
- [4] H.T.Nguyen, G.S.Rogers, Fundamentals of Mathematical Statistics, Springer Verlag, 1989.
- [5] A.Sen, M.Srivastava, Regression analysis, Springer Verlag, 1990.
- [6] Ž.Pauše, Uvod u matematičku statistiku, Školska knjiga, Zagreb, 1993.
- [7] M.Bilodeau, D.Brenner, Theory of Multivariate Statistics, Springer Verlag, 1999.
- [8] G.McPearson, Applying and Interpreting Statistics, Springer Verlag, 2001.

STUDENT WORKLOAD (hours in a semester)

Lectures	30	Exercises	45	Individual work	100	T o t a l	175
GRADING				REMARKS			
Criterion		Maximum points	Minimum points				
Tests		40	22				
Seminar		10	5,5				
Final exam		50	27,5				
T o t a l		100	55				

Program	Level		Short cycle		
	Name of the program		Information Technologies		
COURSE					
Course title	Discrete Mathematics				
Course code	Semester	Course status	ECTS	Contact (L+AE+LE)	hours
IT 190	II	Mandatory course	7	2+2+0	
Lecturer					
Course Goals	The aim of the course is to familiarize students with some topics that are the subject of discrete studies of mathematics. The focus is on the basic principles and types of finite object counting set and multiset, and the basis of graph theory.				
Learning Outcomes	After successful completion of the course, the student is expected to: - Understand the basic concepts of counting theory, graph theory and finite automata, - To be able to apply different counting principles, - Summarize the theoretical basis of some basic graph theory algorithms and be able to apply those algorithms, - apply acquired knowledge to solve some concrete examples, - To be able to acquire and understand other knowledge from the field of discrete mathematics with which to meet in the continuation of education.				
COURSE CONTENT					
- Logical tautologies; resolution principle; automatic inference, - Valid predicate calculus formulas; positive test for the validity of formulas of predicate logic,					



- Alternative logics; trivalent logic; fuzzy logic,
- Finite sets and multisets,
- Dirichlet's principle (weak, strong and general form),
- Principles of counting,
- Permutations and combinations of sets and multisets,
- Basic number theory algorithms,
- Recursive relations,
- Asymptotic notations and algorithm complexity analysis,
- The notion of a graph,
- Types and basic properties of graphs,
- Trees,
- The shortest path problem,
- Graph search (BFS, DFS),
- Minimum spanning tree (Prim's and Kruskal's algorithm).

LITERATURE

- [1] D. Veljan, Kombinatorika sa teorijom grafova, Školska knjiga, Zagreb, 1989.
 [2] K. Rosen, Discrete mathematics and its applications, 7th edition, McGraw Hill Publishing Co., 2012.
 [3] R. Merris, Combinatorics, California State University, Hayward, 1996.

STUDENT WORKLOAD (hours in a semester)

Lectures	30	Exercises	45	Individual work	100	Total	175
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GRADING

REMARKS

Criterion	Maximum points	Minimum points	
Midterm exams	50	25	
Final exam	50	25	
Total	100	55	

Program	Level		Short cycle	
	Name of the program		Information Technologies	
COURSE				
Course title	Data Structures and Algorithms			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
IT 210	III	Mandatory course	7	3+2+2
Lecturer				
Course Goals	This course introduces some basic data structures (arrays, linked lists, stacks, queues, trees and heaps) and algorithms (various sorting algorithms, and algorithms for operations on binary search trees and heaps).			
Learning Outcomes	Upon successful completion of this course, student should be able to: - define basic static and dynamic data structures and relevant standard algorithms for them: stack, queue, dynamic linked lists, trees, graphs, heap, priority queue, hash tables, sorting algorithms, min-max algorithm, - demonstrate advantages and disadvantages of specific algorithms and data structures, - select basic data structures and algorithms for autonomous realization of			



simple programs or program parts							
COURSE CONTENT							
- Introduction to Algorithms, Algorithm analysis, Complexity of an algorithm. Asymptotic notations; - Classical sequential sorting algorithms (bubble sort, selection sort, insertion sort, shell sort, quick sort, radix sort, external sort) - Searching algorithms (sequential search, binary search, binary tree search, external search, interpolation search, Fibonacci search); - Divide-and-conquer - The concept of data structure. Types of data structures. Linear and branched data structures. - Linear data structures. Arrays and Linked List. Stacks and Queues. Implementation. Singly Linked and Doubly-linked lists; Static and Dynamic Implementation; - Branched data structures. Three. Binary Search Trees. Static and Dynamic Implementation; Application of trees; - Heaps. Heap sort. Hash tables and hashing; - Graphs and graph algorithms, Breadth First Search (BFS), Depth First Search (DFS), - Shortest-path algorithms (Dijkstra's and Floyd's algorithms) - Minimum spanning tree (Prim's and Kruskal's algorithms) - Ford-Fulkerson Algorithm for Maximum Flow and Applications							
LITERATURE							
[1] Notes and slides from lectures [2] T. H. Cormen, C. E. Leiserson, R. L. Rivest & C. Stein, Introduction to Algorithms, MIT Press, 2009. [3] Robert Sedgewick and Kevin Wayne, Algorithms, 4th Edition, Addison Wesley Publishing, 2011. [4] A. Drozdek, Data Structures and Algorithms in C++, Course Technology; 3 edition, 2004 [5] M. Živanović, Algoritmi, Matematički fakultet, Beograd, 2000. [6] Milo Tomašević, Algoritmi i strukture podataka, Akademska misao, Beograd, 2008. [7] V. Aho, J. E. Hopcroft, J. D. Ulman: Data Structures and Algorithms, Addison-Wesley, 1983. [8] D. E. Knuth, The Art of Computer Programming, Volume 1: Fundamental Algorithms, Addison-Wesley, 1968.							
STUDENT WORKLOAD (hours in a semester)							
Lectures	45	Exercises	60	Individual work	70	Total	175
GRADING				REMARKS			
Criterion		Maximum points	Minimum points				
Midterm exams		30	15				
Projects and homeworks		20	10				
Final exam		50	25				
Total		100	55				

Program	Level	Schort cycle
	Name of the program	Infomation Technologies
COURSE		
Course title	Databasaes	

Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)			
IT 220	III	Mandatory course	6	3+0+2			
Lecturer							
Course Goals	The course aims to familiarize students with entities, relations, models, SQL database language, logical design and database integrity. The above concepts are necessary for students to understand the working principles of databases and information systems. In addition, students will be familiar with the methodology of solving problems in relational databases.						
Learning Outcomes	Through the mentioned course, students will master the use of the SQL language through independent work on laboratory exercises as a means for designing and implementing a small information system, as well as training students to develop such and similar techniques.						
COURSE CONTENT							
• Relational data model; Formalisms of the relational model; Relational algebra; Relational calculus; • Relational query languages. SQL Query language; Views; SQL standards • Logical dependencies; Functional dependence; Ambiguous dependencies; • Normal forms (NF): First normal form; Second normal form; Third normal form; Other normal forms; • Boyce-Codd normal form; • Fourth normal form; Fifth normal form • Structures and algorithms. Sequential representation. • Direct organization. • Index representation; Network representation. • Transaction management. • Data integrity; Transactions and integrity; Locking protocols. • Logical padlocks; Physical padlocks; Distributed databases.							
LITERATURE							
[1] Thomas Connolly, Carolyn Begg: Database Systems: A Practical Approach to Design, Implementation, and Management 4th Edition, Addison Wesley, 2004. [2] S. Sumathi, S. Esakkirajan: Fundamentals of Relational Database Management Systems, Springer, 2007. [3] Lecture notes. [4] J.D. Ullman, Principles of Database Systems. Computer Science Press, 1980. [5] Raghu Ramakrishnan, Johannes Gehrke: Database Management Systems, 3rd Edition 3rd Edition, McGraw-Hill, 2002.							
STUDENT WORKLOAD (hours in a semester)							
Lectures	45	Exercises	30	Individual work	75	T o t a l	150
GRADING				REMARKS			
Criterion		Maximum points	Minimum points				
Midterm exams		5	3				
Homework		5	3				
Projects		40	21				
Seminar		5	3				
Final exam		45	25				
T o t a l		100	55				



Program	Level	Short cycle					
	Name of the program	Information Technologies					
COURSE							
Course title	Software Development						
Course code	Semester	Course status		ECTS	Contact hours (L+AE+LE)		
IT 230	III	Mandatory course		6	3+0+2		
Lecturer							
Course Goals	The aim of the course is to introduce students to modelling, designing, implementing, testing, and debugging large object-oriented software. Also, students will be introduced to effective methods during Java application development, including inheritance, multithreading, networking, database work, and web application development.						
Learning Outcomes	Upon completion of the course, students are expected to be able to: independently design and implement larger programs, write quality Java code for them, test software to find and debug, analyze and improve open source Java programs of other developers.						
COURSE CONTENT							
1) Introductory consideration. Defining a model through UML. Object-oriented analysis and design. Introduction to facilities. 2) Creating and destroying objects. Common methods to all objects. Operators. Execution controls. Initialization and cleaning of objects. 3) Classes and interfaces. Reuse classes. Polymorphism. Inner classes. Storage of objects. Work with exceptions. 4) Strings. Recognition of class instances. Generic data types. Arrays. Containers. 5) Input-output operations. Enumerated data types. Annotations. 6) General methods and efficient programming. Exceptions. Competitiveness. Serialization. 7) Graphical user interface.							
LITERATURE							
[1] Alempije Veljović: Osnove objektnog modeliranja UML, drugo izdanje, (2004), Kompjuter biblioteka. [2] Bruce Eckel: Thinking in Java, 4th edition, (2006), Prentice Hall. [3] Joshua Bloch: Effective Java, 2nd edition, (2008), Addison-Wesley. [4] Paul T. Tymann; G. Michael Schneider: Modern Software Development Using Java: A Text for the Second Course in Computer Science, 2nd edition, (2007), Course Technology. [5] Dejan Živković: Java Programiranje, prvo izdanje, (2013), Beograd.							
STUDENT WORKLOAD (hours in a semester)							
Lectures	45	Exercises	30	Individual work	50	Total	125
GRADING				REMARKS			
Criterion	Maximum points	Minimum points					
Midterm exam	30	15					
Homework	10	5					
Students project	30	15					
Final exam	30	20					
Total	100	55					

Program	Level		Short cycle				
	Name of the program		Information Technologies				



COURSE							
Course title	Comparative Analysis of Programming Languages						
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)			
IT 260	IV	Mandatory course	5	3+0+2			
Lecturer							
Course Goals	The module is an advanced programming course. The goals of the module are to get acquainted with several programming languages that students have not had the opportunity to encounter in other modules. The course also considers and compares different programming paradigms such as procedural, object-oriented, functional and logical programming.						
Learning Outcomes	Upon completion of the module, students will be able to: - Understand what functional, object-oriented and logical programs mean - Learn new programming languages quickly - Recognize the characteristic concepts of different programming languages - Determine the strength and elegance of programming languages and their parts - Use new programming languages - Use already known languages more skillfully						
COURSE CONTENT							
- Functional programming (change avoidance; use of recursion and higher order functions, closures, anonymous functions) - Algebraic data types and pattern matching - Object oriented programming - Abstractions - Syntax and semantics - Static and dynamic types, type safety - Polymorphism and generic programming - Logical programming							
LITERATURE							
[1] R. W. Sebesta, Concepts of Programming Languages, 11th Edition, 2015 [2] M. L. Scott, Programming Language Pragmatics, 4th Edition, 2015. [3] A. Tucker, R. Noonan, Programming Languages: Principles and Paradigms, 2nd Edition, 2006. [4] H. Abelson, G. J. Sussman, J. Sussman, Structure and Interpretation of Computer Programs, 2nd Edition, 1996.							
STUDENT WORKLOAD (hours in a semester)							
Lectures	45	Exercises	30	Individual work	50	T o t a l	125
GRADING				REMARKS			
Criterion		Maximum points	Minimum points				
Laboratory assignments		30					
Tests		30					
Final exam		40					
T o t a l		100	55				

Program	Level	Schort cycle
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	Name of the program		Information Technologies				
COURSE							
Course title	Web Programming II						
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)			
IT 270	IV	Mandatory course	5	2+0+2			
Lecturer							
Course Goals	The module's objectives are to familiarize students with creating dynamic web systems through scripting languages and connecting with databases—knowledge of client-server technology. In addition, students are introduced to the methodology of solving problems by creating a dynamic website.						
Learning Outcomes	Through the mentioned module, students will master the use of scripting languages and databases through independent work on laboratory exercises as a means for designing and implementing an information system, as well as training students to develop these systems.						
COURSE CONTENT							
• Basics of PHP language; • Creating PHP scripts; • Scalar values; • Advanced PHP programs; • PHP and My SQL; • Node.js; • Npm; • Asynchronous programming; • React framework - Git and GitHub; • Web services SOAP and REST models; • WSDL; • Writing web services; • MongoDB; • Mongoose; • Express; • Socket.IO; • Angular.JS; • JWT Authentication.							
LITERATURE							
[1] Larry Ullman: PHP and MySQL for Dynamic Web Sites: Visual QuickPro Guide (5th Ed.), Peachpit Press, 2017. [2] Jim Wilson: Node.js the Right Way: Practical, Server-Side JavaScript That Scales, 1st Ed., Pragmatic Bookshelf, 2013. [3] Evan M. Hahn: Express in Action (Writing, building, and testing Node.js applications), Manning Publications, 2016. [4] Basarat Ali Syed: Beginning Node.js, Apress, 2014.							
STUDENT WORKLOAD (hours in a semester)							
Lectures	30	Exercises	30	Individual work	65	T o t a l	125
GRADING			REMARKS				
Criterion	Maximum points	Minimum points					
Midterm exams	5	3					
Homework	5	3					



Projects	40	21	
Seminar	5	3	
Final exam	45	25	
Total	100	55	

Program	Level		Short cycle	
	Name of the program		Information Technologies	
COURSE				
Course title	Linear Algebra and Analytic Geometry			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
IT 250	III	Mandatory course	6	3+3+0
Lecturer				
Course Goals	The course aims to acquire some knowledge about matrices, determinants, systems of linear equations, linear mappings, vectors, and simple geometrical objects such as planes, lines, and some simple surfaces in space.			
Learning Outcomes	After completing this course, students should demonstrate competency in the following skills:			
	- Understand and be able to use matrices and their basic operations; - Analyse the solvability of linear equation systems and be able to find their solutions; - Understand basic concepts of linear operators and their matrix representation; - Overwhelm the techniques of eigenvalues and eigenvectors associated to linear operators in finite dimensional space; - Understand and be able to use vectors and their basic operations; - Understand the basic objects studied in analytic geometry (straight lines, plains, simple surfaces), and their equations, and be able to discuss their relationships; - Be able to apply achieved knowledge to solve particular practical problems in different disciplines in mathematics and information technologies.			
COURSE CONTENT				
- Basic of the theory of vector spaces. - Matrices, operations with matrices, determinants, inverse matrices, matrix equations. - Systems of linear equations, techniques to solve systems of linear equations. - Linear operators, associated matrices, eigenvalues and eigenvectors, diagonalization. - Vectors, basic vector operations, dot, cross, and triple product of vectors, their properties, vector decomposition, the notion of coordinate systems, and coordinate systems transformations (translation and rotation). - Concept of line and surface equation. Equations of planes and lines in space. Mutual relations between two lines, two planes, and plane and line in space. Basic surfaces in the space. - Orthogonal sets, dot product, orthogonal projections, Gram-Schmidt orthogonalization method.				
LITERATURE				
[1] S. H. Freidberg, A. J. Insel, L. E. Spence: Linear algebra, Pearson, 2002. [2] A. Odžak, S. Odžak: Linearna algebra i analitička geometrija sa primjenama, UNSA, Sarajevo, 2017. [3] P. Miličić, M. Uščumlić: Zbirka zadataka iz više matematike I, Nauka, Beograd, 1996. [4] M. M. Dizdarević, A. Odžak, L. Šćeta: Zbirka zadataka iz analitičke geometrije sa				

osnovama teorije, Univerzitet u Sarajevu, Sarajevo 2021.							
[5] A. Muratović-Ribić: Uvod u linearnu algebru, Prirodno-matematički fakultet, UNSA, 2015.							
[6] B. Stojanović: Zbirka zadataka iz matematike, Svejtlost, Sarajevo, 1987.							
[7] C. L. Byrne, Applied and Computational Linear Algebra: A First Course, University of Massachusetts, Lowell, 2013.							
[8] D. C. Lay, Linear Algebra and Its Applications, Pearson, 2015.							
[9] G. Strang, Linear algebra and Applications, Wellesley Cambridge Press, 2009.							
STUDENT WORKLOAD (hours in a semester)							
Lectures	45	Exercises	45	Individual work	60	Total	150
GRADING				REMARKS			
Criterion		Maximum points	Minimum points				
Midterm exams		50	25				
Final exam		50	25				
Total		100	55				

Program	Level		Schort cycle	
	Name of the program		Information Technologies	
COURSE				
Course title	Selected Topics in Information Technology			
Course code	Semester	Course status	ECTS	Contact hours (L+AE+LE)
IT 240	III	Mandatory course	5	2+0+2
Lecturer				
Course Goals	The module aims to deepen the knowledge acquired in a group of subjects in the field "Information Technologies" through teaching units for which students express a particular interest in coordination with the subject teacher.			
Learning Outcomes	After completing the module, students will deepen and complete the previously acquired knowledge in computer disciplines that belong to the "Information Technologies" field and acquire the basis for independent creative research work in the directions in which they express particular interest.			
COURSE CONTENT				
The content of the teaching process for this module is not fixed. However, the students who elected this module choose topics from disciplines in which they express a particular interest so they can deepen their knowledge in the "Information Technologies" field. The lecturer approves topics. Possible disciplines include the theory of algorithms, complexity and computability theory, language and automata theory, parallel algorithms and architectures, web application development, programming languages, operating systems, computer graphics, multimedia systems, advanced programming techniques and others.				
LITERATURE				

The exact choice of literature depends on the choice of topics that students choose for study in agreement with the lecturer. Roughly among the recommended literature are the following titles:

- Thomas Corman, Charles Leirserson, Ronald Rivest: *"Introduction to Algorithms"*
- Robert Sedgewick: *"Algorithms"*, Addison-Wesley
- Miodrag Živković, *"Algoritmi"*, Matematički fakultet, Beograd, 2000
- Hary Lewis, Christos Papadimitriou: *"Elements of the Theory of Computation"*
- Jozef Gruska: *"Foundations of Computing"*, International Thomson Computer Press, 1997
- Michael Sipser: *"Introduction to the Theory of Computation"*, Course Technology, 2005
- Michael Garey, David Johnson: *"Computers and Intractability, A Guide to the Theory of NPCompleteness"*
- Peter Linz, *"An Introduction to Formal Languages and Automata"*, Jones and Bartlett Publishers, 2000
- Martin, John, *"Introduction to Languages and the Theory of Computation"*, McGraw-Hill, 1997
- Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar: *"Introduction to Parallel Computing"*

STUDENT WORKLOAD (hours in a semester)

Lectures	30	Tutorial	30	Individual work	65	T o t a l	125
GRADING				REMARKS			
Criterion		Maximum points	Minimum points				
Midterm exams		60	30				
Laboratory assignments		0	0				
Final exam		40	25				
T o t a l		100	55				

2.4. Developed Materials

Efforts to tailor learning materials have predominantly focused on enhancing the online learning experience, assuming onsite courses would also benefit. Improving traditional in-class experiences poses challenges due to the need for significant additional human resources. For instance, scaling up improvements to meet diverse student needs in onsite classes requires substantial effort. In contrast, enhancements in online learning can be disseminated more rapidly and sometimes at reduced costs to online and onsite courses utilizing online materials.

The eLearning Portal, implemented through MS Teams, is a central platform in our educational ecosystem, facilitating online and onsite learning experiences. It offers a diverse range of materials, including:

Comprehensive Learning Materials: The eLearning Portal provides extensive learning resources tailored to accommodate diverse learners. These resources, from lecture notes to quizzes, ensure a rich and adaptable student learning experience. Whether accessing materials remotely or in onsite

classes, students benefit from the platform's flexibility and accessibility, fostering inclusivity for all learners.

Enhanced Learning Modules: The portal's key strength lies in its ability to cultivate a sense of community and encourage active engagement. Through features such as forums, discussion boards, and collaborative activities, students participate in meaningful interactions with peers and instructors. This collaborative environment not only enriches the learning process but also fosters a vibrant learning community, both online and onsite. Instructors create dynamic learning environments tailored to diverse learning preferences and styles by incorporating various activities into course materials.

Seamless Integration with Onsite Learning: The portal seamlessly integrates with onsite learning activities, enhancing the educational experience. Instructors can supplement face-to-face lectures and discussions with online resources, assignments, and assessments. This integration promotes continuity and flexibility in learning, enabling students to access course materials conveniently and review content beyond traditional class hours.

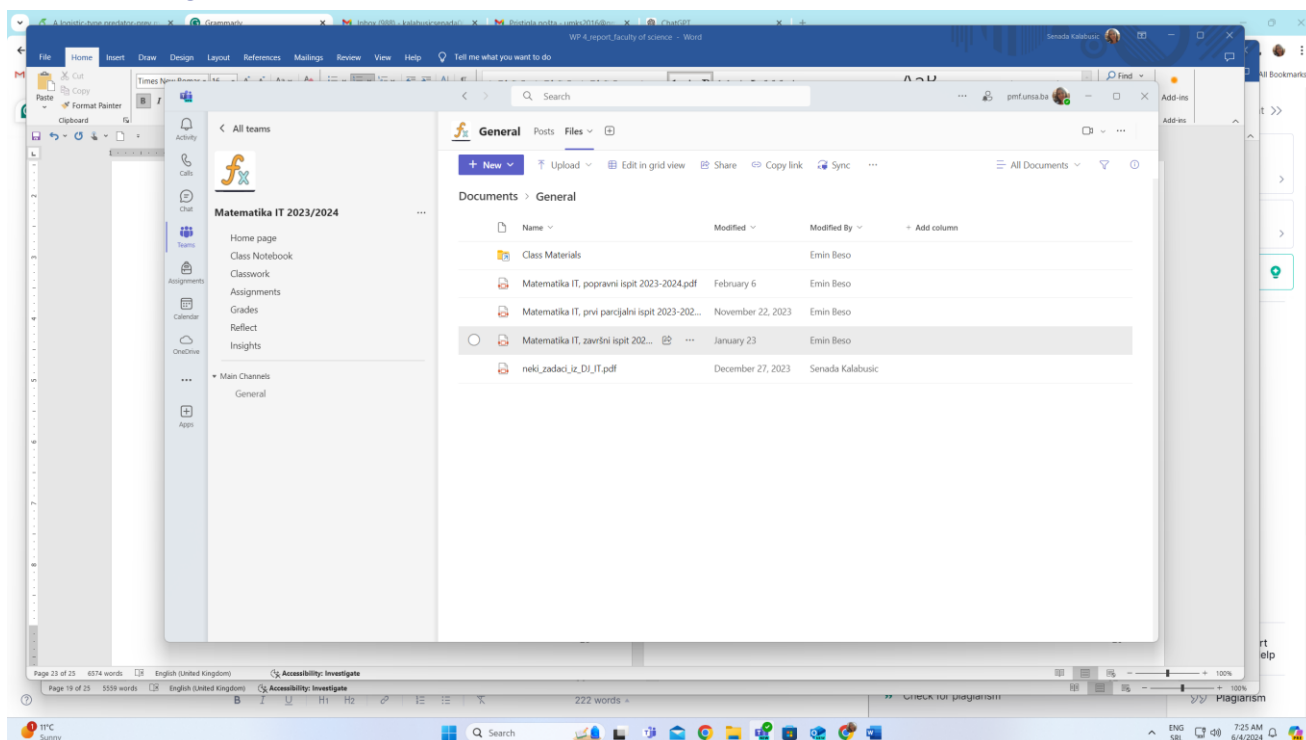
Overall, the eLearning Portal powered by MS Teams serves as a versatile platform that enriches learning experiences by offering comprehensive materials, promoting engagement, and seamlessly integrating with onsite learning activities. It caters to students' diverse needs in both online and onsite settings.

2.5. Operational eLearning Portal

The MSTEams platform can significantly enhance the learning experience for information technology students.

Experience the power of collaborative learning with MS Teams. This platform enables real-time collaboration, fostering group projects, discussions, and peer-to-peer learning. It is a community-building tool that encourages active participation.

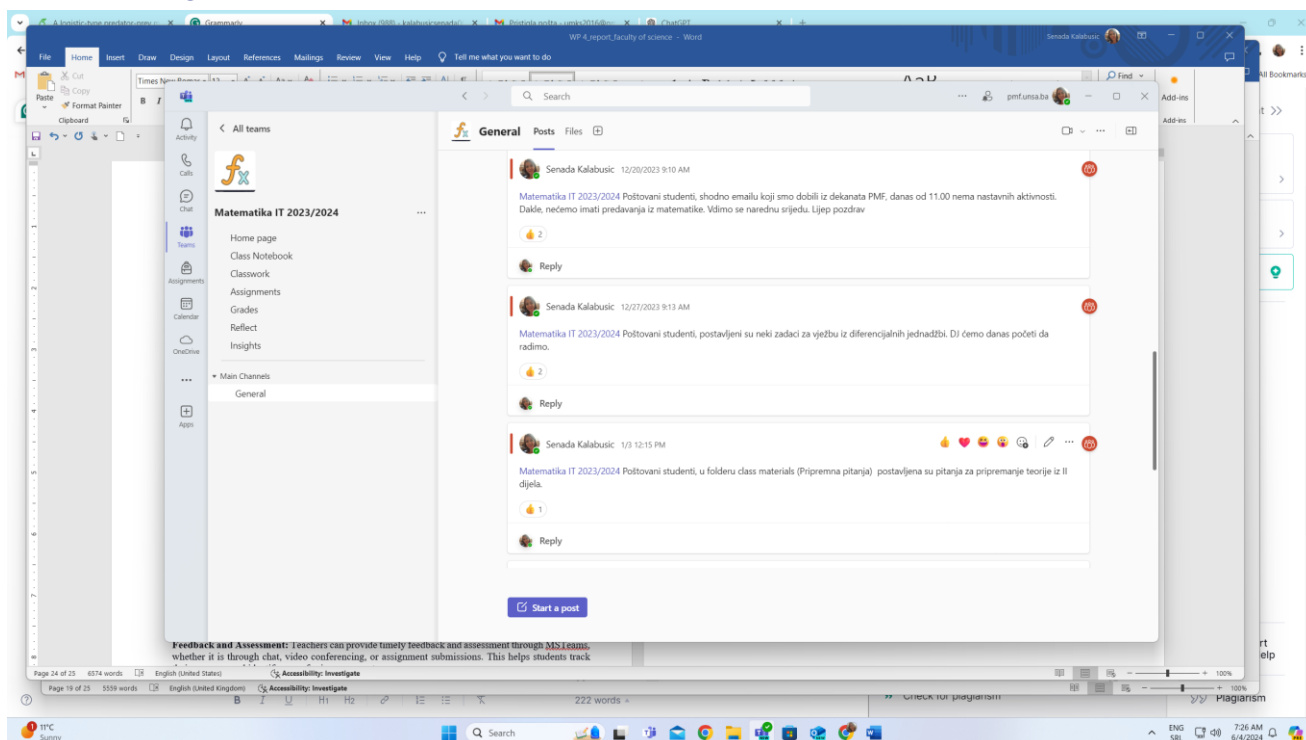
Resource Sharing: Professors can easily share resources such as lecture notes, presentations, and supplementary materials on MSTEams. This ensures that students have access to relevant content at all times, enhancing their understanding of IT concepts.



With MSTEams, IT students can enjoy the convenience of virtual meetings. Whether students are distance learners or have busy schedules, these meetings, including lectures, Q&A sessions, or guest speaker presentations, enrich students' learning experiences.

Integration with Tools: MSTEams integrates seamlessly with various tools and applications commonly used in IT education, such as coding platforms, project management tools, and collaborative document editors. This streamlines workflows and makes accessing and utilizing relevant resources more accessible for students.

Feedback and Assessment: Teachers can provide timely feedback and assessment through MSTEams, whether it is through chat, video conferencing, or assignment submissions. This helps students track their progress and identify areas for improvement.



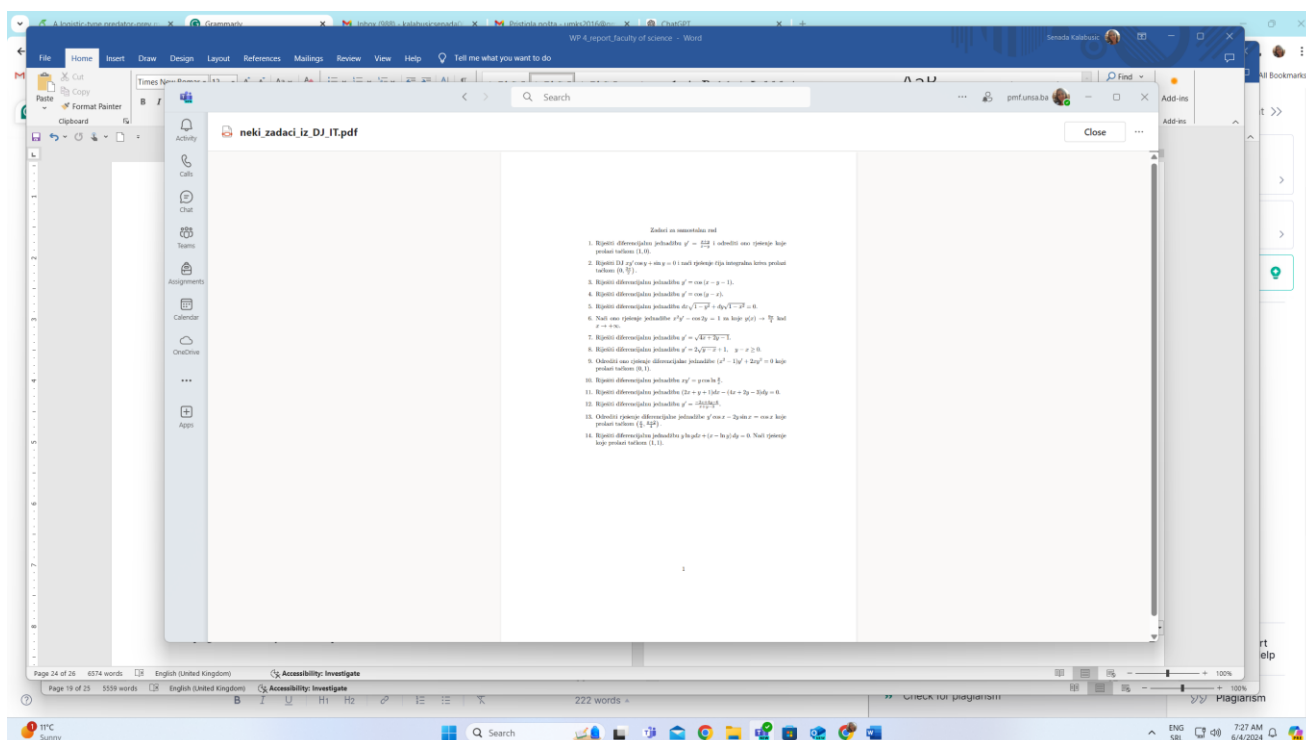
Matematika IT 2023/2024

Senada Kalabusic 12/20/2023 9:10 AM
Matematika IT 2023/2024 Poštovani studenti, shodno emailu koji smo dobili iz dekanata PMF, danas od 11:00 nema nastavnih aktivnosti. Dakle, nećemo imati predavanja iz matematike. Vidimo se narednu srijedu. Lijep pozdrav

Senada Kalabusic 12/27/2023 9:13 AM
Matematika IT 2023/2024 Poštovani studenti, postavljeni su neki zadaci za vježbu iz diferencijalnih jednačija. Dajmo danas početi da radimo.

Senada Kalabusic 1/3 12:15 PM
Matematika IT 2023/2024 Poštovani studenti, u folderu class materials (Priprema pitanja) postavljena su pitanja za pripremanje teorije iz II dijela.

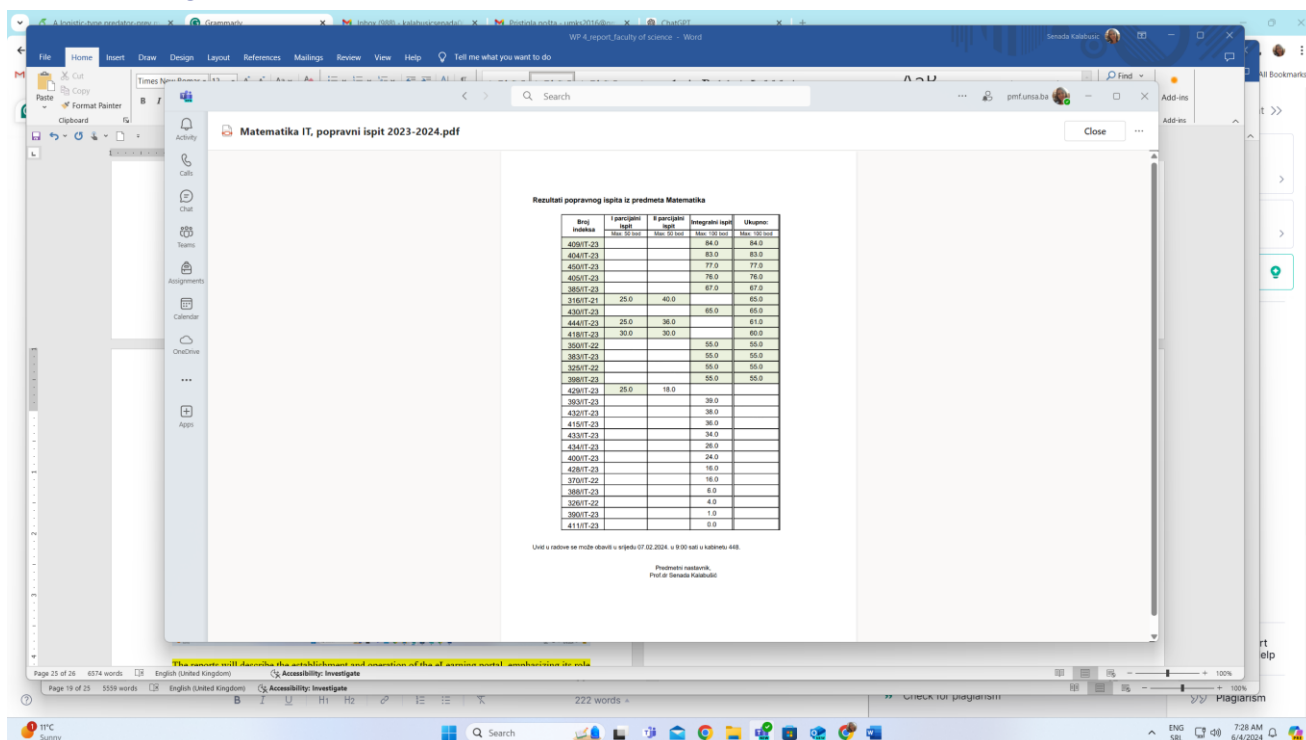
Feedback and Assessment: Teachers can provide timely feedback and assessment through MS Teams, whether it is through chat, video conferencing, or assignment submissions. This helps students track



neki_zadaci_iz_DJ_IT.pdf

Zadaci na samostalno rad

1. Riješi diferencijalnu jednačinu $y' = \frac{y}{x}$ i odredi onu rješenje koje prolazi tačkom (1, 0).
2. Riješi DGL $y'' + y = 0$ sa početnim uslovima $y(0) = 1$ i $y'(0) = 0$.
3. Riješi diferencijalnu jednačinu $y' = \cos(x - y)$.
4. Riješi diferencijalnu jednačinu $y' = \cos(x - y)$.
5. Riješi diferencijalnu jednačinu $y' = \sqrt{1 - y^2} + \sin y$.
6. Napiši opšte rješenje jednačine $x^2 y' + xy = 1$ na koje $y(x) \rightarrow 0$ kad $x \rightarrow \infty$.
7. Riješi diferencijalnu jednačinu $y' = \sqrt{x^2 + y^2}$.
8. Riješi diferencijalnu jednačinu $y' = 2\sqrt{y^2 + 1}$, $y = 0$ za $x = 0$.
9. Odredi onu rješenje diferencijalne jednačine $(y^2 - 1)y' + 2xy = 0$ koje prolazi tačkom (0, 1).
10. Riješi diferencijalnu jednačinu $xy' = y \ln x$.
11. Riješi diferencijalnu jednačinu $(2x + y - 1)y' - (x + 2y - 5)y = 0$.
12. Riješi diferencijalnu jednačinu $y' = \frac{y}{x} \ln \frac{y}{x}$.
13. Odredi opšte rješenje diferencijalne jednačine $y' + \tan x = \sec x$ na koje prolazi tačkom $(\frac{\pi}{2}, \frac{1}{2})$.
14. Riješi diferencijalnu jednačinu $y' + \tan x = \sec x$ na koje prolazi tačkom (1, 1).



Rezultati popravnog ispita iz predmeta Matematika

Broj indeksa	I parcijalni ispit Max. 20 bod.	II parcijalni ispit Max. 20 bod.	Integrirani ispit Max. 100 bod.	Ukupno Max. 140 bod.
409/IT-23			84.0	84.0
404/IT-23			83.0	83.0
405/IT-23			77.0	77.0
405/IT-23			76.0	76.0
385/IT-23			87.0	87.0
318/IT-23	25.0	40.0		65.0
430/IT-23			65.0	65.0
444/IT-23	25.0	36.0		61.0
418/IT-23	20.0	30.0		50.0
366/IT-22			55.0	55.0
383/IT-23			55.0	55.0
325/IT-22			55.0	55.0
386/IT-23			55.0	55.0
428/IT-23	25.0	18.0		
393/IT-23			39.0	
430/IT-23			38.0	
415/IT-23			36.0	
433/IT-23			34.0	
434/IT-23			28.0	
400/IT-23			24.0	
428/IT-23			16.0	
370/IT-22			16.0	
386/IT-23			6.0	
326/IT-22			4.0	
390/IT-23			1.0	
411/IT-23			0.0	

Unit u radnje se može obaviti u srijedu 07.02.2024. u 9:00 sati u kabinetu 408.

Prodekan nastavnika,
Prof. dr. Senada Kadićević

Improving communication between students and professors through the use of MSTeams involves several key benefits:

Instant Messaging: MSTeams provides a platform for real-time messaging, allowing students to easily reach out to professors with questions, concerns, or clarifications. This fosters a more dynamic and responsive communication channel than traditional email exchanges.

Virtual Meetings: MSTeams allow professors to conduct virtual office hours or scheduled meetings with students, opening avenues for personalized interactions and discussions. This functionality transcends physical barriers, enhancing accessibility for both parties.

Group Chats and Channels: MSTeams fosters collaboration through the creation of group chats and channels dedicated to specific courses or topics. This feature encourages collaborative discussions among students and professors, nurturing a sense of community and facilitating peer-to-peer support.

File Sharing and Collaboration: Professors can share relevant materials such as lecture slides, readings, and assignments through MS Teams. Students can also collaborate on documents or projects within the platform, streamlining communication and enhancing teamwork.

Feedback and Assessment: MSTeams facilitate efficient feedback and assessment processes. Professors can provide comments and grades on assignments directly within the platform, allowing for timely and constructive feedback. Additionally, students can seek clarification or further guidance on their performance through MS Teams.

Overall, MSTeams serves as a centralized hub for communication between students and professors, offering various features that promote engagement, collaboration, and effective feedback exchange, thereby enhancing the learning experience for all parties involved.

3. SC program: Software Development

The “Software Development” programme is categorized as a short-cycle higher education programme according to the European Qualification Framework (EQF). The study carries 120 ECTS points, and upon its successful completion, students reach EQF level 5.

All persons with a high school diploma have the right to enrol. The study lasts two years (four semesters), and the internationally recognised degree obtained at the end of the study is recognized in the Bologna system as “Associate degree (Ad)”, or “stručni specijalista” in Bosnian / “stručni pristupnik” in Croatian. The full title of the degree is “Associate degree in software development”.

The “Software Development” programme is one of the first studies of this type in Bosnia and Herzegovina and in part is the result of cooperation between the University of Sarajevo and the association of IT companies “Bit Alliance”, which actively participated in the preparation of the curriculum.

The curriculum is designed to include courses in the field of information technology, computing, programming and informatics with a special focus on the acquisition of practical skills, and students are exempt from courses in the field of advanced mathematics and physics.

The eponymous courses of the “Software Development” programme and the bachelor programme are similar in content and students of both study programs take the exams under the same criteria. Students have the option of switching from the “Software Development” programme to the bachelor programme, with the condition that they additionally take subjects that are part of the bachelor programme, but not part of the “Software Development” programme.

The short-cycle higher education programme “Software Development” offers the necessary knowledge for a successful IT career, but also requires the full commitment of students to their study obligations and continuous learning.

3.1. Intended Learning Outcomes

The intended learning outcomes that are obtained by fulfilling the study obligations are as follows:

- possession of fundamental knowledge in the field of programming, computer algorithms and software development
- having a broad education in the field of computer science and software engineering with an insight into current issues in the aforementioned fields, which qualifies for identifying and solving problems in the field of software development
- possessing the skills necessary to work as a programmer in the analysis, design, implementation and maintenance of software for various purposes
- possession of knowledge, skills and competences that enable continued education and lifelong learning
- possessing appropriate communication skills, readiness for teamwork with people from the same or other fields, and possessing responsibility towards the profession and society as a whole.

3.2. Developed Curricula and Course Syllabi

The curriculum was created with the aim of students developing the following knowledge, skills and competencies during two years of study (four semesters):

- basic knowledge of mathematics, computer science and programming
- the ability to analyse, identify and define the requirements of appropriate problems in the field of software engineering
- ability to design and implement software solutions
- good knowledge of the following areas of computer science and software engineering: programming and programming languages, computer algorithms and data structures, software engineering, information systems
- the ability to choose and apply appropriate engineering principles and mathematical and computational methods to problems in the field of computing and informatics
- the ability to identify, analyse and express problems in the field of software engineering by applying the acquired knowledge
- the ability to design and implement tests and experiments in the field of software engineering and draw conclusions and test hypotheses
- knowledge of standards and understanding of the impact that computer systems, their operation and maintenance have on the environment
- understanding the need and realizing the constant monitoring of the development of computer systems and the learning of new principles, techniques and technologies in all the above-mentioned areas
- the ability to work in different professional fields thanks to the acquired general, specialist and methodological competences
- ability to communicate with colleagues and the public about issues and problems related to all areas of software development
- the ability to work individually and as a team, to organize and implement projects

During the first semester (30 ECTS points), students attend five courses, attending a total of 216 hours of lectures and 114 hours of practical exercises.

	Course Title	Code	ECTS	L	PE
1	Mathematics in computer science 1	ETF RSO MRI I-1180	8	52	28
2	Introduction to programming	ETF UUP I-1170	7	44	26
3	Introduction to databases	ETF RSO UBP I-1150	5	40	20
4	Front-end web technologies	ETF RSO FEWT I-1150	5	40	20
5	Computer literacy	ETF RSO RP I-1150	5	40	20

L – Lectures

PE – Practical Exercises

During the second semester (30 ECTS points), students attend five courses, attending a total of 200 hours of lectures and 133 hours of practical exercises.

	Course Title	Code	ECTS	L	PE
1	Mathematics in computer science 2	ETF RSO MR II I-1280	8	40	40
2	Programming techniques	ETF TP I-1270	7	44	26
3	Software development	ETF RSO RS I-1250	5	38	22
4	Computer architectures and networks	ETF RSO ARM I-1250	5	38	20
5	Probability and Statistics	ETF RIO VS I-1265	5	40	25

L – Lectures

PE – Practical Exercises

During the third semester (30 ECTS points), students attend six courses, attending a total of 210 hours of lectures and 126 hours of practical exercises.

	Course Title	Code	ECTS	L	PE
1	Algorithms and data structures	ETF RIO ASP I-2360	5	38	22
2	Software testing	ETF RSO TS I-2350	5	30	20
3	Programming languages and translators	ETF RII PJP I-3550	5	36	14
4	Back-end web technologies	ETF RIO BEWT I-2350	5	40	20
5	Data warehouses	ETF RSO SP I-2350	5	36	14
6	Human-computer interaction	ETF RSO HCO I-2350	5	30	36

L – Lectures

PE – Practical Exercises

During the fourth semester (30 ECTS points), students attend three courses (a total of 210 hours of lectures and 126 hours of practical exercises) and 90 hours of practice in IT industry.

	Course Title	Code	ECTS	L	PE
1	Development of mobile applications	ETF RII RMA I-2450	5	35	15
2	Advanced software development	ETF RSO NRS I-2450	5	25	25
3	Basics of information systems	ETF RIO OIS I-3560	5	30	30
4	Final paper - practice	ETF RSO ZR I-24150	15	0	0

L – Lectures

PE – Practical Exercises

Course Syllabus, Mathematics in computer science 1

Course content:

- Elements of statement logic and statement algebra: Statements; Basic laws of statement logic; Transformations of logical statements; Tautologies and mathematical reasoning; Quine's procedure for finding MDNF and MKNF; Veitch diagrams; Sheffer's and Pierce's operation.

- Elements of set theory: Basic concepts of set theory; Operations with sets; Laws of set algebra; Ordered n-tuples and Decartes product of sets; Binary and n-ary relations; Relational model of databases; Mappings (functions); Equivalence relations and order.
- Boolean algebra and related topics: Concept and examples of Boolean algebras; Switch functions; Logic diagrams;
- Elements of predicate logic: Definition of predicate; Quantifiers (quantifiers); Predicate logic of the first order; Valid expressions and logical consequences; Reduction of the expression to the prenex form; A positive test for the validity of the expression.
- Introduction to elementary number theory: Divisibility and divisibility criteria; Prime numbers; The greatest common divisor and the least common denominator; Euclid's algorithm; Diophantus equations; Congruences and modular arithmetic; Some applications of number theory in cryptography.
- Introduction to enumerative combinatorics: Introductory terms; Permutations, variations and combinations with and without repetition; Sample selection problem; Permutations of total disorder (derangements); Stirling numbers; Partitions and compositions; The twelvefold way.
- Introduction to discrete probability theory: Algebra of events; Concept and calculation of probability; Conditional (relative) probability and independent events; Total probability and Bayes theorem; Experimental determination and statistical interpretation of the meaning of probability.
- Elements of graph theory: Basic terms and labels; Paths and connectivity of graphs; Ways to represent graphs; Isomorphism of graphs; Planar graphs; Euler's and Hamilton's paths; Graph coloring; Trees, skeletons and graph searching; Minimal spanning tree; Finding the shortest path in a graph; Transport networks and the maximum flow problem; Pairing; Rooted trees and binary trees.
- Elements of language and automata theory: Formal grammars; Grammar types; Finite automata; Slot machines with a stack; Linear bounded automata; Turing machine; Church-Turing thesis; Algorithmically unsolvable problems.

Prerequisites

- Elementary high school mathematics

Course Syllabus, Introduction to programming

Course content:

- Introduction: analysis and problem solving, algorithms, flow charts, top-down and bottom-up development methodologies, programming languages, program development.
- Programming language C: syntax, data types, local and global variables.
- Control structures, operators, arrays, pointers, declaration and initialization of pointers, strings.
- Functions, function definition, function call, function prototype, function arguments and data transfer to functions: transfer by value and transfer via pointers, recursive functions.

- Structures, arrays of structures, access to structure elements, operations on structures.
- Files, working with files, program modularity, function libraries, dynamic memory allocation.

Course Syllabus, Introduction to databases

Course content:

- Introduction to databases: What is a database system? What is a database? Why a database? Data independence
- Database system architecture: Three-layer architecture. Conceptual level. External level. Internal level. Database Administrator. Database management system. Client/Server architecture.
- Types: Type definition. Operators. Values versus variables. Types in relation to representation. User-defined data types.
- Relational data model: Set of entities. Attributes. Rules for links. Link attributes. Elements of the relational data model. Types of connections between tables. Entity-relationship diagrams.
- Relations: A data structure consisting of multiple parts (tuples). Types of relations. Values of the relation. Relational variables.
- Integrity: Predicates and propositions. Basic types of constraints. Limit check. Internal versus external predicate. Correctness versus consistency. Constraint Classification Scheme. Integrity and views. Keys.
- Introduction to SQL: An Overview. Catalogue. SQL commands for creating objects in the database. Simple SQL commands for writing, modifying and deleting data. SQL simple queries. SQL queries against multiple tables. SQL functions.
- Views: What is a view? Browsing views. Updating the view.
- Functional dependencies: Basic definitions. Trivial and non-trivial dependencies. Dependency set and attribute set conclusion.
- Normalization: First, second and third normal form. Boyce/Codd standard form. Value-related attributes.

Course Syllabus, Front-end web technologies

Course content:

- Front-End Web technologies
- Markup language for web page development
- Introduction to web design
- Style sheet language for creating the layout of web pages
- UI and UX design
- The role of psychology in design
- Principles of good design
- Responsive web design
- DOM – Document Object Model
- Client-side scripting language for web page interactivity
- Front-end web development

Course Syllabus, Computer literacy

Course content:

- Current technological trends here and in the world: definition of computer and information literacy, impact of technology on global society and family, impact of technology on different careers.
- Understanding of basic computer components: basic computer functions, input/output devices, data processing, memory, data storage, connection to the outside world, computer power supply.
- Using the Internet: history, efficient use of network resources, Web 2.0, e-mail, e-commerce, efficient web browsing.
- Application software: basic differences between application and system software, different ways of installing and using application software, business software and productivity software, software for working with multimedia, software maintenance.
- System software: fundamentals of system software, different types of operating systems, basic operations, computer boot process, basic ways of organizing documents, various useful tools.
- Understanding and assessment of hardware: assessment of basic computer components (processor, memory, disks, audio and video systems), reliability, assembling a computer configuration.
- Basic concepts of computer system networking: network architecture and components, Internet connection, home network setup, wireless network security.
- Digital components and different ways of recording data: digital and analog signals, digital formats, images, audio and video recordings, connection to mobile devices.
- Ethics in computing: intellectual property, privacy, geolocation, electronic communication, censorship, misuse of computers.

Course Syllabus, Mathematics in computer science 2

Course content:

1. Vectors and matrices: Vector as a geometric term; Vector operations; Algebraic generalization of the vector concept; Linear combinations; Linear dependence and independence; Matrices; Matrix operations; Rank matrix and inverse matrix; Determinants.
2. Systems of linear equations: Definite, indeterminate and impossible systems; Cramer's Rule; Gauss method; Gauss-Jordan elimination; Canonical form arranged in rows; Kronecker-Capelli's position.
3. Analytical geometry in the plane: Concept of line equation; Straight lines; Relationship between point and direction; Relationship of multiple directions; Second order curves.
4. Basic number sets: Whole numbers; Rational numbers; Real numbers; Complex numbers; Operations with real and complex numbers.
5. Elementary functions: Power function; Polynomials; Exponential function; Logarithmic function; Trigonometric and their inverse functions; Hyperbolic and their inverse functions;

6. Boundary processes: Numerous series and rows; The concept of threshold value; Limit value of series and function; Basic properties of limit values; Continuity; Convergent series; Convergence criteria.
7. Differential calculus of functions of one variable: Concept of derivative; Features of the extract; Derivative calculation techniques; Geometrical and mechanical interpretation of the term derivative; Higher order derivatives; Taylor's rows; Application of the differential calculus to the study of the flow of functions.
8. Integral calculus of functions of one variable: Indefinite integral; Techniques for finding indefinite integrals; Definite integral; Connection of definite and indefinite integral; Geometrical and mechanical interpretation of a definite integral; Approximate calculation of certain integrals; Trapezoidal and Simpson's rule.

Course Syllabus, Programming techniques

Course content:

- Fundamentals of imperative programming in the C++ language: Basic elements of the C++ language; Input and output flow; C++ standard libraries; Data types in the C++ language; Logical and enumerated types; Vectors, decks and strings; Exceptions; References; Default function parameters; Overlapping functions; Generic functions and templates; Concepts and models
- Advanced imperative programming in the C++ language: Dynamic memory allocation; Dynamic variables; Memory leak; Dynamic arrays; Dynamic allocation and exceptions; Complex pointer types (pointers to arrays, arrays of pointers, pointers to pointers); Dynamic allocation of multidimensional arrays using complex pointer structures; Indirect access to data; Pointers to functions; Standard library algorithms; Blocks and iterators; Use of standard algorithms for sorting and searching; Structures (syllables or records); Pointers to structures; Dynamic allocation of structures; Generic structures; Structures with pointers; Shallow copying; Nodes; Linked lists
- Object-based programming in the C++ language: Limitations of structures as data modeling elements; Philosophy of object-based programming; Classes and instances of classes (objects); Member functions (methods); Hiding information; Encapsulation; Class interface; Friendly functions and classes; Constructors; Destructors; Interaction between destructors and shallow copies; Deep copying; Copy constructor; Folded assignment operator; Memory management techniques; Generic classes; Overlapping operators; Function objects (functors); Standard library functors; Connectors and adapters
- Object-oriented programming in the C++ language: Inheritance; Base and derived classes; Occurrence of cutting off; Inheritance and pointers; Static and dynamic types; Virtual member functions; Polymorphism; Heterogeneous container facilities; Type identification; Class hierarchies; Purely virtual functions; Abstract base classes; Polymorphic copying; Files; Serialization of container classes
- An example of object-oriented design: Arithmetic expression trees; The need for object-oriented design; Memory management problem; Management classes; Expanding functionality

Course Syllabus, Software development

Course content:

- Introduction: software development process, introduction to fundamental concepts of UML and object-oriented modeling. Introduction to UML notation.
- UML diagrams: use case diagrams, class diagrams, object diagrams,
- UML diagrams: interaction diagrams (sequence and collaboration diagram), activity diagram
- UML diagrams: state diagram, implementation diagrams (component diagrams, deployment diagrams) and other related diagrams.
- Mapping the UML model to the implementation level of object-oriented languages (Java).
- Java programming: encapsulation, polymorphism, abstraction, interfaces, lambda expressions, collections, ...
- Java programming: inheritance, interfaces, exceptions, and deployment.
- Java programming: Date/Time API, I/O, file I/O, and concurrency.
- Java programming: concurrency, parallelism, JDBC API and working with database, localization.
- Software development using UML and Java programming language, presentation of project results and discussions.

Course Syllabus, Computer architectures and networks

Course content:

Hardware architecture:

- Data Representation: Bits, Bytes and Words. Numeric and non-numeric data. Display number.
- Computer architecture: basic blocks (logic gates, flip-flops, counters, registers). Fetch / execute cycle. Instructions and types.
- Data Storage: Memory Hierarchy and Associated Technologies. Physical and virtual memory.

Operating systems:

- Principles of operating systems. Abstractions. Processes and resources. Security. Application program interfaces.
- I/O devices buffering, programmed and interrupt-driven I/O. Direct memory access.
- File systems: Physical structure. File and directory organization, structure and content. Backup.

Networks:

- Background and history of networking and the Internet.
- LAN and WAN, layered protocol design. TCP / IP protocol stack; theory and practice. Connection-oriented connections and connectionless communication. Unicast, multicast and broadcast. Naming and addressing. Protocols; examples: SMTP, HTTP).

Course Syllabus, Probability and Statistics

Course content:

- Introduction to statistics and data collection; arithmetic mean, median, variance, standard deviation. Discrete and continuous data. Graphical presentation of data.
- Basics of combinatorics: permutations, combinations and variations. Definition of probability. The probability of the union of events.
- Conditional probability, independent events and Bayes formula.
- Random variables. distribution function (distribution)
- Mathematical expectation, mean, variance and covariance of a random variable
- Mean and variance of a linear combination of random variables, Chebyshev's theorem
- Some discrete probability distributions: binomial, multinomial, hypergeometric, Poisson
- Some continuous probability distributions: normal, Gamma, exponential, Chi-square
- Fundamental sample distributions and data description, Theorem of Central Limit
- Estimates of arithmetic mean, proportion, variance, tolerance, confidence interval
- Statistical hypotheses. Testing the validity of statistical hypotheses.
- Simple linear regression and correlation

Course Syllabus, Algorithms and data structures

Course content:

- Introduction to algorithms, analysis of algorithms, complexity and assessment of complexity of algorithms, notation
- Definition, memory representation and classification of data structures.
- Arrays: one-dimensional and multidimensional.
- Lists: singly linked, doubly linked, rings and special cases, such as stacks and queues.
- Trees, binary, balanced and search trees.
- Heaps, hashing, hash tables, graphs.
- Classic sequential sorting algorithms (bubble sort, selection sort, insertion sort, shell sort, quick sort, radix sort, heap sort, external sort) and search algorithms (sequential search, binary search, binary tree search, hashing, external search).
- Techniques (paradigms) of designing algorithms such as: divide and rule, dynamic programming, greedy algorithms, backtracking algorithms, branch and bound algorithms, randomized algorithms.
- Algorithms over graphs, algorithms for determining the shortest path, algorithms for determining the minimum spanning tree, algorithms for determining the maximum flow
- Practical work: realization of characteristic data structures and algorithms in the programming language C++.

Course Syllabus, Software testing

Course content:

- Introduction to testing: general principles of testing, basic terminology, testing strategies and techniques, types and levels of testing, software quality factors, software verification and validation, testing standards.
- Unit testing: unit environments, data-driven testing, replacement objects.
- White Box testing: principles and types of white box testing: code inspections; code refactoring, static white box testing, cyclic complexity; test scenarios.
- Black Box testing: principles and types of black box testing, black box functionality testing, equivalent classes, combinatorial models of functionality testing.
- Manual and automated testing: basic principles, creating test cases, how to run tests, reporting errors, human component, software testing tools.
- Levels and types of testing: unit testing; integration testing; system testing; performance testing, stress and load testing, security testing, configuration testing; regression testing; usability testing, acceptance testing

Course Syllabus, Programming languages and translators

Course content:

- Become familiar with many common procedural languages, as well as representational functional, logic-oriented and object-oriented languages.
- Understand the components and features of programming languages needed for program development and maintenance of various applications.
- Develop skills to assess language for own needs, abilities, limitations, environmental requirements.
- Study the stages and components of typical programming language translators.
- Study relevant language theory and understand its use in translation.
- To design, develop and test large software projects, using several software tools, resulting in a programming language translator.

Course Syllabus, Back-end web technologies

Course content:

- Back-End Web technologies
- Web server and HTTP protocol principles
- Server-side scripting language
- Back-end web development
- Access to databases from web applications
- Web services
- Web service testing
- Security of web applications
- Web sockets
- Deployment and maintenance of web applications

Course Syllabus, Data warehouses

Course content:

- Introduction to data warehouses, decision support systems (DSS), operational and analytical systems, evolution of DSS and data warehouses, online transaction processing (OLTP), characteristics of data warehouses, online analytical processing (OLAP).
- Data warehouse planning and construction, costs, prerequisites, obstacles, challenges and risks, SDLC methodologies - waterfall and RUP approach, planning and management, logical and physical design, implementation and implementation
- Data warehouse design, multidimensional analysis, relational model limitations, data cubes, dimensional modeling and advantages of dimensional models, logical and physical design, normalization and its advantages/disadvantages, de-normalization, data warehouse characteristics, subject orientation, integration, temporal volatility, star scheme
- Data Warehouse Schema, Dimensions and Dimension Tables, Facts and Fact Tables, Star Schema, Snowflake Schema, Degenerate and Waste Dimensions, Bus Architecture, Conforming Dimensions and Standard Facts, Data Granularity, Dimension Change
- Data warehouse components, source systems, presentation, access tools, data matrix construction, multiple fact tables in a data mart, heterogeneity, transactions/snapshots and aggregate facts, fact table details, source identification for each fact and dimension, mapping from source to the goal
- ETL process, data extraction, extractions from different platforms, full and incremental extractions, data change detection, data transformation, complexity of data integration, working with missing and dirty data, loading data
- Data aggregation, goals and risks of aggregation, deciding on the subject of aggregation, data dispersion, problem with aggregates, navigators of aggregation
- Dimension Selection, Fact Determination, Avoiding Null Keys, Additive and Semi-Additive Facts, Allocation of Lower Level Facts
- Web-based data warehouses, data tracking, creating a consistent state, state monitoring techniques, user registration, log files, online advertising, tracking and analytics
- Data mining, statistics, artificial intelligence and machine learning, examples and tools, connection between mining and data warehouse, retrospective and predictive reporting, mining applications, mining / statistics / OLAP, statistical mining techniques (sampling, regressions and decision trees), clusters, segmentation and nearest neighbor
- Mining techniques, classification, regression, similarity matching, clustering of consecutive events, predictive models, clusters / segmentation, supervision, entropy

Course Syllabus, Human-computer interaction

Course content:

- Human-computer interaction: definition, significance, basic terms, principles of interaction design
- User understanding and analysis, design thinking

- Interaction design: user- and task-oriented methods
- Prototype: role, types, tools
- Examples of good interaction design ("design patterns")
- Visualization techniques
- Usability evaluation: importance, principles, methods, user evaluation, expert evaluation (heuristic evaluation)

Course Syllabus, Development of mobile applications

Course content:

- Introduction to the Android operating system and its components
- Android Application Resources and Activities
- Mobile application user interface design
- Intents, filters and communication between applications
- Fragments and user interface design through fragments
- Instrumented testing of mobile applications
- Services and receivers of notifications
- Asynchronous processing of tasks
- Use of web services in the mobile application
- Content and database providers
- Hybrid approach in mobile application development

Course Syllabus, Advanced software development

Course content:

- Basic principles of software engineering. Organization of tasks and roles in the development team. Software development methods and processes. Agile methods. Extreme programming. Requirements engineering.
- Working environment for software development: Eclipse, Ant, JUnit. Systems for building software (build system). Automated testing. Test Driven Development (TDD). Refactoring.
- Source code control systems: Git. Principles of problem and conflict resolution. Using Git from the Eclipse development environment, through the web environment, or separate applications.
- Management of software projects: GitHub, GitLa
- Software development – ETF RSO RS I-1250b, Atlassian Jira.
- Continuous Integration (CI): Jenkins. Principle of operation, installation and configuration. Solving problems.
- Continuous installation/deployment (CD). Basic concepts and terms. Puppet/Chef. Ansible.
- Continuous monitoring and continuous supervision. Containerization. Deployment to the cloud.

Course Syllabus, Basics of information systems

Course content:

- Introduction: what is IS; IT is not IS; 4 components of IS: technology (hardware), process (software), structure, people;
- IS efficiency and effectiveness: IS budget and return on investment (ROI); use of information and satisfaction of users and employees
- IS development process: technologies and innovations; global development strategy; iterative development; alternative approaches
- Requirements: analysis, prioritization; formulating functional and quality requirements
- IS Architecture: the importance of architecture; choice, extension or creation of architecture
- Design IS: external design; physical interaction, flow of interaction: data, media content; interior design
- Coding; testing: why to test, V model of verification, validation, testing; how to test: preparing the test, executing the test and recording the results, finding and correcting errors
- Prototyping, maintenance
- Business process modeling and process management
- Methodologies for IS development and design

Course Syllabus, Final paper - practice

Course content:

- Defining the problem. Hypothesis, task, project. Selection, search and use of literature. Choice of method.
- Planning the creation of the practical part. Development of the practical part (software). Verification, validation of the offered solution.
- Consultations, conflict of views, corrections, compliance with set deadlines.
- Creation of a preliminary version of the text of the paper. Formalized writing of professional and technical work. Using literature. Citation. Comparison of methods. Commenting on the results. Graphical and formal presentation of results.
- Finalization of the work with the adoption of remarks or suggestions from the mentor. Technical and graphic editing.
- Presentation of results. Creating a presentation. Public exposure. Presentation skills. Time and content planning. Separating the essential from the non-essential. Focusing on own results. Answering questions.

3.3. Developed Materials

Majority of efforts regarding creating tailor learning materials were concentrated on the online experience, as it was safe to assume that onsite courses would also benefit from these improvements. Traditional in-class experience would be more difficult to significantly improve without engaging considerable additional human resources. For example, improvements to

traditional in-class experience to meet diverse needs of students would be difficult to scale up, while improvements in online experience in general can be propagated at higher speed and sometimes at reduced costs to other online courses and onsite courses utilizing online materials.

The eLearning Portal, implemented using Moodle, serves as a pivotal platform in our educational ecosystem, facilitating both online and onsite learning experiences. Following range of materials are developed:

Comprehensive Learning Materials: Extensive array of learning materials tailored to meet the needs of diverse learners. From lecture notes and presentations to quizzes, these resources provide students with a rich and multifaceted learning experience. Whether accessing materials remotely or during onsite classes, students benefit from the flexibility and accessibility offered by the platform.

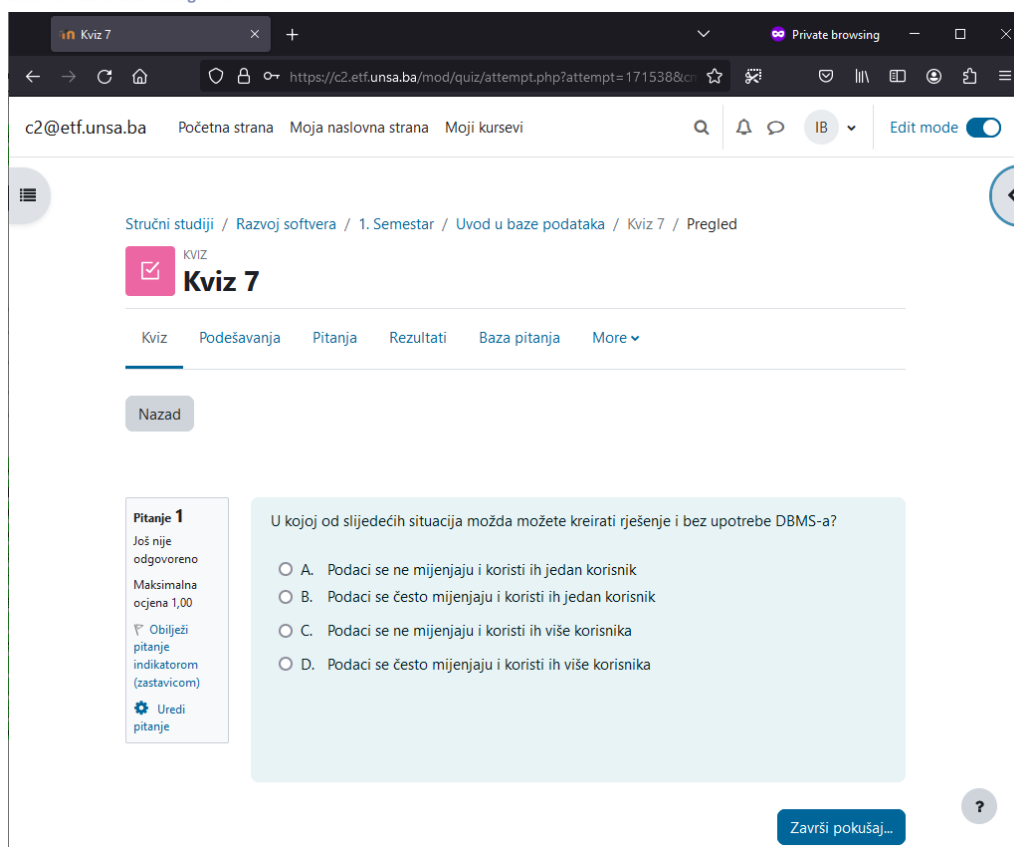
Enhanced Learning Modules: One of the key strengths of the portal is its ability to facilitate enhanced learning experiences. Through the use of forums, discussion boards, and collaborative activities, students engage in meaningful interactions with their peers and instructors. This fosters a sense of community and promotes active participation, both online and onsite. By integrating various activities into course materials, instructors create dynamic learning environments that cater to diverse learning styles and preferences.

Seamless Integration with Onsite Learning: The portal seamlessly integrates with our onsite learning activities, enhancing the overall educational experience for students. Instructors can supplement face-to-face lectures and discussions with online resources, assignments, and assessments. This integration promotes continuity and flexibility in the learning process, allowing students to access course materials at their convenience and review content outside of traditional class hours.

3.4. Operational eLearning Portal

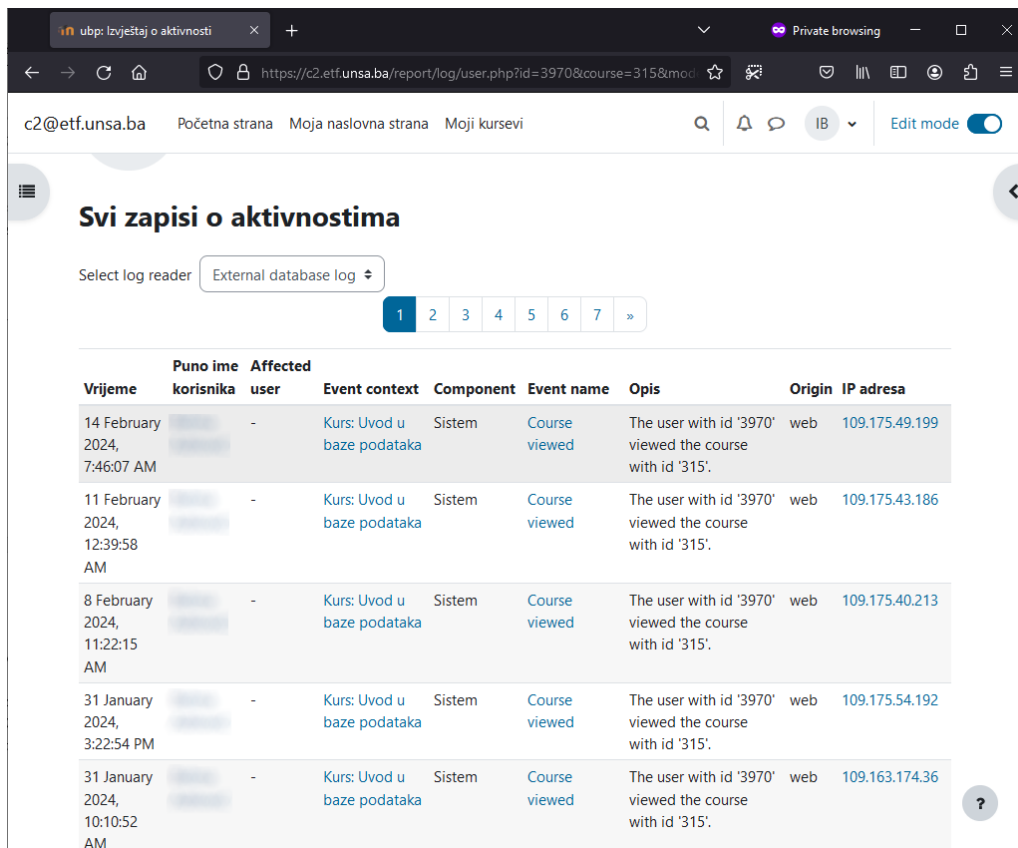
The portal plays a central role in enhancing eLearning and onsite education. By providing a diverse range of materials and interactive learning modules, the portal promotes engagement, collaboration, and flexibility in the learning process.

Utilizing the quiz activity within the eLearning portal offers students a versatile and comprehensive learning experience, enriched by the platform's flexibility and accessibility.



By incorporating quizzes into course materials, students gain opportunities for self-assessment, reinforcement of key concepts, and immediate feedback on their progress. Whether accessing materials remotely or during onsite classes, students benefit from the convenience and adaptability afforded by the platform. With features such as timed quizzes, random question selection, and adaptive feedback, the quiz activity accommodates diverse learning preferences and supports individualized learning pathways. Moreover, the ability to include a variety of question types, including multiple choice, short answer, and essay questions, allows instructors to assess students' understanding across different cognitive domains and encourage critical thinking skills. Additionally, the quiz activity enables instructors to monitor student performance in real-time, track progress over time, and identify areas for further instruction or review. This data-driven approach to assessment enhances the overall learning experience by providing timely insights into student comprehension and mastery of course content. Furthermore, the flexibility of the platform allows students to engage with quizzes at their own pace and convenience, fostering a sense of autonomy and ownership over their learning journey. Whether completing quizzes asynchronously outside of class hours or participating in live quizzes during onsite sessions, students have the opportunity to engage with course materials in ways that suit their individual needs and preferences. Overall, the quiz activity plays a crucial role within the eLearning portal, providing students with a rich and multifaceted learning experience that promotes active engagement, reinforces learning objectives, and supports their academic success.

Within the eLearning portal's operational framework, activity logs stand as indispensable tools for monitoring and enhancing student progress and engagement.



ubp: Izvještaj o aktivnosti

Private browsing

https://c2.etf.unsa.ba/report/log/user.php?id=3970&course=315&mod...

c2@etf.unsa.ba Početna strana Moja naslovna strana Moji kursevi

Svi zapisi o aktivnostima

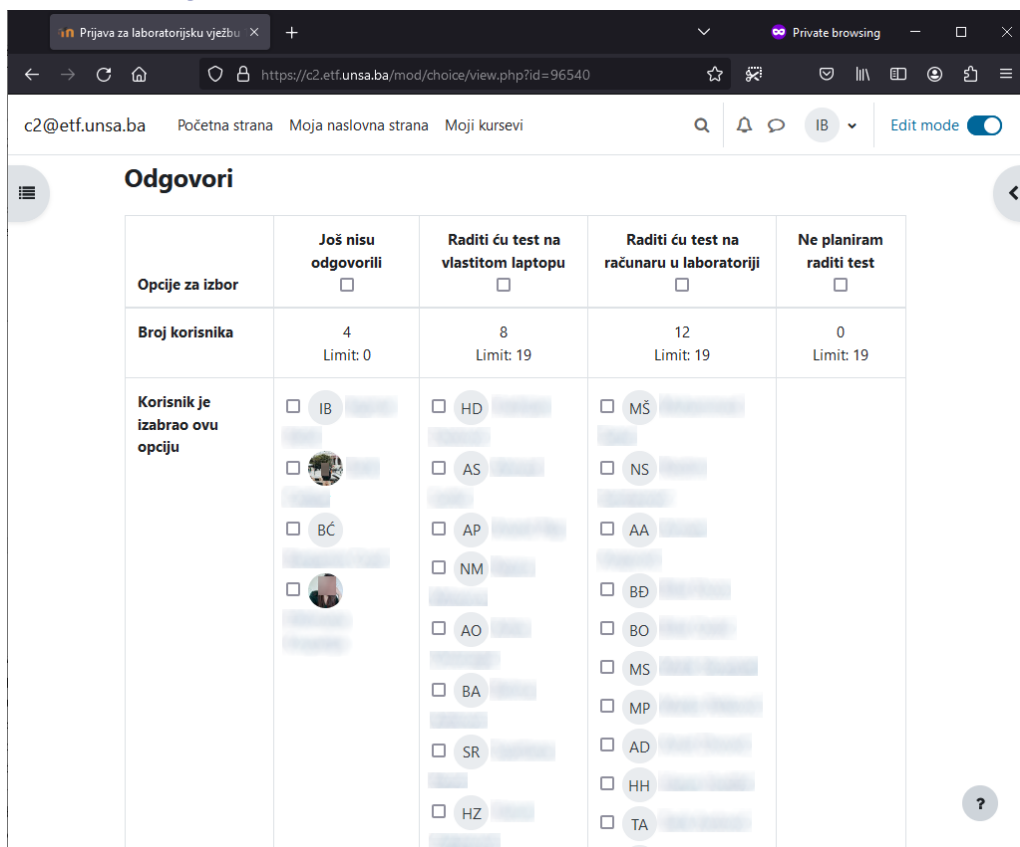
Select log reader External database log

1 2 3 4 5 6 7 »

Vrijeme	Puno ime korisnika	Affected user	Event context	Component	Event name	Opis	Origin	IP adresa
14 February 2024, 7:46:07 AM		-	Kurs: Uvod u baze podataka	Sistem	Course viewed	The user with id '3970' viewed the course with id '315'.	web	109.175.49.199
11 February 2024, 12:39:58 AM		-	Kurs: Uvod u baze podataka	Sistem	Course viewed	The user with id '3970' viewed the course with id '315'.	web	109.175.43.186
8 February 2024, 11:22:15 AM		-	Kurs: Uvod u baze podataka	Sistem	Course viewed	The user with id '3970' viewed the course with id '315'.	web	109.175.40.213
31 January 2024, 3:22:54 PM		-	Kurs: Uvod u baze podataka	Sistem	Course viewed	The user with id '3970' viewed the course with id '315'.	web	109.175.54.192
31 January 2024, 10:10:52 AM		-	Kurs: Uvod u baze podataka	Sistem	Course viewed	The user with id '3970' viewed the course with id '315'.	web	109.163.174.36

These logs meticulously record each student's interactions within the platform, offering insights into their navigation patterns, time spent on tasks, and participation levels across various activities. By analyzing these logs, instructors gain a comprehensive understanding of individual students' engagement with course materials, discussions, and collaborative activities. Moreover, activity logs enable instructors to identify trends and patterns at both the individual and cohort levels, facilitating data-driven decision-making and targeted interventions to support student success. From tracking attendance in virtual classrooms to monitoring completion rates of assignments and quizzes, the detailed information provided by activity logs empowers instructors to tailor their instructional strategies, provide timely feedback, and offer personalized support to students as they progress through their learning journey. Furthermore, the accessibility and transparency of activity logs promote accountability and motivation among students, as they can easily monitor their own progress and engagement metrics. Overall, activity logs play a pivotal role within the eLearning portal, serving as dynamic tools for fostering student success and facilitating a supportive and enriching learning experience.

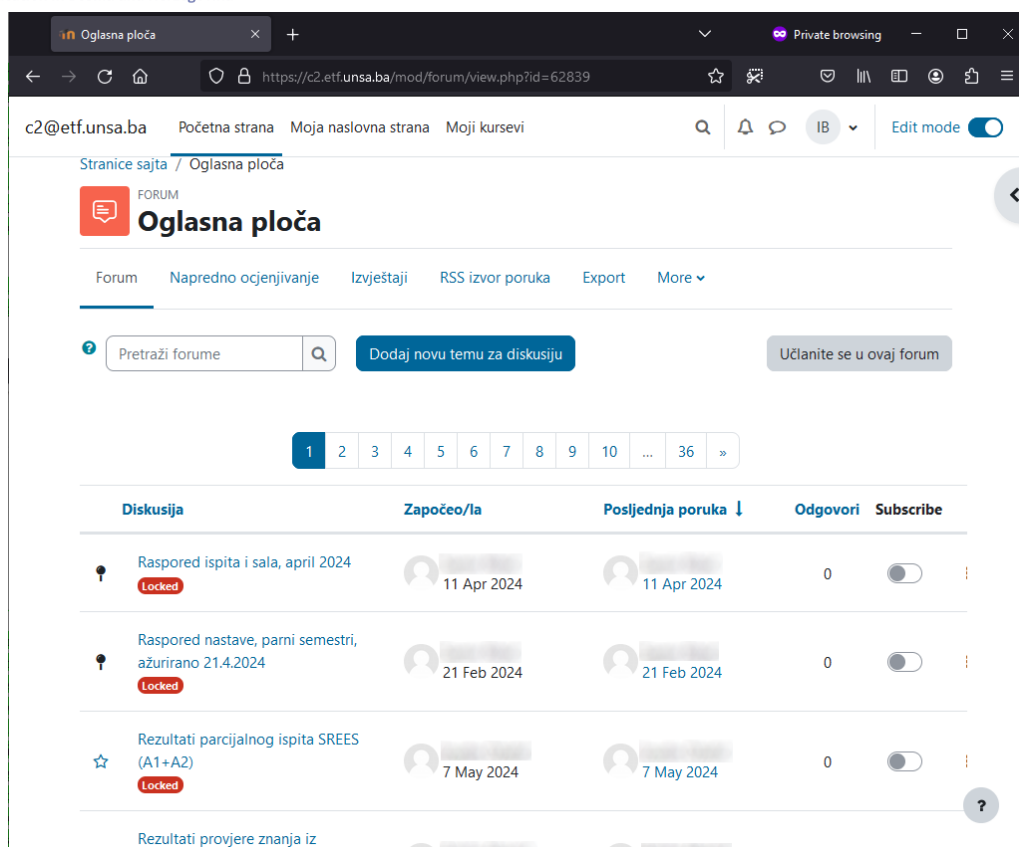
The utilization of choice activity feature within the eLearning portal revolutionizes the process of organizing laboratory and project groups while facilitating customizable schedules for shared resource usage.



Opcije za izbor	Još nisu odgovorili ☐	Raditi ću test na vlastitom laptopu ☐	Raditi ću test na računaru u laboratoriji ☐	Ne planiram raditi test ☐
Broj korisnika	4 Limit: 0	8 Limit: 19	12 Limit: 19	0 Limit: 19
Korisnik je izabrao ovu opciju	☐ IB ☐ [Avatar] ☐ BĆ ☐ [Avatar]	☐ HD ☐ AS ☐ AP ☐ NM ☐ AO ☐ BA ☐ SR ☐ HZ	☐ MŠ ☐ NS ☐ AA ☐ BĐ ☐ BO ☐ MS ☐ MP ☐ AD ☐ HH ☐ TA	

Through the choice activity, students are empowered to dynamically form groups based on their preferences, schedules, and project requirements. This functionality fosters flexibility and autonomy, enabling students to collaborate with peers who share similar interests or availability. By allowing students to create and modify their group memberships as needed, the choice activity promotes inclusivity and adaptability within the learning environment. Additionally, the customizable scheduling feature empowers students to coordinate the use of shared resources, such as laboratory equipment or project rooms, according to their group's specific needs and availability. Students can collaboratively establish timelines, allocate resources, and plan meetings through the online platform, streamlining the logistical aspects of group projects and enhancing overall efficiency. Furthermore, choice activity facilitates transparent communication and decision-making among group members, as students can view available options, make informed choices, and negotiate preferences within the platform. Instructors also benefit from this functionality, as they can monitor group formation processes, assess student engagement, and provide support as needed. Moreover, the choice activity promotes student ownership of their learning experience, fostering a sense of responsibility and accountability as students actively participate in the organization and management of their collaborative projects. Overall, choice activity serves as a powerful tool within the eLearning portal, empowering students to create dynamic laboratory and project groups, customize schedules for resource usage, and collaborate effectively in pursuit of academic excellence.

Within the portal, the forum activity serves as a cornerstone for fostering meaningful interactions among students and instructors, thereby cultivating a vibrant sense of community and promoting active participation in both online and onsite settings.



By facilitating discussions, collaborative problem-solving, and knowledge sharing, the forum activity enables students to engage with course content in dynamic and interactive ways. Through threaded discussions, students can explore diverse perspectives, exchange ideas, and seek clarification from peers and instructors, thus enriching their learning experience. Moreover, the asynchronous nature of the forum activity accommodates diverse learning styles and preferences, allowing students to participate at their own pace and convenience. This flexibility not only empowers students to take ownership of their learning journey but also promotes inclusivity and accessibility for all learners. Additionally, the forum activity promotes engagement and collaboration beyond the confines of the traditional classroom, extending the learning experience into the digital realm. Whether students are engaging in discussions from the comfort of their homes or participating in onsite sessions, the forum activity serves as a platform for building connections, fostering camaraderie, and nurturing a supportive learning community. Furthermore, the forum activity allows instructors to facilitate discussions, provide feedback, and scaffold learning experiences tailored to the needs of their students. By leveraging the technical capabilities of the platform, instructors can create dynamic learning environments that cater to diverse learning styles and preferences, promoting active engagement and deepening students' understanding of course concepts. Overall, the forum activity is serving as a catalyst for collaboration, communication, and community building among students and instructors alike.

Moving forward, continued investment in the development and enhancement of the portal will further optimize the educational experience for students and instructors alike.

Constructive feedback. Additionally, students can seek clarification or further guidance on their performance through MS Teams.

Overall, MSTeams serves as a centralized hub for communication between students and professors, offering various features that promote engagement, collaboration, and effective feedback exchange, thereby enhancing the learning experience for all parties involved

4. SC program: Information technologies in public governance – collaboration between Faculty of Science and Faculty of Public Governance

4.1. Introduction

As a part of the PARTISH activities, Faculty of Science and Faculty of Public governance developed a joint short – circle study program “Information technologies in Public Governance”.

In accordance with the Development Strategy of Faculty for Public Governance and contemporary social trends, two members of the University developed the joint professional two-year study program (120 ECTS). The study is intended for all interested candidates from Bosnia and Herzegovina and from abroad, who want to expand their knowledge in the field of IT in administration, public management and business. By launching a two-year professional study in the field of informatics in the administration, it is initiated, in addition to educational aspect, both interstate, interregional and interlocal connection of students. Almost all countries in the world have a developed system of local authorities. In this context, during the professional study, students are required to produce certain research papers which cover the premises of their local self-government units. In this sense, by exchange of different experiences, new knowledge and knowledge about different approaches will be acquired and exchanged and models of connection with the local government and the local community in all countries of the region. Moreover, by implementing education in the field of informatics in the administration, Faculty of Public Governance and Faculty of Science want to achieve a productive and affirmative cooperation with administrative bodies of all levels of government, not only in Bosnia and Herzegovina, but also in countries from which potential students come, and thereby meet the requirements of professional associations when talking about meeting the professional training requirements of persons who will work on IT jobs in public administration.

The program for the vocational study "Information Technologies in Administration" is designed last for two (2) academic years and carries 120 ECTS credits. The program will be implemented over four semesters, with five (5) mandatory subjects per semester, each worth between 4-8 ECTS credits, resulting in a total semester workload of 30 ECTS credits. The number of teaching hours will range from thirty (30) to seventy-five (75) per subject, depending on the complexity of the subject and the number of ECTS credits, and will be delivered by multiple instructors and associates from both organizational units, the Faculty of Administration and the Faculty of Sciences and Mathematics. Part of the teaching will be conducted by completing practical assignments and analyses (in the form of lectures and laboratory exercises), which will contribute significantly to the overall grade.

This program study is meticulously designed to nurture the professional development and training of staff (programmers) for real-world IT needs in administration. It offers two-year professional training with the potential for students to pass the 1st cycle of studies in the direction of e-governance by the Faculty of Administration. By the end of this program, you will be armed with the practical skills and knowledge necessary to thrive in the IT industry in administration, paving the way for many career opportunities.

In the final semester, students are required to intern in a selected company with a sector for information technology as a primary or supporting activity, or in an administration institution that uses information technologies and systems in its operations. The internship will carry 6 ECTS credits. Additionally, during the final semester, the candidate will, under the supervision of a chosen instructor, create and defend a Final Project before a committee, thereby confirming their competencies in expressing and conveying information, ideas, and solutions in both written and oral form. The Final Project also carries 6 ECTS credits and is defended after all other subjects prescribed by the study program have been completed. Students are granted the flexibility to progress to the next year of study within one study cycle, with a maximum of 12 ECTS study points or a maximum of two failed subjects, regardless of evaluation. This is provided that the failed subject that is carried forward to the next study year is not a prerequisite for taking the subject in that study year.

4.2. Intended Learning Outcomes

Students who fulfill all the obligations outlined in the curriculum of the two-year vocational study program "Information Technologies in Administration" receive the professional title:

“Specialist in Informatics in Administration”

The program carries 120 ECTS credits.

A Specialist in Informatics in Administration is a person trained to work in information technology positions within government service, public enterprises, and institutions, as well as other organizations, on tasks and responsibilities that require IT knowledge, making significant decisions, improving the efficiency and effectiveness of administrative regulation within the overall system of government, as well as strategic planning and the creation and implementation of informatization in administration.

With completed education, students will be able to:

- Understand and explain fundamental terms, principles, concepts, and theories in the field of informatics in administration.
- Understand how to properly use and recognize existing verified knowledge in the field of informatics in administration.
- Define and describe the latest knowledge from various specialized areas of informatics in administration.
- Understand key findings and processes in the field of informatics in administration.

Upon completing the study program, students will be capable of:

- Applying theoretical and practical principles and analyses to a range of questions and problems in informatics in administration.

- Research relevant literature in the field of informatics in administration.
- Summarizing and presenting an overview of relevant literature from various sources.
- Formulating and explaining arguments in professional discussions, debates, and research papers.
- Effectively communicating the results of analyses and ideas both orally and in writing.
- Applying acquired knowledge in concrete business practices in the field of informatics in administration.
- Gaining skills in strategic planning and the informatization of business processes.

Upon completing the vocational study, students will be able to apply knowledge and skills practically as follows:

- Reflect on the premises of major theories and their applications.
- Communicate effectively in both oral and written forms in informatics in administration.
- Work as part of a team and lead others, ensuring they are prepared to manage diverse teams.
- Possess the knowledge and skills necessary for employment in the field of informatics in administration.
- Specific learning outcomes related to each subject within the curriculum are outlined in the course syllabi.
- Conduct analyses and provide professional recommendations in the development and planning of informatization of business processes in administration.

4.3. Developed Curricula and Course Syllabi

This curriculum is designed to build upon foundational knowledge and skills systematically, gradually introducing more advanced concepts and real-world applications.

“Information Technologies in Administration”

-120 ECTS-

I Semester (30 ECTS)

<u> Code</u>	<u> Course Title</u>	<u> ECTS</u>	<u> Semester</u>
ITU 100	Fundamentals of Programming	8	3+2
ITU 110	Introduction to Information Technologies	6	2+2

ITU 120 Computer Networks	6 2+2
ITU 130 Science of Administration	6 2+2
ITU 140 English Language in Administration	4 1+1

II Semester (30 ECTS)

Code	Course Title	ECTS	P+V
ITU 150	Fundamentals of Statistics	6	2+2
ITU 160	Web Technologies	6	2+2
ITU 170	Management and Organization in the Public Sector	6	2+2
ITU 180	Legal Framework of Public Administration	6	2+2
ITU 190	Public Procurement in Administration	6	2+2

III Semester (30 ECTS)

Code	Course Title	ECTS	P+V
ITU 200	Databases	6	2+2
ITU 210	Statistics in Administration	6	2+2
ITU 220	Administrative Procedure and Administrative Dispute	8	3+2
ITU 230	E-Governance	6	2+2
ITU 240	Office Business and Archiving	4	1+1

IV Semester (30 ECTS)

Code	Course Title	ECTS	P+V
ITU 250	Multimedia in Administration	6	2+2
ITU 260	Development of Information Systems	6	2+2
ITU 270	Project Management in Administration	6	2+2
ITU 280	Internship	6	0+4
ITU 290	Final Project	6	0+4

I SEMESTER

Subject password: ITU 100	Subject title: Basics of programming		
Cycle: Professional study (Short two-year cycle)	Academic year: I	Semester: I	Number of ECTS points: 8

Status: Obligatory subject	Total hours: 75 (3+2) Lectures – 45 hours Laboratory exercises – 30 hours
Participants in classes:	Teachers and associates selected for the field to which the subject belongs
Prerequisite for admission to the faculty:	No prerequisite for admission to the faculty
Objective(s) of the subject:	The subject is an elementary course in computer programming. The main goals of the course are to develop a way of thinking that enables solving computer problems and developing the process of information manipulation in the context of computers. Achieving these goals is achieved by getting to know the basic programming techniques, as well as the basic principles of algorithm and program development. Some of the modern programming languages are used for this purpose.
Thematic units: (If it's necessary plan of conducting classes per weeks is determined accounting specifics of the faculty)	• Introduction to programming language • Data types, arithmetic expressions, operators, formatted printing • Branching structures • Loops • Nested loops • Generating random numbers • Subroutines, functions • Sequential data types • Files and exceptions • Strings as arrays of characters • Complex data types • Recursion
Learning outcomes:	Knowledge: After completing the course, students will be able to understand the basics of control structures, standard data types and their application, syntax and semantics of a programming language, as well as procedural components of the language. Skills: - Designing algorithms for solving simpler practical problems - Implementation of the algorithm in the programming language,



	including the appropriate selection of data structures; - Structuring the program using subprograms Competences: Competencies arise from acquired knowledge and skills.		
Teaching methods:	Lectures and laboratory exercises on the computer.		
Knowledge testing methods with a grade structure¹:	Knowledge check - criteria - Tests during the semester - 30% - Laboratory exercises – 30% - Final exam – 40% Grading		
	Scored number of points	Grade (Bosnia and Herzegovina)	ECTS grade
	< 55	5	F, FX
	55 - 64,99	6	E
	65 – 74,99	7	D
	75 - 84,99	8	C
	85 – 94,99	9	B
	95 -100	10	A
Literature²:	Obligatory: 1. T. Gaddis, Starting out with Python, 5th ed. Pearson, 2021. Supplementary: 1. B. Lubanovic, Uvod u Python, Mikro knjiga, 2015.		

¹Points structure and points criteria for each subject are determined by Faculty Council before the beginning of each academic year in which subject classes are conducted, according to section 64.6. Zakona o visokom obrazovanju Kantona Sarajevo.

²Senate of University of Sarajevo and Faculty Council are determining obligatory and recommended textbooks and handbooks, but also other recommended literature on which basis students prepare and take exams, with special administrative decision, which must be published on the faculty's web page before the beginning of each academic year, according to section 56.3. Zakona o visokom obrazovanju Kantona Sarajevo.

Subject password: ITU 110		Subject title: Introduction to Information Technology	
Cycle: Professional study (Short two-year cycle)	Academic year: I	Semester: I	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 30+30	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	The objectives of the module are to introduce the basics of informational technologies from the user’s point of view, which includes an introduction to working with operating systems, computer work, basic computer components, and basic application software for word processing and table calculations.		
Thematic units: (If it’s necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	• Introduction to informational technologies. • Application of informational technologies. • Digital data processing. Informational system and its components. • System software. Applicational software (Software for word processing, table calculations, Office 365, and so on) • Hardware (processor, memory, input and output computer components). • Software development. • Security and privacy. • Ethics in IT-u. Cybercrime. • Digital forensics. • Methodology of solving problems.		
Learning outcomes:	After finishing the module, students will acquire the following competencies: - Understanding of informational technologies as a whole, adopting terms, application of basic knowledge on informational technologies in practice, and preparation for easier understanding of other subjects in the curriculum. - Through the specified module which includes independent work in laboratory exercises students will be especially directed toward efficient usage of operating systems, and also of office business applications in the real sector and solving complex problems by		



	using office business applications for word processing, table calculations and business graphics.		
Teaching methods:	Lectures and laboratory exercises with computer usage.		
Knowledge testing methods with a grade structure³:	Knowledge evaluation - criterion Conducted partial tests during the semester carry 50 percent of the exam and the final exam carries the other 50 percent of the exam. Besides the theoretical part of the exam, student is also taking the practical part of the exam, which should be passed, but it doesn't carry any points.		
	Grading		
	Scored number of points	Grade (Bosnia and Herzegovina)	ECTS grade
	< 55	5	F, FX
	55 - 64,99	6	E
	65 – 74,99	7	D
	75 - 84,99	8	C
	85 – 94,99	9	B
	95 -100	10	A
Literature⁴:	Obligatory: - Using Information Technology – A Practical Introduction to Computers & Communications, McGraw-Hill Companies, New York, 2000 - Lokesh Lalwani, Excel 2019 All-in-One: Master the new features of Excel 2019 / Office 365, BPB Publications; 1st edition, 2019 - Priti Sinha, Pradeep K., Sinha, Computer Fundamentals: Concepts, Systems & Applications: BPB Publications; 6th ed., 2004 Supplementary: - Digital Evidence and Computer Crime, Third Edition: Forensic Science, Computers, and the Internet, Eoghan Casey, 2011		

³Points structure and points criterion for each subject are determined by Faculty Council before the beginning of each academic year in which subject classes are conducted, according to section 64.6. Zakona o visokom obrazovanju Kantona Sarajevo.

⁴Senate of University of Sarajevo and Faculty Council are determining obligatory and recommended textbooks and handbooks, but also other recommended literature on which basis students prepare and take exams, with special administrative decision, which must be published on the faculty's web page before the beginning of each academic year, according to section 56.3. Zakona o visokom obrazovanju Kantona Sarajevo.

Subject password: ITU 120		Subject title: Computer networks	
Cycle: Professional study (Short two-year cycle)	Academic year: I	Semester: I	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (2+2) Lectures - 30 Laboratory exercises - 30	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	Objectives of the module are introducing basic concepts of data transfer, computer communications, and local and widespread computer networks, but also mastering of basic computer networking techniques.		
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	• Data transfer; Serial and parallel transfer; Synchronous and asynchronous transfer; Modulation and demodulation; Modems; Communication networks; Net architecture; Commutation; Multiplexing. • Local and widespread computer networks; Topologies of local computer networks; Communication in local computer networks. • Structure of global computer networks; Net protocols; TCP/IP protocol and IP addresses; Net services. • ISO–OSI referential module; Concept of service and protocol; Functionality of layers; Layer interactions and service primitives. • Physical layer; Communication media; Weakening and distortion. Propagation of signal; Problems of synchronization. • Layer of data flow; Error control; Protocol of selective repeating; Go Back N protocol; HDLC protocol. • Net layer; Topology and metric of the network; Table of routing; Algorithms of routing. • Transport layer; Functionality of layer; TCP/IP protocol. • Session layer; Presentation layer; Application layer. • Standard network and telecommunication equipment; Configuration of computer networks. • Structure of Internet; Internet protocols; Internet services. • Network operative systems; Configuration of network servers. • Review of the advanced computer network technologies.		
Learning outcomes:	After finishing the module, students will be able to:		

	- Understand basic concepts of computer communications and data transfer; - Understand the structure and topology of local and widespread computer networks; - Understand network protocols and ISO/OSI referential module; - Understand basic network and telecommunication equipment; - Independently work with network operative systems; - Independently configure simpler computer networks.		
Teaching methods:	Lectures and laboratory exercises with computer usage.		
Knowledge testing methods with a grade structure:⁵:	Knowledge check - criteria Conducted partial tests during the semester carry 50 percent of the exam and the final exam carries the other 50 percent of the exam. Besides the theoretical part of the exam, students are also taking the practical part of the exam, which should be passed, but it doesn't carry any points.		
	Grading		
	Scored number of points	Grade (Bosnia and Herzegovina)	ECTS grade
	< 55	5	F, FX
	55 - 64,99	6	E
	65 – 74,99	7	D
	75 - 84,99	8	C
	85 – 94,99	9	B
	95 -100	10	A
Literature⁶:	Obligatory: 1. A. Tanenbaum: "Computer Networks (5th edition)", Prentice Hall, 2010. 2. D. E. Comer, R. E. Droms, Computer Networks and Internets, 4th edition, Prentice Hall, 2003. Supplementary: 1. William Stallings, Data & Computer Communications; (10th edition)", 2013 2. Halsall, F., Data Communications, Computer Networks and OSI.		

⁵Struktura bodova i bodovni kriterij za svaki nastavni predmet utvrđuje vijeće organizacione jedinice prije početka studijske godine u kojoj se izvodi nastava iz nastavnog predmeta u skladu sa članom 64. st.6 Zakona o visokom obrazovanju Kantona Sarajevo

⁶Senat visokoškolske ustanove kao ustanove odnosno vijeće organizacione jedinice visokoškolske ustanove kao javne ustanove, utvrđuje obavezne i preporučene udžbenike i priručnike, kao i drugu preporučenu literaturu na osnovu koje se priprema i polaže ispit posebnom odlukom koju obavezno objavljuje na svojoj internet stranici prije početka studijske godine u skladu sa članom 56. st 3. Zakona o visokom obrazovanju Kantona Sarajevo

Project reference number: 617421-EPP-1-2020-1-RS-EPPKA2-CBHE-SP

Key Action 2: Capacity Building in the field of Higher Education

	Addison-Wesley, 1988.
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Subject password: ITU 130	Subject title: The science of administration		
Cycle: Professional study (Short two-year cycle)	Academic year: I	Semester: I	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (2+2)	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisite for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	1. Enable students to achieve basic knowledge about the legality of social phenomena in relation to administrative organizations and governance practice. 2. Teach students about basic terms, scientific sources, and theoretical concepts in the Department of Administration and Governance. 3. Develop knowledge about the interactive nature of governance and political systems in a global sense. 4. Develop knowledge about the connection between social development and current trends and challenges in the development of administration and administrative organizations, with emphasis on processes of digitalization of public services, electronic public consultations, and electronic legislation.		
Thematic units:	1. Role of the state in the social context 2. Organisational and normative aspects of the state (state practice and legal acts) 3. Definition of administration, administration as administrative organization and as governance practice. 4. Subject and support of administrative sciences, methods of administrative sciences, sources of materials for administrative sciences 5. Role of the administration in society, tendencies of social development, administration, and administrative organizations 6. Role of the administration in the political system 7. Bureaucratic power – term, features, way of creation and exercise, consequences 8. Means of political control of the administration 9. E-administration (concept, organizational and procedural aspects) 10. Administration as human activity		

	11. Digitalization of the official system 12. Means and planning in administration 13. Leadership and communication in administration (traditional and modern approach) 14. Term and types of administrative systems 15. Public administration in Bosnia and Herzegovina, basic structure and directions to reform.
Learning outcomes:	Knowledge: Student will master conceptual-categorical apparatus in the field of general role of the state and the organization of the state and administrative sciences, learn the types of administrative systems and theoretical aspects of administrative organizations. Also, students will acquire knowledge about the influence of digitalization and other modern trends of previously mentioned aspects. Skills: Application of basic terms and acquiring knowledge about theoretical concepts in the domain of the state and administration will provide students with analytical skills and understanding of different specific aspects in the field of administration and governance in the educational and work process. Competencies: Students will be trained for expert analysis and understanding of the place and role of the state, administration, and administrative organizations in specific political and legal systems, but also in a wider social environment. Simultaneously, students will develop competencies for comparisons of different systems and social conditions, in the context of the potential digitalization of organizational and procedural aspects of the administration.
Teaching methods:	1. ex-chair 2. presentations 3. guest lecturers 4. exercises The practical part of the lesson covers the preparation and presentation of seminar papers, essays, preparation of legal acts, debates, practical exercises of different skills, analysis of audio and video recordings, visits to institutions, and guest presentations by experts from practice, particularly: - practical exercises in the preparation of seminar papers, essays, basic submissions (application, appeal, letter), and basic reports - discussions about the role of the state and the position of administration in the system of social regulation - analysis of the constitutional and legal position of the administration in the world (Germany, Austria, France, Great Britain, USA, New Zealand, Turkey, Arab countries, China, India, Russia, African countries, Brazil, Mexico, and Scandinavian countries) - analysis of international acts and forms of administration



	organization - analysis of regulations in the field of constitution and organization of administration in Bosnia and Herzegovina - analysis of internal organizational acts of administrative bodies in Bosnia and Herzegovina - analysis of internal acts of organization and management in companies - analysis of labor relations in the administration (legal status of employees, determination of the need to hire employees, preparation of the text of the competition, writing of the application for the competition, drafting of acts in the field of rewards and disciplinary responsibility) - practical exercises of leadership skills, organization of meetings and communication - discussions on the quality and supervision of administrative activities - comparative analysis, and creation of recommendations for the reform of administration in Bosnia and Herzegovina and the region of Southeast Europe. A significant part of the aforementioned exercises will be implemented through the prism of digitization of planning, communication and cooperation in public administration, as well as conducting administrative procedures and other official actions of the administration.						
Knowledge testing methods with a grade structure:	<table> <tr> <td>1. Tests</td><td>50%</td></tr> <tr> <td>2. Student activity (assignments, seminar papers, essays, debates, etc.)</td><td>30%</td></tr> <tr> <td>3. Final exam</td><td>20%</td></tr> </table>	1. Tests	50%	2. Student activity (assignments, seminar papers, essays, debates, etc.)	30%	3. Final exam	20%
1. Tests	50%						
2. Student activity (assignments, seminar papers, essays, debates, etc.)	30%						
3. Final exam	20%						
Literature:	Obligatory: 1. Eugen Pusić: „Nauka o upravi“, Školska knjiga, Zagreb, 2002. Supplementary: 1. Tanović, Merima, Savremena javna uprava, Fakultet za upravu, Sarajevo, 2018. 2. Pierson, Christopher, The Modern State, Routledge, 2011. 3. Schiavo-Campo, Salvatore, Running the Government: Public Administration and Governance in Global Context, Routledge 2018. 4. Đelmo, Zenaid, Pravno uređenje javne uprave, Fakultet za upravu, Sarajevo, 2009. 5. Pusić, Eugen, Upravljanje u suvremenoj državi, Pravni fakultet, Zagreb, 2002. 6. Pusić, Ramljak, Koprić, Kregar, Perko – Šeparović, Blažević, Lozina: “Hrestomatija upravne znanosti”, sv. 1., Pravni fakultet, Zagreb, 1998. 7. Onesin Cvitan: “Uvod u upravu”, Veleučilište u Splitu, Split, 2002.						

	8. 8. Ured koordinatora za reformu javne uprave, Strategija reforme javne uprave u BiH i Akcioni plan, Sarajevo. At the beginning of each academic year, students will be informed about current literature in this field.
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Subject password: ITU 140	Subject title: English language in administration		
Cycle: Professional study (Short two-year cycle)	Academic year: I	Semester: I	Number of ECTS points: 4
Status: Obligatory subject		Total hours: 30 Lectures: 15 hours Exercises: 13 hours Seminar: 2 hours	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	The goal of teaching English in the administration is to improve the level of knowledge of the general English language, which most students learn in elementary and high school. Students will develop their communicative level of knowledge, and all four language skills (listening, writing, reading, and speaking) and improve their spoken English style. Special attention is focused on the acquisition of collocations, idiomatic phrases, and lexicon of business English.		
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	Unit 1: The State Unit 2: Public Administration and Bureaucracy Unit 3: Rule of law Unit 4: Human Rights Unit 5: Constitutions Unit 6: Decentralization and Devolution Unit 7: Types of Political Systems Unit 8: The Legislative Branch Unit 9: The Executive Branch		



	Unit 10: The Judicial Branch Unit 11: Law Enforcement: The Police Unit 12: Diplomacy
Learning outcomes:	Knowledge: Theoretical and practical knowledge at level C1 according to CERF Skills: Cognitive skill of knowledge application along with social skill of successful verbal and non-verbal communication Competences: Responsible and independently solve all language written and oral tasks
Teaching methods:	Ex chair 50% and exercises 50%
Knowledge testing methods with a grade structure:	Tests 50% Seminar work 10% Attendance and activity 5% Final exam 35%
Literature:	Obligatory: 1. English for Public Administration, Lelija Sočanac i Marija J. Čubrić, Narodne novine, Zagreb, 2018. Supplementary: 1. Jednojezični rječnik (Collins, Webster, Oxford, Cambridge) 2. Dvojezični rječnik (Bujas, Drvodelić, Filipović) 3. Poslovno-upravni rječnik, Ivir, Školskajniga, 1998. 4. Key words for Fluency-Intermediate Collocation practice, Wooland, Thomson, 2004.

II SEMESTER

Subject password: ITU 150	Subject title: Basics of statistics		
Cycle: Professional study (Short two-year cycle)	Academic year: I	Semester: II	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (2+2)	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	The goal of the course is to train students to work on specific tasks		



	that they will encounter in their business environment, which are related to the use of statistical analysis and data processing in administration. Students will become familiar with the use of certain software packages for statistical data processing.
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	The following terms from descriptive statistics and dynamic data analysis will be covered: • statistical set (population) and sample, • measuring scales, • presentation of statistical data, • frequencies, • statistical variables, • measures of central tendency, • measures of dispersion, • measures of the form of distribution, • concentration measures. • absolute and relative changes, • indices, • time series and trend.
Learning outcomes:	Knowledge: Students will be trained to recognize the possibility of using statistics in jobs related to administration. Students will acquire the necessary knowledge of descriptive statistics and dynamic analysis, which they will be able to successfully use in the analysis, processing, and presentation of statistical data, as well as monitoring the development of phenomena over time. Students will learn how to use certain software packages in the processing and analysis of statistical data. Skills: Independent use of descriptive statistics and software packages in the processing of statistical data that are necessary for making various decisions in public administration and creating public policies. Competencies: Competencies arise from acquired knowledge and skills.
Teaching methods:	Lectures, and auditory exercises with the use of computers (use of certain software packages in the processing of statistical data).
Knowledge testing methods with a grade structure:	Knowledge check - criteria Partial exam in the eighth week (maximum number of points 50, of



	which 25 are required to pass)		
	Final exam: Students who pass the partial exam, on the final exam, take the part that was not included in the partial exam. In this case, the maximum number of points is 50, of which 30 is the minimum for passing. Students who do not pass the partial exam, pass all the material and in that case, the maximum number of points is 100, of which 55 is the minimum for passing.		
	Grading		
	Scored number of points	Grade (Bosnia and Herzegovina)	ECTS grade
	< 55	5	F
	55 - 64,99	6	E
	65 – 74,99	7	D
	75 - 84,99	8	C
	85 – 94,99	9	B
	95 -100	10	A
Literature⁷:	Obligatory: 1. Rabija Somun-Kapetanović, Statistika u ekonomiji i menadžmentu, Ekonomski fakultet u Sarajevu, 2008. 2. Kenneth J. Meier, Jeffrey L. Brudney, John Bohte, Applied Statistics for Public and Nonprofit Administration, Ninth Edition, Cengage Learning, 2015. Supplementary: 1. Linda Herkenhoff, John Fogli, Applied Statistics for Business and Management using Microsoft Excel, Springer, 2013. 2. Richard I. Levin. Masood H. Siddiqui, David S. Rubin Sanjay Rastogi, Statistics for Management, Pearson India Education Services Pvt. Ltd, 2018.		

Subject password: ITU 160	Subject title: Web technologies		
Cycle: Professional study (Short two-	Academic year: I	Semester: II	Number of ECTS points: 6

⁷Senat visokoškolske ustanove kao ustanove odnosno vijeće organizacione jedinice visokoškolske ustanove kao javne ustanove, utvrđuje obavezne i preporučene udžbenike i priručnike, kao i drugu preporučenu literaturu na osnovu koje se priprema i polaže ispit posebnom odlukom koju obavezno objavljuje na svojoj internet stranici prije početka studijske godine u skladu sa članom 56. st 3. Zakona o visokom obrazovanju Kantona Sarajevo

Project reference number: 617421-EPP-1-2020-1-RS-EPPKA2-CBHE-SP

Key Action 2: Capacity Building in the field of Higher Education

year cycle)			
Status: Obligatory subject		Total Hours: 60 (2+2) Lectures - 30 Laboratory exercises - 30	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	The goals of the course are to familiarize students with the basics of web page development using HTML, CSS, and JavaScript technologies. In addition, students are introduced to the use of a web content management system (CMS).		
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	• Introduction to website development • How the web works • Introduction to HTML • CSS selectors and basic styling • HTML tables and forms • Web media • CSS layout of elements • Introduction to JavaScript • Manipulation of elements using JavaScript • Overview and installation of CMS • Settings available in CMS • Categories		
Learning outcomes:	Knowledge: After completing the course, students will understand client-server architecture and know HTML elements, CSS styling rules, and the JavaScript programming language. Also, students will know what web content management systems enable. Skills: - Creating and designing simple web pages using HTML, CSS, and JavaScript technologies; - Use of the web content management system; - Setting up the web server to make the website publicly available. Competencies: Competencies arise from acquired knowledge and skills.		
Teaching methods:	Lectures and laboratory exercises with computer usage.		

Knowledge testing methods with a grade structure:	Knowledge check - criteria - Tests during the semester - 30% - Laboratory exercises – 30% - Final exam – 40% Grading		
	Scored number of points	Grade (Bosnia and Herzegovina)	ECTS grade
	< 55	5	F
	55 - 64,99	6	E
	65 – 74,99	7	D
	75 - 84,99	8	C
	85 – 94,99	9	B
	95 -100	10	A
Literature⁸:	Obligatory: 1. R. Connolly, R. Hoar, Fundamentals of Web Development, 3rd ed. Pearson, 2021 Supplementary: 1. J. N. Robbins: Learning Web Design, 5th ed. O’Rilly, 2018.		

Subject password: ITU 170	Subject title: Management and Organization in the Public Sector		
Cycle: Professional study (Short two-year cycle)	Academic year: I	Semester: II	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (2+2)	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	The aim of this course is to inform students about the role and importance of management in the public sector. The goal is also to acquaint students with:		

⁸Senat visokoškolske ustanove kao ustanove odnosno vijeće organizacione jedinice visokoškolske ustanove kao javne ustanove, utvrđuje obavezne i preporučene udžbenike i priručnike, kao i drugu preporučenu literaturu na osnovu koje se priprema i polaže ispit posebnom odlukom koju obavezno objavljuje na svojoj internet stranici prije početka studijske godine u skladu sa članom 56. st 3. Zakona o visokom obrazovanju Kantona Sarajevo

Project reference number: 617421-EPP-1-2020-1-RS-EPPKA2-CBHE-SP

Key Action 2: Capacity Building in the field of Higher Education

	- The role and importance of management in modern organizations, - Management development theory, - Causes for the emergence of management, - Managerial skills, - Specifics of management in the public sector, good management practices in the public sector.
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	1. Management and managers - managerial functions, - managerial roles, - managerial knowledge and skills, -organization-framework for managing the management process, - organizational resources, 2. Measuring organizational performance. 3. Strategic management with strategic planning 4. Vision and Mission, 5. Interest groups, External strategic analysis, Internal strategic analysis 6. Designing a business strategy 7. Organizing 8. Human resource management 9. Business decision-making 10. Control 11. Building a competitive advantage managerial skills and managerial tools in administration 12. The New Public Management 13. Limitations of the managerial approach in public administration. 14. The Good Governance 15. Change management in the public sector
Learning outcomes:	Knowledge: Understanding the competencies, processes, and management systems in the public sector. Skills: Application of management techniques and tools in public sector management. Competencies: Managing an organization through the functions of planning, organizing, and human resource management, as well as leading and controlling employees and all processes within the organization.
Teaching methods:	- Practical part of the class: thematic essays for creation and analysis (concept of management, types of managers, managerial functions,



	planning, organizing, human resource management, leadership, control, business decision-making, management in public administration, management models and concepts, - Thematic debates and analyses: analysis of different models that are applied to improve management in the public sector, - Creation and public presentation of research papers
Knowledge testing methods with a grade structure:	1. Tests 50% 2. Research work 10% 3. Presentation 5% 4. Final exam 35%
Literature:	Obligatory: 1. Šašić Đ, Menadžment u javnom sektoru, Fakultet za upravu, 2020. 2. Dževad Šehić, Zijada Rahimić, Menadžment, Ekonomski fakultet u Sarajevu 2005. Supplementary: 1. Drucker, P., (2005): Najvažnije o menadžmentu, M.E.P.Consult, Zagreb

Subject password: ITU 180	Subject title: Legal regulation of public administration		
Cycle: Professional study (Short two-year cycle)	Academic year: I	Semester: II	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (2+2)	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	1. To connect the organizational and functional aspects of modern administration with the role it has in the constitutional system. 2. To acquaint students with the constitutional regulation of the organization and the legal regulation of administrative activities, particularly analyzing state administration bodies and non-state administration entities, especially local self-government bodies and institutions with entrusted public powers. 3. To acquaint students with special aspects of administrative		



	organization and activities in the fields of public services, public legal entities, public procurement, concessions, the civil service system, public administration financing, and contemporary administrative concepts, such as New Public Management or Good Governance, with an emphasis on processes digitization of public services, electronic public consultations and electronic legislation. 4. To connect the principles of the work of administrative bodies, modern administrative concepts, and standards with practice, especially with regard to the control of the work of public administration entities.
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	1. CENTRAL ADMINISTRATIVE SYSTEM (state as a legal organization, organization as an element of state power, state public law, state legal order, public administration and its role in the legal and political process, 2. POLITICAL SYSTEM AND PUBLIC ADMINISTRATION (legal policy, public administration and administrative regime) 3. METHODS OF STUDYING ADMINISTRATION (descriptive, axiomatic, comparative, dogmatic, historical-legal, cybernetic, jurisprudential method) 4. BODIES AND ORGANIZATIONS OF PUBLIC ADMINISTRATION (state, non-state administration, public service, classification of functions and activities of administration, etc.) 5. ADMINISTRATION AS A PART OF THE EXECUTIVE AUTHORITY (positive legal review) 6. LEGAL REGULATION OF STATE ADMINISTRATION (constitutional aspects and legal regulations, internal organization, competencies, rights, obligations, and responsibilities in state administration bodies, basic organization of non-state administration in BIH) 7. LOCAL ADMINISTRATIVE SYSTEMS (positive legal solutions with a comparative presentation of local systems and legal regulations, principles, organs, tasks, and statutes of local self-government units, etc.) 8. FUNCTIONAL ADMINISTRATIVE SYSTEM (public services, concept, types, public service concession, financing of public services, etc.) 9. PERSONS UNDER PUBLIC LAW (public institutes, public agencies, public funds, chambers) 10. MATERIAL OVERVIEW OF PUBLIC ADMINISTRATION (system of public finances and administration, budget, public procurement, official system) 11. MODERN ASPECTS OF MANAGEMENT AND DIGITALIZATION OF PUBLIC ADMINISTRATION 12. DEMOCRATIC STATE, RULE OF LAW, 13. PRINCIPLE OF LEGALITY 14. CONTROL OVER THE WORK OF THE ADMINISTRATION
Learning outcomes:	Knowledge: Students will develop theoretical knowledge about the constitutional regulation of the organization and the legal regulation of administrative activities, with a particular focus on the activities of state administration bodies and institutions that have public powers,



	primarily at the local and state levels. Students will also develop knowledge about the impact of e-administration on the organization and operation of the administration in the previously described context. Skills: Students will develop the skills of analyzing general and individual administrative acts and drafting individual administrative acts. Competences: Students are competent to perform positive legal analyses in the field of administration and bring them into a logical and dogmatic connection with subjects and activities within the system of social regulation. At the same time, it develops competencies related to comparing different systems and social conditions, in the context of the potential digitization of the organizational and process aspects of administration.
Teaching methods:	Lectures and exercises with practical work: 1. ex-chair 30% 2. presentation 10% 3. guest lecturers 10% 4. exercises 50% The practical part of the lesson: - Analysis of elements of solutions and conclusions - similarities and differences - Analysis of solutions with regard to the division of individual legal acts: individual/general, legally bound/with discretionary assessment, constitutive/declaratory, independent/collective, at the request of a party/ex officio - Analysis of legal sources and regulations that regulate the organization of state administration in BiH - Formation of administrative bodies, appointment of managers, and adoption of the Ordinance on internal organization - Practical analysis of the regulation of the Rulebook on Internal Organization - Analysis of solutions with reference to the adopter of the administrative act: organization of state administration and application of legal regulations - Application of the institute of illegality exceptions in practice - Analysis of authoritative and non-authoritative tasks of administrative bodies A significant part of the aforementioned exercises will be



	implemented through the prism of digitization of planning, communication, and cooperation in public administration, as well as conducting administrative procedures and other official actions of the administration.
Knowledge testing methods with a grade structure:	1. Tests 50% 2. Student activity (assignments, seminar papers, essays, debates, etc.) 30% 3. Final exam 20%
Literature:	Obligatory: 1. Zenaid Đelmo, "Pravno uređenje javne uprave, Sarajevo", 2008. god. Supplementary: 1. Tanović Merima, Savremena javna uprava, Sarajevo, 2018. 2. Pierson, Christopher, The Modern State, Routledge, 2011. 3. Schiavo-Campo, Salvatore, Running the Government: Public Administration and Governance in Global Context, Routledge 2018. 4. Zenaid Đelmo, "Upravno pravo i evropsko upravno pravo", Sarajevo, 2007. god. 5. Zenaid Đelmo, "Sistemi društvene regulacije", Sarajevo, 2005. god. 6. Sead Dedić, "Upravno pravo Bosne i Hercegovine ", Sarajevo, 2001. god 7. Mustafa Kamarić - dr Ibrahim Festić "Upravno pravo", Sarajevo, 2004. god. 8. Velimir Ivančević - "Institucije Upravnog prava" – Zagreb, 1983. god. 9. Ivo Borković, Upravno pravo, Zagreb, 1981. god.

Subject password: ITU 190	Subject title: Public Procurement in the Administration		
Cycle: Professional study (Short two-year cycle)	Academic year: I	Semester: II	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (2+2)	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		

Objective(s) of the subject:	Familiarize students with the basic characteristics of public procurement procedures, and contracting authorities, as well as the dependence of the estimated value of public procurement and the type of procedure in positive law. Electronic public procurement, digitization of the public procurement process, and application of information technologies in public procurement
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	1. Public procurement - term, definition, and principles 2. Contracting authorities 3. Value classes and estimated value of public procurement, 4. Conditions for starting public procurement procedures (procurement plan, decision to initiate public procurement procedures), 5. Conditions for the application of public procurement procedures, 6. Open procedure 7. Limited procedure 8. Negotiation procedure with the publication of the procurement notice 9. Negotiation procedure without publication of procurement notice 10. Competitive dialogue 11. Framework agreement 12. Competition for conceptual design 13. Notifications in public procurement procedures 14. Deadlines in the public procurement procedure 15. Sectoral contractual bodies, 16. Procedures for awarding contracts of small value 17. Digitization of public procurement and implementation of electronic procurement 18. Electronic procurement procedure and dynamic purchasing system 19. E-auction 20. E-ESPD – form 21. Electronic offer 22. Electronic opening and evaluation of bids, a system for deciding and ranking bids, and electronic archiving 23. Electronic issuing of invoices in accordance with EU Directives
Learning outcomes:	After completing the subject, students will know the basic techniques of public procurement (determine the types of procedures and calculation of deadlines), and master the techniques of creating TDs, as well as the basics of electronic public procurement.
Teaching methods:	1. ex-chair 30% 2. presentation 30% 3. guest lecturers 10% 4. practical work 30%
Knowledge testing methods with a grade structure:	1. tests 30% 2. research paper 10% 3. presentation 10% 4. final exam 50%

Literature:	Obligatory: 1. Lapandić N., Postupak ugovaranja javne nabavke, 2020, Fakultet za upravu 2. Hajrudin B. i dr., Javne nabavke legislativa i praksa, Fakultet za upravu, Sarajevo 2015. 3. Elektronske javne nabavke, Kratko uputstvo o načinu korištenja informacionog sistema E-nabavke, Agencija za javne nabavke BiH, Sarajevo 2020 4. Kovačević D., Provođenje postupka E-aukcije i obaveze ugovornih organa, REC, Sarajevo, 2017
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III SEMESTER

Subject password: ITU 200	Subject title: Databases		
Cycle: Professional study (Short two-year cycle)	Academic year: II	Semester: III	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (2+2)	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	The goal of the course is to familiarize students with concepts such as entities, relations, models, and SQL language, as well as logical design and database integrity, which are necessary to fully understand both databases and information systems. In addition, students are introduced to the methodology of solving problems in relational databases.		
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	• Introduction to databases. • Database architecture. • Types of databases. • Entities. • Relations. • Relational model. • Decomposition of attributes. • Data integrity. • Relational algebra. • Database indexing. • Base normalization. • Query languages: SQL.		



	- SQL: SELECT statement. - SQL: DDL - sublanguage for defining data. - SQL: DML - insertion, deletion, modification. - Views. - SQL standards.		
Learning outcomes:	Through the mentioned subject, students will master the use of the SQL language for working with databases through independent work on exercises		
Teaching methods:	Lectures and exercises.		
Knowledge testing methods with a grade structure:	Knowledge check - criteria		
	Criteria	Maximum number of points	Points to pass
	Regularity of class attendance	5	2
	Activity in class	5	3
	Semester test during the course	20	11
	Projects	30	17
	Final exam	40	22
	IN TOTAL	100	55
	Grading		
	Scored number of points	Grade (Bosnia and Herzegovina)	ECTS grade
	< 55	5	F
	55 - 64,99	6	E
	65 – 74,99	7	D
	75 - 84,99	8	C
	85 – 94,99	9	B
	95 -100	10	A
Literature:	Obligatory: C. J. Date, SQL and Relational Theory: How to Write Accurate SQL Code, 3rd edition, 2015. - G.Pavlović-Lažetić: Osnove relacionih baza podataka, drugo izdanje, Matematički fakultet, 1999. S. Alagić, Relacione baze podataka, Svijetlost, Sarajevo, 1985. Supplementary: - Ramez Elmasri and Shamkant B. Navathe: Fundamentals of		

	database systems, 7th edition, 2016.
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Subject password: ITU 210	Subject title: Statistics in Administration		
Cycle: Professional study (Short two-year cycle)	Academic year: II	Semester: III	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (2+2)	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	The goal of the course is to train students to work with problems related to making (statistically) correct decisions that will guide the conduct of public policies. Making such decisions is often related to processing a large amount of data and setting up statistical hypotheses that need to be tested to make decisions. To achieve this goal, students will become familiar with the use of parametric and non-parametric tests in hypothesis testing. Students will learn about regression analysis and correlation. Students will become familiar with the use of certain software packages for statistical hypothesis testing.		
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	The following terms will be covered: • Regression analysis and correlation, • Random sample, • Confidence interval, • Hypothesis testing, • Parametric tests (Z-test, t-test, ANOVA) • Non-parametric tests (Chi-square test, Run test, Wald-Wolfowitz test, Wilcoxon T-test, Mann-Whitney U-test, Kruskal-Wallis)		
Learning outcomes:	Knowledge: Students will be trained to, based on the collected data, which are related to the tasks they deal with at work, in order to make decisions, examine the distribution of data, set up a hypothesis, and correctly choose a test for testing it. Based on the test results, the student will make a statistically valid conclusion on the basis of which he will make important decisions related to public administration. Students will learn how to use specific software packages for statistical hypothesis testing.		

	Skills: Independent use of inferential statistics and software packages to test various hypotheses that naturally arise when making decisions related to management jobs. Competencies: Competencies arise from acquired knowledge and skills.		
Teaching methods:	Lectures, and auditory exercises with the use of computers (use of certain software packages in the processing of statistical data).		
Knowledge testing methods with a grade structure:	Knowledge check - criteria Partial exam in the eighth week (maximum number of points 50, of which 25 are required to pass) Final exam: Students who pass the partial exam, on the final exam, take the part that was not included in the partial exam. In this case, the maximum number of points is 50, of which 30 is the minimum for passing. Students who do not pass the partial exam, pass all the material and in that case the maximum number of points is 100, of which 55 is the minimum for passing.		
	Grading		
	Scored number of points	Grade (Bosnia and Herzegovina)	ECTS grade
	< 55	5	F
	55 - 64,99	6	E
	65 – 74,99	7	D
	75 - 84,99	8	C
	85 – 94,99	9	B
	95 -100	10	A
Literature:	Obligatory: 1. Rabija Somun-Kapetanović, Statistika u ekonomiji i menadžmentu, Ekonomski fakultet u Sarajevu, 2008. 2. Kenneth J. Meier, Jeffrey L. Brudney, John Bohte, Applied Statistics for Public and Nonprofit Administration, Ninth Edition, Cengage Learning, 2015.		
	Supplementary: 1. Linda Herkenhoff, John Fogli, Applied Statistics for Business and Management using Microsoft Excel, Springer, 2013. 2. Richard I. Levin. Masood H. Siddiqui, David S. Rubin Sanjay Rastogi, Statistics for Management, Pearson India Education Services Pvt. Ltd, 2018. 3. James O. Aldrich, James B. Cunningham, Using IBM SPSS Statistics: An Interactive Hands-On Approach, SAGE Publications, Inc, 2015.		



Subject password: ITU 220		Subject title: Administrative Procedure and administrative dispute	
Cycle: Professional study (Short two-year cycle)	Academic year: II	Semester: III	Number of ECTS points: 8
Status: Obligatory subject		Total hours: 75 (3+2) Lectures 45 hours Exercises 30 hours	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	The aim of the course is for students to acquire basic theoretical knowledge about the principles, assumptions, and phases of the administrative procedure up to the finality, legal force, and enforceability of the decision. Through the basic institutes of administrative procedural law and current legislation, students will be able to clearly recognize when and how the general principles of administrative action are applied in specific administrative areas. Judicial control of the legality of administrative acts enables the acquisition of knowledge about the legal mechanisms of party protection and the characteristics of decision-making in administrative disputes.		
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	I INTRODUCTION TO ADMINISTRATIVE PROCEDURE LAW a) Administrative procedural law and administrative substantive law b) Significance of procedural legal protection: rights and obligations of citizens and protection of public interest c) Concept of administrative procedure and administrative dispute d) Legal framework and assumptions of e-administration II FUNDAMENTAL CHARACTERISTICS OF ADMINISTRATIVE PROCEDURE LAW a) Procedural legal guarantees in the decision-making process in administrative proceedings and administrative disputes III ADMINISTRATIVE PROCEDURE a) General and special administrative procedure and subsidiary		

	application b) Principles of administrative procedure c) Assumptions for conducting administrative proceedings (jurisdiction, exemption, legal aid.) d) (Electronic) communication between authorities and parties e) Delivery, electronic notification and e-delivery f) Participants, party, and representation in the administrative procedure g) Deadlines in the administrative procedure h) Costs and maintenance of order in the administrative procedure i) Initiation and management of administrative proceedings j) Adopting a decision in the first instance k) Regular and extraordinary legal means of protecting the party in administrative proceedings l) Second instance administrative procedure m) Execution IV ADMINISTRATIVE DISPUTE a) Concept and subject of an administrative dispute b) Principles of administrative dispute c) Significance of administrative judicial control of administrative acts and comparative review d) Lawsuit in an administrative dispute e) Parties and types of administrative disputes f) Procedure in an administrative dispute g) Legal means of protection of parties in an administrative dispute h) Decisions and binding judgments in administrative disputes
Learning outcomes:	Knowledge: Knowledge of the prerequisites and the legal flow of administrative decision-making Skills: Ability to conduct administrative proceedings and make decisions Competences: orientation and improvement of legal logic, interpretation of legal regulations, critical and analytical thinking, efficient and economical management of proceedings
Teaching methods:	1. ex-chair 40% 2. presentation 10%



	3. guest lecturers 10% 4. exercises 40%
Knowledge testing methods with a grade structure:	Test 30% Seminar work and student activities 30% Practical work 10% Final exam 30%
Literature:	Obligatory: 1. Dr. Zenaid Đelmo, Upravno procesno pravo, Fakultet za javnu upravu Sarajevo, 2007. 2. Dr. Pero Krijan, Komentar zakona o upravnom postupku Federacije BiH sa sudskom praksom, Sarajevo, 2002 god. 3. Dr. Pero Krijan, Komentar zakona o upravnom sporu Federacije BiH sa sudskom praksom, Sarajevo, 2001 god. 4. Stevan Lilić, Upravno pravo-Upravno procesno pravo, šesto izmijenjeno i dopunjeno izdanje, Pravni fakultet Beograd, 2014. 5. Erševan, Erik; Androjna, Vilko: Upravno procesno pravo, GV Založba, Ljubljana 2018. 6. Žuber, Bruna: Primeri iz upravnega procesnega prava, študijsko gradivo, Ljubljana, 2020. Supplementary: 1. Đerđa, Dario i Šikić Marko; Komentar Zakona o upravnim sporovima; Novi informator (2012) 2. Đerđa, Dario; Opći upravni postupak u Republici Hrvatskoj; Inženjerski biro (2010) 3. Doc. Dr. Mirjana Rađenović, Pravo opšteg upravnog postupka, Pravni fakultet Univerziteta u Banja Luci, Banja Luka, 2004. 4. Dr. Sead Dedić, Upravno procesno pravo, Magistrati Pravni fakultet u Bihaću, Sarajevo, 2001. 5. Prof. Dr. Slavoljub Popović, Prof. Dr. Branislav Marković i Prof. Dr. Milan Petrović, Upravno pravo – opšti deo- Savremena administracija Beograd, 1998.

Subject password: ITU 230	Subject title: E-government
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Cycle: Professional study (Short two-year cycle)	Academic year: II	Semester: III	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (2+2) Lectures 30 hours Exercises 30 hours	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	1. to familiarize students with the key concepts and technologies of e-government 2. to acquaint students with key methods for analysis, design, implementation, and maintenance of information systems in public administration. 3. to introduce students to ways of transforming traditional administration into a new e-administration. 4. introduce students to e-government services and their implementation and maintenance in public administration. 5. to acquaint students with ways of creating an e-strategy and e-plan for the transformation and improvement of e-administration.		
Thematic units: (If it's necessary plan of conducting classes per weeks is determined accounting specifics of the faculty)	1. Advantages and problems in the work of public administration. Definition of e-government. Goals and results of the implementation of the e-government strategy. E-business, advantages, and obstacles. Trends governing e-government. Concepts, tasks, and patterns of e-administration. E-strategy and the existence of innovative administration. 2. Challenges and preconditions for the development of e-government. Maturity of e-government. Integrated service and integrated applications. E-government services. 3. Development and possibilities of e-business. Models and trends in e-business. Web-applications. 4. Design of e-government strategy. E-solution of requests. Determining strategic goals. Forms of e-government design. 5. Web portal. E-plan. Creation and evaluation of the e-plan. 6. E-integration. Innovations. The influence of new trends. E-channel. Expanding and innovating e-channels. 7. E-portal. Infrastructure services. Challenges of public administration. Innovative business solutions. Business operations. Flexible and efficient service chain. Service model according to request. 8. Principles of introduction of e-government. Building resources. Applications.		
Learning outcomes:	Knowledge: Students will become familiar with the basic concepts and technologies of e-government and develop the ability to critically evaluate websites and other electronic channels for the provision of services by administrative bodies by comparing them with "best practices", principles and internationally adopted standards for the provision of		

	electronic services by administrative bodies. Students will get to know the most important regulations of Bosnia and Herzegovina and the European Union that cover the development of the information society and e-government in Bosnia and Herzegovina. Skills: After listening to and studying this subject, students will be able, in the capacity of a strategic planner, to see how and in what way to include e-business in the business strategy of public administration in order to take advantage of all the advantages of e-administration. Competences: Students will be able to decide which e-projects are the most prioritized and how to implement them to achieve their function, and to independently assess and solve many problems that will await them in the practice of e-Government implementation.								
Teaching methods:	1. ex chair 2. presentation 3. laboratory exercises								
Knowledge testing methods with a grade structure:	<table> <tr> <td>1. first partial test</td><td>40%</td></tr> <tr> <td>2. seminar work</td><td>10%</td></tr> <tr> <td>3. exercises</td><td>10%</td></tr> <tr> <td>4. final exam</td><td>40%</td></tr> </table>	1. first partial test	40%	2. seminar work	10%	3. exercises	10%	4. final exam	40%
1. first partial test	40%								
2. seminar work	10%								
3. exercises	10%								
4. final exam	40%								
Literature:	Obligatory: 1. Habul, A. Pilav-Velić, A., Kuldija, N. (2013) Informatika u javnoj upravi. Fakultet za 2. javnu upravu u Sarajevu 3. Radivojević M. „e-Uprava od vizije do implementacije“, Univerzitet za poslovne studije, Banja Luka, 2007 4. Radivojević M. „Nove tehnologije u reformi javne uprave“ Grafokomerc, Trebinje – Banja Luka, 2005 5. Materijali za E-vladu (u elektronskoj verziji)								

Subject password: ITU 240	Subject title: Office business and archiving		
Cycle: Professional study (Short two-year cycle)	Academic year: II	Semester: III	Number of ECTS points: 4
Status: Obligatory subject		Total hours: 30 (1+1) Optionally elaborate the distribution of hours by type: Lectures: 1 (15) Exercises: 1 (15)	

Participants in classes:	Teachers and associates selected for the field to which the subject belongs
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty
Objective(s) of the subject:	The aim of the course is to acquaint students with the basics and principles of office business and the basics and principles of archiving. Students will acquire knowledge about techniques and methods of dealing with documents from their creation to their archiving. Students will develop knowledge and awareness of the importance of office operations and archiving in the context of the functioning of public administration.
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	1. What is and what are the goals of office business 2. Basic concepts and the relationship between office and archival business 3. Legal basis for the regulation of office business 4. Principles of office business 5. Organization of office operations (Officers performing office operations, Office operations) 6. Recording in office operations 7. Business and official act 8. Communication and reception of third parties 9. Document Management System (DMS) 10. Seals and stamps 11. Reconstruction of the case and Certification of signatures, manuscripts, and transcripts 12. Competences, rights, and obligations of archival institutions 13. Duties and obligations of the creator and holder of registry and archival materials 14. List of categories of registry materials with retention periods and Rulebook on archival (and office) operations 15. The procedure for selecting and extracting worthless registry materials and handing over archival materials to the competent archive
Learning outcomes:	Knowledge: Knowledge of the rules and methods of office and archival business Skills: Cognitive and practical skills of acting according to the rules and methods of office and archival business Competences: Ability to work independently in office business
Teaching methods:	1. lectures ex-chair - 40% 2. presentation - 10% 3. practical examples - 10% 4. exercises - 40%
Knowledge testing methods	1. tests - 30%



with a grade structure:	2. student activity (research, assignments, seminar papers, essays, debates, etc.) - 20% 3. final exam - 50%
Literature:	Obligatory: 1. Hadžimusić, Mensur, Kancelarijsko poslovanje, Fakultet za javnu upravu, Sarajevo, 2009. 2. Zahirović, Šaban i dr., Priručnik za polaganje stručnog arhivističkog ispita, Fakultet za javnu upravu, 2006. 3. Mehmedović, Emir. Šarić, Edvin. Hadrović, Admir, Osnove kancelarijskog i arhivskog poslovanja: upravljanje dokumentima od nastanka do arhiva, Agencija za pravni konsalting i edukaciju, Sarajevo, 2019. Supplementary: 1. Relevant legal and by-laws.

IV SEMESTER

Subject password: ITU 250	Subject title: Multimedia in management		
Cycle: Professional study (Short two-year cycle)	Academic year: II	Semester: IV	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (2+2) Lectures: 30 hours Exercises: 30 hours	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	The goals of the module are visualization of data and reports, and automation of complicated or frequent processes and tasks in order to save time and increase efficiency.		
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	• Design of presentations in PowerPoint • Developing solutions, analyzing and visualizing data, and automating processes in business and administration using the Microsoft Power platform.		



Learning outcomes:	Knowledge: Familiarity with modern tools suitable for use by non-professional users. Skills: After completing the module, students will be able to graphically present data and design simple applications without the need to learn programming languages. Competences: Understanding of modern processes in the creation of multimedia solutions.		
Teaching methods:	Lectures and exercises.		
Knowledge testing methods with a grade structure:	Knowledge check - criteria		
	Criteria	Maximum number of points	Points to pass
	Tests during the course	30	
	Projects and seminar papers	40	
	Final exam	30	
	IN TOTAL	100	55
	Grading		
	Scored number of points	Grade (Bosnia and Herzegovina)	ECTS grade
	< 55	5	F
	55 - 64,99	6	E
	65 – 74,99	7	D
	75 - 84,99	8	C
	85 – 94,99	9	B
	95 -100	10	A
Literature:	Obligatory: 1. Microsoft powerpoint 2021 for beginners & power users: The Concise Microsoft PowerPoint 2021 A-Z Mastery Guide for All User, 2021, Independently published; 2. Mitchell Pearson, Brian Knight, Devin Knight, Manuel Quintana, Pro Microsoft Power Platform: Solution Building for the Citizen Developer, 2020, Apress; Supplementary: 1. Julian Sharp, Microsoft Power Platform Functional Consultant_ PL-200 Exam Guide, 2020, Packt; 2. Craig Zacker, Exam Ref PL-900 Microsoft Power Platform		



	Fundamentals, 2020, Microsoft Press;
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Subject password: ITU 260		Subject title: Development of information system	
Cycle: Professional study (Short two-year cycle)	Academic year: II	Semester: IV	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (2+2)	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	The aim of the course is to introduce students to the design and development of a mini information system using scripting languages in combination with databases.		
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	• Languages for the development of information systems. • Client-server technology for system development. • PHP: Introducing the PHP language, embedding the PHP language in an HTML page, sending data to a Web server using the HTTP protocol, accessing form elements in PHP, exchanging information between PHP scripts, writing functions in PHP, as well as using built-in functions, writing class in PHP. • MYSQL: Logging in to the MySQL Server, creating schemas on the MySQL server, creating, deleting, and updating the table structure on the MySQL server, and entering, updating, and deleting data from tables on the MySQL server. • PHP-MYSQL: Connection to the MySQL server via PHP, closing the connection from PHP to the MySQL server, opening the MySQL database from PHP, sending statements to the MySQL server from PHP, searching the MySQL table from PHP. • DEVELOPMENT OF A MINI INFORMATION SYSTEM: Problem description based on the use of UML notation, writing modules for the development of a simple information system, implementation, and use of the information system		
Learning outcomes:	Through the course, students will master the use of scripting languages and databases in laboratory exercises and will be able to design and implement simple information systems.		
Teaching methods:	Lectures and exercises.		
Knowledge testing methods	Knowledge check - criteria		
	Criteria	Maximum number of	Points to pass

with a grade structure:		points	
	Regularity of class attendance	5	2
	Activity in class	5	3
	Semester tests during the course	10	6
	Projects	60	33
	Final exam	20	11
	IN TOTAL	100	55
	Grading		
	Scored number of points	Grade (Bosnia and Herzegovina)	ECTS grade
	< 55	5	F, FX
	55 - 64,99	6	E
	65 – 74,99	7	D
	75 - 84,99	8	C
	85 – 94,99	9	B
	95 -100	10	A
Literature:	Obligatory: 1. Adis Alihodžić, Nedžad Dukić: Uvod u dinamičke web sisteme, PMF, Sarajevo, 2017. 2. Alempije Veljović, Projektovanje informacionih sistema u praksi, Kompjuter biblioteka, Čačak, 2020. 3. Robin Nixon, Learning PHP, MySQL & JavaScript: A Step-by-Step Guide to Creating Dynamic Websites, 6th edition, 2021. 4. Prezentacije sa predavanja. Supplementary: 1. Steve Prettyman, Learn PHP 8: Using MySQL, JavaScript, CSS3, and HTML5, Apress, 2020. 2. Eric Vanier, Birju Shah, Tejaswi Malepati, Advanced MySQL 8: Discover the full potential of MySQL and ensure high performance of your database, Packt Publishing, 2019.		

Subject **password:**
ITU 270

Subject title: Project management in management



Cycle: Professional study (Short two-year cycle)	Academic year: II	Semester: IV	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (2+2)	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	To acquaint students with the basic concepts of project management and the components of the project cycle, to train students to write project proposals and other types of project applications, to train students to manage the implementation of certain phases of the project cycle or projects as a whole, to train students to harmonize development and other requirements of administrative organizations with logic and project management requirements.		
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	1. Basic concepts of project management 2. Project cycle, stages in the project cycle 3. Project idea 4. Summary/summary of the project, 5. Introduction and explanation (background of the project), 6. WBS 7. Project interventions, logical framework, sustainability factors, indicators, sources of verification 8. Project monitoring and evaluation, reporting 9. Project financing, donor organizations, and funds 10. Project budget 11. Quality and project risk management 12. Time management 13. Intersectoral project partnership in the context of the accession of Bosnia and Herzegovina to the EU		
Learning outcomes:	Knowledge: Students will develop theoretical and practical knowledge about project management and modern methodologies for writing projects in the world and EU countries. Skills: Application of knowledge from project management and the skills of creating a project proposal. Competences: Possesses the basic knowledge necessary for writing and project management, as well as competencies related to teamwork, leadership, control of employees, and all project resources within the organization.		
Teaching methods:	- Practical part of the lesson: Work in groups, creation, and presentation of project proposals. - Thematic debates and analyses: analysis of project proposals from		



	different fields and apparently from public administration. - Creation and public presentation of research papers.
Knowledge testing methods with a grade structure:	1. Tests 50% 2. Research work 10% 3. Presentation 5% 4. Final exam 35%
Literature:	Obligatory: - Šašić, Đ., Čizmić, E., Softić, S. Principi projektnog menadžmenta, perfecta 2021 Supplementary: - Kerzner, H. : Project Management: A Systems Approach to Planning, Scheduling, and Controlling, John Wiley and Sons, New York, 2005. At the beginning of each academic year, students will be informed about current literature in this field.

Subject password: ITU 280	Subject title: Practice		
Cycle: Professional study (Short two-year cycle)	Academic year: II	Semester: IV	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (0+4)	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisites for admission to the faculty:	No prerequisite for admission to the faculty		
Objective(s) of the subject:	Acquisition of direct knowledge about the functioning of business systems that deal with jobs within the profession for which the candidate is being trained and the possibilities of applying previously acquired knowledge in practice.		
Thematic units: (If it's necessary plan of conducting classes per week	It is formed for each candidate separately, in agreement with the management of the company or institution where professional practice is carried out, and in accordance with the needs of the profession for which the candidate is being trained.		

is determined by accounting specifics of the faculty)	
Learning outcomes:	- Enable candidates to acquire practical knowledge necessary for designing, programming, and managing processes based on the application of modern information technologies, - Acquiring specific knowledge in solving problems from practice and performing design, development, implementation, and administration of information systems, databases, computer networks, and applications, as well as protection and security of networks and systems, - As part of the professional practice, the candidate keeps a professional practice diary and participates in solving the project task.
Teaching methods:	Independently with consultations with teachers and experts from practice.
Knowledge testing methods with a grade structure:	Knowledge check - criteria Consultations and writing an internship diary in which the candidate describes the activities and tasks he performed during the internship. Internship is carried out in a selected company that has an information technology sector as a primary or supporting activity in its operations, or in administrative institutions that use information technology and systems in their work. Evaluation Successfully completed obligations are verified by entering in the index "Completed the obligation" by the teacher in charge, based on the evidence presented by the candidate in the form of a certificate issued by the company, as well as the presented internship diary certified by the company where he did the internship.
Literature:	Defined for each student separately.

Subject password: ITU 290	Subject title: Final project		
Cycle: Professional study (Short two-year cycle)	Academic year: II	Semester: IV	Number of ECTS points: 6
Status: Obligatory subject		Total hours: 60 (0+4)	
Participants in classes:	Teachers and associates selected for the field to which the subject belongs		
Prerequisite for admission	No prerequisite for admission to the faculty		



to the faculty:			
Objective(s) of the subject:	The candidate will master independent work in finding software solutions with the use of theoretical and practical knowledge acquired during the course of study.		
Thematic units: (If it's necessary plan of conducting classes per week is determined by accounting specifics of the faculty)	- Defining the project problem; choosing a method and technology, searching and using the literature; - Planning the creation of the practical part; creation of the practical part (software, model, device); verification, and validation of the offered solution; - Consultations, conflicting views, corrections, meeting deadlines; - Finalization of the work with the adoption of remarks or suggestions from the mentor; technical and graphic editing; - Presenting the results, creating a presentation, public presentation, presentation skills; time and content planning; separating the essential from the non-essential; focusing on own results; answer to questions.		
Learning outcomes:	- By creating and defending the final project, the candidate confirms his/her competence in written and oral expression and transfer of information, ideas, and solutions in written form (final thesis) and oral form (presentation and defense of final thesis).		
Teaching methods:	Independently with consultations with subject teachers.		
Knowledge testing methods with a grade structure:	Knowledge check - criteria Before the beginning of the IV semester, each candidate will, by his interest, in agreement with some of the subject teachers who are involved in teaching, define a final project proposal that will be defended before the project defense committee, after passing all other subjects provided by the curriculum study. Upon successful implementation and defense of the project, it will be verified in the index with a passing grade from 6 to 10, depending on the method of project implementation, technical documentation, as well as the defense of the project itself.		
	Grading		
	Scored number of points	Grade (Bosnia and Herzegovina)	ECTS grade
	< 55	5	F, FX
	55 - 64,99	6	E
	65 – 74,99	7	D
	75 – 84,99	8	C
85 – 94,99	9	B	

	95 -100	10	A
Literature:	Defined for each work separately.		

4.4. Developed Materials

Efforts to tailor learning materials have predominantly focused on enhancing the online learning experience, assuming onsite courses would also benefit. Improving traditional in-class experiences poses challenges due to the need for significant additional human resources. For instance, scaling up improvements to meet diverse student needs in onsite classes requires substantial effort. In contrast, enhancements in online learning can be disseminated more rapidly and sometimes at reduced costs to online and onsite courses utilizing online materials. A web portal has been created to assist in the implementation of this study program (informatika.fu.unsa.ba). Additionally, MSTeams will be used in the delivery of the lessons.

The eLearning Portal, implemented through MS Teams, is a central platform in our educational ecosystem, facilitating online and onsite learning experiences. It offers a diverse range of materials, including: Comprehensive Learning Materials: The eLearning Portal provides extensive learning resources tailored to accommodate diverse learners. These resources, from lecture notes to quizzes, ensure a rich and adaptable student learning experience. Whether accessing materials remotely or in onsite classes, students benefit from the platform's flexibility and accessibility, fostering inclusivity for all learners. Enhanced Learning Modules: The portal's key strength lies in its ability to cultivate a sense of community and encourage active engagement. Through features such as forums, discussion boards, and collaborative activities, students participate in meaningful interactions with peers and instructors. This collaborative environment not only enriches the learning process but also fosters a vibrant learning community, both online and onsite. Instructors create dynamic learning environments tailored to diverse learning preferences and styles by incorporating various activities into course materials.

Seamless Integration with Onsite Learning: The portal seamlessly integrates with onsite learning activities, enhancing the educational experience. Instructors can supplement face-to-face lectures and discussions with online resources, assignments, and assessments. This integration promotes continuity and flexibility in learning, enabling students to access course materials conveniently and review content beyond traditional class hours.

Overall, the eLearning Portal powered by MS Teams serves as a versatile platform that enriches learning experiences by offering comprehensive materials, promoting engagement, and seamlessly integrating with onsite learning activities. It caters to students' diverse needs in both online and onsite settings.

4.5. Operational eLearning Portal

The MSTeams platform can significantly enhance the learning experience for information technology students. This platform enables real-time collaboration, fostering group projects, discussions, and peer-to-peer learning. It is a community-building tool that encourages active participation.

Resource Sharing: Professors can easily share resources such as lecture notes, presentations, and supplementary materials on MSTeams. This ensures that students have access to relevant content at

all times, enhancing their understanding of IT concepts. With MSTEams, IT in Administration students can enjoy the convenience of virtual meetings. Whether students are distance learners or have busy schedules, these meetings, including lectures, Q&A sessions, or guest speaker presentations, enrich students' learning experiences.

Integration with Tools: MSTEams integrates seamlessly with various tools and applications commonly used in IT education, such as coding platforms, project management tools, and collaborative document editors. This streamlines workflows and makes accessing and utilizing relevant resources more accessible for students.

Feedback and Assessment: Teachers can provide timely feedback and assessment through MSTEams, whether it is through chat, video conferencing, or assignment submissions. This helps students track their progress and identify areas for improvement. Improving communication between students and professors through the use of MSTEams involves several key benefits: Instant Messaging: MSTEams provides a platform for real-time messaging, allowing students to easily reach out to professors with questions, concerns, or clarifications. This fosters a more dynamic and responsive communication channel than traditional email exchanges.

Virtual Meetings: MSTEams allow professors to conduct virtual office hours or scheduled meetings with students, opening avenues for personalized interactions and discussions. This functionality transcends physical barriers, enhancing accessibility for both parties.

Group Chats and Channels: MSTEams fosters collaboration through the creation of group chats and channels dedicated to specific courses or topics. This feature encourages collaborative discussions among students and professors, nurturing a sense of community and facilitating peer-to-peer support.

File Sharing and Collaboration: Professors can share relevant materials such as lecture slides, readings, and assignments through MS Teams. Students can also collaborate on documents or projects within the platform, streamlining communication and enhancing teamwork.

Feedback and Assessment: MSTEams facilitate efficient feedback and assessment processes. Professors can provide comments and grades on assignments directly within the platform, allowing for timely and constructive feedback. Additionally, students can seek clarification or further guidance on their performance through MS Teams.

Overall, MSTEams serves as a centralized hub for communication between students and professors, offering various features that promote engagement, collaboration, and effective feedback exchange, thereby enhancing the learning experience for all parties involved.

Constructive feedback. Additionally, students can seek clarification or further guidance on their performance through MS Teams.

Overall, MSTEams serves as a centralized hub for communication between students and professors, offering various features that promote engagement, collaboration, and effective feedback exchange, thereby enhancing the learning experience for all parties involved.