ALFA BK UNIVERSITY

Faculty of Information Technologies

STUDY PROGRAMME

Information and Communication Technologies

UNDERGRADUATE ACADEMIC STUDIES

Course: Mathematics 1

Teacher: Danijela Karaklić; assistant: Zorica Savanović

Course status: Mandatory

Number of ECTS: 7

Precondition courses: None

Educational goal

Getting to know and mastering the basic concepts from the differential and integral calculus of functions of one real variable.

Educational outcomes (acquired knowledge):

Upon completion of the course, the student has a basic knowledge of the functions of one real variable and the differential and integral calculus. He is able to follow courses in professional fields in which the concepts and techniques he has mastered are applied and to identify problems to which he can apply the acquired knowledge.

Course content/structure

Theoretical classes: Arrays. Convergence criteria. The notion of a real function of one variable. Limit value of the function. Continuity of function. Properties of functions continuous on a segment. The first derivative of the function. Differential function and application. Higher order differentials. Basic theorems of differential calculus. Taylor's formula. The notion of extremum. Necessary and sufficient conditions for the extreme.

Convexity of curve and bend point. Curve asymptotes. A definite integral. Indefinite integral. Relationship of definite and indefinite integral. Shift and partial integration methods. Integration of rational and some classes of irrational functions. Integral calculus applications. Uncharacteristic integrals.

Practical teaching: Tasks from the stated theoretical areas.

Literature

1. D. Adnađević, Z. Kadelburg: Mathematical Analysis 1, Faculty of Mathematics, Belgrade 2008.
2. S. Dajović: Mathematics 1 and 2, FON, Belgrade 2007.
3. Đ. Jovanov, R. Lazović, D. Đorić: Mathematics 1, Collection of tasks, FON, Belgrade 2007.

Number of active teaching classes (weekly)	Lectures: 2	Practical classes: 2

Teaching methods

Frontal, group

Knowledge evaluation (maximum 100 points)

Pre-examination obligations:
Colloquium exam: 50
Lecture attendance: 5
Exercise attendance:5
Final exam:40
Total points: 100

Course: Introduction to information and communication technology

Teacher: Dejan Djukic, assistant: Stefan Popovic

Course status: Mandatory

Number of ECTS: 7

Precondition courses: none

Learning goal

Comprehensive introduction to computer sciences. Aquiring basic knowledge in logic and Boolean calculus, number systems, binary representation of numbers and letters, algorithms, formal grammars and syntax, finite automata, Turing machine.

Educational outcome (acquired knowledge)

Competency in use of Boolean calculus. Competency in arithmetic in binary number system. Knowledge of ASCII and Unicode coding systems. Ability to represent and analyse algorithms. Ability to represent and analyse formal syntax. Ability to represent and analyse finite automata.

Course content/structure

Lectures

Basic notions of formal logic, set theory, relations, functions. Boolean algebra, boolean variables, functions, normal forms. Number systems, binary number system. Coding of natural and integers in binary number systems, excess code, complement of 1, complement of 2. Coding of rational numbers in binary systems, fixed and floating point numbers, IEEE 754. Coding of text, ASCII, Unicode. Algorithms, flowcharts, pseudocode. Formal grammars, Bachus Naur forms, syntax diagrams. Finite automata, Moore and Mealy machines, tabelar and graphical representations. Turing machines, basic programming of Turing machines.

Tutorials related to the lectures

Learning resources

1. Harold Abelson, Gerald Jay Sussman, Julie Sussman: Structure and Interpretation of Computer Programs - 2nd Edition, The MIT Press, 1996.
2. G.Michael Schneider, Judith Gersting: Invitation to Computer Science, 6 edition, Cengage Learning, 2012
1. Maxfield, C., An unconventional guide to electronics fundam., compon., and processes, Elsevier, 2003.

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 3	Programming demonstrations	Project work	

Teaching and learning methods

Lectures and tutorials: classroom work with contemporary IT learning aids

Knowledge evaluation (maximum 100 points)

Pre-examination	**points**	**Final exam**	**points**
Classroom attendance		Written exam	40
Practical work		Oral exam	20
Assignments			
Tests	40		

Course: Programming 1

Teachers: Goran Keković, assistant: Vladimir Mikić

Course Status: Mandatory, first year, first semester

Number of ECTS: 6

Precondition courses: None

Educational goal

The course aims are to give a broad insight into the field of programming languages and learning about the process of software development with special emphasis on procedural programming languages, with the use of basic data structures and algorithms, basic search and sorting.

Educational outcomes (acquired knowledge)

The student is trained to apply top-down methods for designing algorithms. Also, the student is trained to create algorithmic solutions in the form of computer programs as well as to design, encode and test software solutions, including knowledge of techniques and methods for finding and correcting errors.

Course content/structure

Lectures

Introduction to the field of programming languages. Brief overview and comparison of basic program paradigms. Activities in the process of software development and maintenance. The concept of algorithm and its role in the problem-solving process. Basic concepts from low-level programming, machine-oriented languages. High-level procedural programming languages. Fundamentals of syntax and semantics of high-level programming languages. The concept of variable, data type, operator and expression. Basic primitive and structured types. Commands. Basic control structures. Pointing mechanism and dynamic memory allocation. Structural decomposition and modularization. Subroutines. Recursion. File concept. Input / output operations. Illustration of procedural programming concepts in a specific procedural language with parallel and comparative elaboration of alternative implementation of basic concepts in other procedural languages

Exercises

Students independently solve tasks on the computer, going step by step through all phases of program development, from the phase of analysis of the obtained task, selection of the appropriate algorithm, implementation of the selected algorithm, to program entry in the selected environment and appropriate program testing. The topics of the tasks are harmonized with the lectures and exercises from the subject.

Literature

1. L. Kraus, *Programming language C with solved tasks*, Akademska misao, Belgrade, 2008.
2. B. Keringhan, D. Ritche, *Programming Language C*, Contemporary Administration, Belgrade, 1989,
3. D. Urošević, *Algorithms in the programming language C* , Mikroknjiga, Belgrade, 2006.

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 3	Other forms of teaching	Study research	

Teaching methods

Classical teaching methods with the use of modern technology in lectures and exercises.

Knowledge evaluation (maximum 100 points)

Pre obligations	points	**Final exam**	points
Lecture attendance	10	Oral exam	30
Laboratory exercise attendance	20		
Colloquia	30		
Seminar paper	10		

Course: Sociology

Number of ECTS: 5

Teacher: Aleksandar B. Prnjat, assistant: Jovana Jovanović

Course status: Mandatory, first year, first semester

Precondition courses: None

Educational goal

Introduction to the theoretical and methodological assumptions of the study of society. Analysis of key sociological theories. Analysis of social grouping and forms of social sacredness. Analysis of contemporary social conflicts.

Educational outcomes (acquired knowledge):

Acquiring basic knowledge about society, social phenomena and processes.

Course content/structure:

Theoretical classes:

Subject and scientific method of sociology as a science. Society and the individual. Social structure. Social dynamics and social change. Social interaction and everyday life. Social grouping. Biosocial social groups. Pre-ethnic and ethnic global groups. Social stratification. Modern organizations. Work and economic life. Political grouping. Forms of social consciousness.

Practical classes:

Exercises, Other forms of teaching, Study research work. Getting to know modern forms of social conflicts.

Literature

- Gidens, E. (2003). „Sociologija“, Ekonomski fakultet, Beograd

Number of active teaching classes (weekly)	Lectures: 2	Practical classes: 1

Teaching methods

Lectures, exercises, seminar papers, colloquia and discussions.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations:	Final exam:
Colloquium exam: 25 Activity: 15 Lecture attendance: Practical work: 15 Seminar paper: 15	Written exam: Oral exam: 30

Course: English language 1

Number of ECTS: 5

Teacher: Aferdita Crnišanin

Course status: Mandatory, first year, first semester

Precondition courses: None

Educational goal

Introduction to the basic areas of business English. Systematic building of adequate vocabulary and completion of knowledge of grammar basics with even practice of basic skills (reading, writing, listening & speaking). Enabling students to use professional literature in English, for proper communication in all basic areas of English business language

Educational outcomes (acquired knowledge):

Students are able to use spoken and written English in simpler, everyday situations.

Course content/structure

Theoretical classes

Course content English 1 is English for academic and professional purposes in the field of informatics. Knowledge of general English at the intermediate level is assumed and professional English is processed. The main goals of teaching are methodical processing of modern professional texts and the adoption and expansion of knowledge about IT terminology, introducing students to the specific structures of the language of science and technology, as well as the systematization of relevant grammar. The most common skills are reading, understanding original English, speaking, and translating. At the end of the course, students should be able to present / understand basic topics related to their profession.

Practical classes: Exercises, Other forms of teaching, Study research work

Use of article, noun, adjectives, pronouns, auxiliary verbs (be, do, have), modal verbs. Use and construction of verb tenses (Present Simple, Present Continuous, Present Perfect, Past Simple, Future forms). Questionable and negative sentence form. Vocabulary related to everyday topics: dating, family, free time, work, food and drink, naming and description of everyday objects, description of people and places and the like.

Literature

- (2004): Oxford Oxford Dictionary of Business Oxford, University Press
- Mitic, G. (2005): "Reading Texts, Short English Grammar Book," FON, Belgrade
- Prnjat, Z. & Petkovic, V .. (2006): "English Language 1", FTB University "BK", Belgrade
- Murphy, R. (2007): “English Grammar in Use”. Third Edition. CUP
- "Business English Reader 1" (collection of professional texts adapted to the curriculum in electronic edition)
- monolingual and bilingual dictionaries

Number of active teaching classes (weekly)	Lectures: 2	Practical classes: 1

Teaching methods

Classes are realized with the help of modern technology and are supported by a series of practical examples with the aim that students master the subject as well as possible. Workshops for the exchange of ideas and knowledge through group discussion are also applied. Mentoring and team work are used in the preparation of seminar papers on the agreed topic.

Knowledge evaluation (maximum 100 points)

Pre-exam obligations	Points	final exam	*Points*
activity during the lecture	10	*written exam*	20
practical teaching	10	*oral exam*	20
colloquia	30		
Seminar paper	10		

Course: Mathematics 2

Teacher: Danijela Karaklić, assistant: Zorica Savanović

Course status: Mandatory, first year, second semester

Number of ECTS: 6

Precondition courses: Mathematical analysis 1

Educational goal

Introduction and mastering of basic concepts from differential and integral calculus of functions of several variables, differential equations and functions of complex variables.

Educational outcomes (acquired knowledge):

Upon completion of the course, the student has basic knowledge of differential and integral calculus of functions of several variables, differential equations and functions of complex variables. The student is able to follow courses in professional fields in which the concepts and techniques that the student has mastered are applied, and to recognize problems and to apply the acquired knowledge.

Course content/structure

Theoretical classes

The notion of a function of several variables. Limit value and continuity. Partial derivatives. Total differential. Differentiability. Elements of field theory. Differential in a given direction and gradient. Taylor's formula. Necessary and sufficient conditions for an unconditional extreme. Necessary and sufficient conditions for the conditional extremum.

Double and triple integral. Change of variables in double and triple integral.

The concept of differential equation (DE). First order DE solving methods. Linear DEs of the second order. Higher order linear DEs. DE systems. The notion of the first integral. Linear DE systems. Fundamental matrix. Matrix exponent. Stability. The term partial DE.

Functions of a complex variable. Cauchy-Riemann conditions. Analytical functions. Integral. Cauchy's theorem and Cauchy's formulas. Residue.

Laplace transform. Inverse Laplace transform. Application of Laplace transform.

The basic problem of the variational calculus. Euler's equation.

Practical classes

Tasks from the stated theoretical areas.

Literature

1. D. Adnađević, Z. Kadelburg: Matematička analiza 2, Matematički fakultet, Beograd 2008.
2. S. Dajović: Matematika 2, FON, Beograd 2007.
3. V. Vujčić, S. Dajović: Matematika 3, FON, Beograd 2006.

Number of active teaching classes (weekly)	Lectures: 2	Practical classes: 1

Teaching methods

Classes are conducted frontally in a group

Knowledge evaluation (maximum 100 points)

Pre-examination obligations:	Final exam:
Colloquium exam: 50	Written exam: 20
Activity: 10	Oral exam: 20
Lecture attendance:	
Exercise attendance:	

Course: Numerical mathematics

Teacher: Marija Paunović, assistant: Zorica Savanović

Course status: Mandatory

Number of ECTS: 6

Precondition courses: None

Educational goal

Acquisition of general and professional knowledge from numerical algorithms.

Educational outcomes (acquired knowledge):

Upon completion of the course, the student has basic knowledge of numerical algorithms. He is able to follow courses in professional fields in which the concepts and techniques he has mastered are applied and to identify problems to which he can apply the acquired knowledge. He is able to solve practical tasks from the exposed area using the Matlab software package. Can evaluate the reliability of the obtained results.

Course content/structure

Theoretical classes: Sources and types of errors. Interpolation polynomials. Interpolation error. Numerical differentiation and integration. Numerical methods for solving systems of linear equations, finding the inverse matrix and determinant values. Methods for finding eigenvalues and eigenvectors of quadratic regular matrices. Methods for solving nonlinear equations and systems of nonlinear equations. Methods for solving differential equations.

Practical classes: Tasks from the stated theoretical areas.

Literature

1) B. Jovanović, D. Radunović: Numerical Analysis, Faculty of Mathematics, Belgrade 2003.
2) D. Radunović: Numerical Methods, Academic Thought, 2004.
3) D. Radunović, A. Samardžić, F. Marić: Numerical methods - a collection of problems through C, Matlab and Fortran, Academic Thought, 2005.

Number of active teaching classes (weekly)	Lectures: 2	Practical classes: 1

Teaching methods

Frontal, group

Knowledge evaluation (maximum 100 points)

Pre-examination obligations:
Colloquium exam: 50
Lecture attendance: 5
Exercise attendance:5
Final exam:40
Total points: 100

Course: Fundamentals of Information Systems

Teacher: Dejan Đukić

Course status: Mandatory, first year, second semester

Number of ECTS: 7

Precondition courses: None

Educational goal

The aim of the course is to describe with sufficient depth the most important aspects of modern information systems. The course deals with several topics: components and functioning of computers and computer systems; computer networks and communications, protocol issues, topologies, and flow rates; the Internet and its technical and social aspects, Internet-based technologies; databases, their design and use; information systems life cycle, composition and roles of information systems execution and support teams.

Educational outcomes (acquired knowledge)

Upon successful completion of the course, the student will be able to:
- describes in detail and critically evaluates the work and performance of computer system components,
- describes and critically evaluates various protocols and topologies of computer networks,
- explain the system of Internet protocols, and describe in detail the TCP and UDP protocols,
- outlines the organization and administration of the Internet,
- describe the most important services provided by the Internet and their respective protocols,
- designs simple databases and writes queries for their search,
- explain the life cycle of information systems, the composition and roles of development and maintenance teams.

Course content/structure

Theoretical classes

Computer components, processor, memory, data storage, input - output units; computer networks, topologies, protocols, OSI layers, flow rate and network capacity, security and reliability of communication; Internet, Internet Organization and Administration, INOG, ICANN, W3C; use and services provided by the Internet, protocol system, TCP, UDP, SMTP, HTTP, FTP; databases, design, normalization, creation, search, update, SQL; information system life cycle, cycle phases, design and maintenance team, roles, tasks, collaboration and communication.

Practical classes

Computational exercises. Laboratory exercises. Demonstration exercises.

Literature

1. J. Münch, O. Armbrust, et al.: Software Process Definition and Management, Springer; 2012.
2. D. Comer: Internetworking with TCP/IP, Prentice Hall, 2000
3. C. Coronel, S. Morris: Database Systems: Design, Implementation, & Management, Cengage Learning; 2014

Number of active teaching classes (weekly)				Other classes
Lectures: 3	Practical classes: 3	Other forms of teaching:	Study research work:	

Teaching methods

Classical teaching methods with the use of modern technology are used in lectures and exercises.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity		Written exam	40
Practical teaching			
Colloquium exam	30		
Seminar paper	30		

Course: Programming 2

Teacher: Goran Keković, assistant: Vladimir Mikić

Course: Mandatory, second year, third semester

Number of ECTS: 6

Precondition courses: Programming 1

Educational goal

The course continues on Programming 1 with which it represents a whole. Upon completion, students should be able to design, code, test, correct, and document software solutions.

Educational outcomes (acquired knowledge)

The student is trained in programming in the C programming language and solving complex programming tasks.

Course content/structure

Lectures

Introduction to programming languages and programming in a Unix environment. Examples of programs in the programming language C. Basic data types. Constants, variables, enumerated types. Declaration. Operators and expressions. Types of operators. Priorities. Data input and output. Functions scanf, printf, gets, puts, getchar and putchar. Functions for working with characters. Program flow control. While, for and do-while loops. If, switch, and break commands. The continue and goto commands. Functions. Basic terms. Defining functions. Prototypes. Recursive functions. Functions with variable number of arguments. Preprocessor commands. Conditional inclusion. Macro commands. Program structure. Memory classes, lifespan and availability of variables. Programs stored in multiple files. The notion of a field. Multidimensional fields. Fields as function arguments. Fields and strings. Pointers. Pointer arithmetic. Pointers and functions. Pointers and fields. Dynamic memory reservation. Command line arguments. Structures. Definition. Structures and pointers. Self-referential structures. Union. Files. Creating files. File types. Open and close files. Standard read and write functions.

Exercises

Students independently solve complex tasks on the computer, going step by step through all phases of program development, from the phase of analysis of the obtained task, selection of the appropriate algorithm, implementation of the selected algorithm, to program entry in the selected environment and appropriate program testing. The topics of the tasks are harmonized with the lectures and exercises from the subject.

Literature

1. L. Kraus, *Programming language C with solved tasks*, Akademska misao, Belgrade, 2008.
2. B. Keringhan, D. Ritche, *Programming Language C*, Contemporary Administration, Belgrade, 1989,
3. D. Urošević, *Algorithms in the programming language C*, Mikroknjiga, Belgrade, 2006.

Number of active teaching classes (weekly)				Other classes
Lectures: 3	Practical classes: 3	Other forms of teaching	Study research	

Teaching methods

Classical teaching methods with the use of modern technology in lectures and exercises.

Knowledge evaluation (maximum 100 points)

Pre obligations	points	**Final exam**	points
Lecture attendance	10	Oral exam	30
Laboratory exercise attendance	20		
Colloquia	30		
Seminar paper	10		

Course: Digital electronics

Teacher: Negovan Stamenković

Course status: Mandatory, first year, second semester

Number of ECTS: 5

Precondition courses: None

Educational goal

Introducing students to the basic components and principles of digital systems.

Educational outcomes (acquired knowledge)

Acquiring basic knowledge about the functioning of digital systems and understanding the work of certain electronic elements and memory.

Course content/structure

Theoretical classes:

Types of signals and their transmission. Electronic circuit components: resistors, capacitors, coils. Integrator, differentiator, components of electronic devices: transformers, relays, quartz crystal. Semiconductor materials. Clean and impurity semiconductors. PN junction and characteristic. Realistic semiconductor diodes and semiconductor laser. Bipolar transistor and FETs. Amplifiers. Amplifier stages: single-stage amplifiers with bipolar transistors and field-effect transistors, multilayer silicon components: thyristors. Operational amplifier: basic circuits with operational amplifiers. Power sources: rectifiers, linear circuit breakers and converters. Integrated circuit. Operational amplifier and applications. Transistors as switching elements. Multivibrators. Basic logic circuit. A complex logic circuit. Collectors. Addition of binary numbers. Flip-flop - RS, D, JK, MS-JK. Registers and moving registers. Converters. Counters. Decoders. Digital memories. Bistable, monostable circuits, relaxation oscillators. Astable linear time base generators. A / D and D / A conversion. Application for clock generation, microprocessor supervisory circuits. ROM Memory. RAM memory. Programmable components Basics of connecting analog and digital systems.

Practical exercises Realization of combinational and sequential networks, realization of operational amplifiers.

Literature

1. Vanco Litovski, Osnovi elektronike: Teorija, reseni zadaci i ispitna pitanja; Akademska misao; 2006
2. Ivan Popović, Digitalna elektronika zbornik rešenih problema ; Akademska misao; 2006
3. Miomir Filipović, Komponente i praktična realizacija elektronskih uređaja; MikroElektronika; 2008

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 1	Other forms of teaching:	Study research work:	

Teaching methods Classical teaching methods with the use of modern technology are used in lectures and exercises.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity		Written exam	30
Practical teaching		Oral exam	20
Colloquium exam	15+15	.....	
Seminar paper	20		

Course: Signals and systems

Teacher: Dejan Đukić, assistant: Stefan Popović

Course status: Mandatory, second year, third semester

Number of ECTS: 6

Precondition courses: Mathematics 1, Mathematics 2

Learning goal

Introduction to notions of signals and systems, Fourier, Discrete Fourier, Laplace, and Z transforms, introduction to Matlab.

Educational outcome (acquired knowledge)

Knowledge of Fourier analysis of continuous and discrete time signals. Knowledge and application of transfer functions in for continous and discrete time invariant linear systems. Competency in using Matlab for problems related to signals and systems.

Course content/structure

Lectures

Introduction to complex numbers and functions of complex variables. Classification and basic properties of signals. Continuous and discrete time. Fourier analysis of periodic signals continous time - Fourier series. Fourier transform of aperiodic signals in continous time. Laplace transform. Fourier analysis of signals in discrete time - Discrete Fourier transform. Z transform. Classification and basic properties of systems. Linear, time invariant systems. Differential equations and difference equations in system modelling. Input-output relations, their Laplace and Z transforms, and transfer functions. System stability. Estimation of stability of linear time invariant systems in continuous and discrete time. System modelling. Itroduction to Matlab. Using Matlab in signal and system analysis. System simulation.

Tutorials related to the lectures

Programming in Matlab, demonstrations and individual programming exercises.

Learning resources

1. Padulo L., Arbib M.A., (1974): *System Theory, A Unified State-Space Approach to Discrete and Continuous Systems*, Philadelphia, Saunders

2 A. Antoniou, Digital signal processing –signals, systems and filters, McGrawHill, 2006.

Number of active teaching classes (weekly)				Other classes
Lectures 3	Practical classes 3	Programming demonstrations	Project work	

Teaching and learning methods

Lectures and tutorials: classroom work with contemporary IT learning aids

Programming exercises in a computer laboratory.

Knowledge evaluation (maximum 100 points)			
Pre-examination	**points**	**Final exam**	**points**
Classroom attendance		Written exam	40
Practical work		Oral exam	20
Assignments			
Tests	40		

Course: Algorithms and data structures

Teacher: Kopanja S. Lazar, assistant: Mikić Vladimir

Course status: mandatory, second year, third semester

Number of ECTS: 7

Precondition courses: None

Educational goal

Acquiring basic knowledge of fundamental concepts of data structures and algorithms used in applications and programming.

Educational outcome (acquired knowledge)

Ability to apply the acquired knowledge in solving problems, as well as the ability to identify, formulate and solve problems of practical importance.

Course content/structure

Therory classes

1. Introduction
2. Basic data types
3. Static and dynamic data structures
4. Arrays - types and operations
5. Representation of arrays in memory
6. Array optimizations
7. Lists- singly, doubly and circular linked lists - definition and operations
8. Queues - definition, implementation and basic operations
9. Stacks - definition, implementation and basic operations
10. Trees - definition, implementation and types of trees
11. Binary trees - definition, memory representation, basic operations
12. Definition of the algorithm
13. Presentation of algorithms
14. Efficiency of algorithms

Practical classes follow the content of the lecture

Literature

1. Tomašević Milo, Strukture podataka, Akademska misao, 2011.
2. Živković Miodrag, Algoritmi, Matematički fakulte Beograd , 2000.
3. Dejan Živković, Uvod u algoritme i strukture podataka, Univerzitet Singidunum, Beograd, 2010.
4. Branislav Jevtović, Predavanja i vežbe iz Algoritama i struktura podataka,
5. Milo V. Tomašević, Strukture podataka, Elektrotehnički fakultet Beogradskog univerziteta, Beograd 2000. godine.

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching:	Study research work:	

Teaching methods

Lectures, auditory exercises and laboratory exercises.

Knowledge evaluation (maximum 100 points)

Pre-examination	Number of points	Final exam	Number of points
Lecture attendance and activity	**5**	Written exam	30
Exercise attendance and project	**15**	Oral exam	20
Colloquium exam	**30**		
Seminary			

Course: Computer System Architecture

Teacher: Negovan Stamenković

Course status: mandatory, second year, third semester

Number of ECTS: 6

Precondition courses: Programming 1

Educational goal

The goal of the course is to present the structure of modern computer systems, to give an introduction to the hierarchical organization of memory and to explain the concepts of cache and virtual memory, to explain the mechanism of interruption, its significance, use and writing software for modern computer systems, to present mechanisms of communication with peripheral units, to introduce the basic concepts of parallel and flow execution of instructions, multiprocessor systems and computer communications.

Educational outcomes (acquired knowledge):

Upon successful completion of the course, the student will be able to:
- explain the operation of cache memory and virtual memory
- uses the program interrupt mechanism, analyzes the capabilities of the processor from the point of view of interrupts and to write simple programs for processing interrupts
- analyzes the mechanisms of communication of the processor with peripheral units
- describes the mechanisms of parallel and flow execution of commands, and presents the basic types of multiprocessor systems
- uses synchronization mechanisms in writing programs for communication and data transmission

Course content/structure:

Theoretical classes:

Hierarchical organization of memory in modern computer systems; cache memory, virtual memory; interrupt mechanism, interrupt signal processing and software; data input and output, communication with peripheral units; parallel and flow execution of instructions; parallel processing, synchronization and communication between processes; multiprocessor systems; basics of computer communications;

Practical classes:

Laboratory exercises. Demonstration exercises. Practical experiments and project.

Literature

1. Saltzer, Jerome H., and M. Frans Kaashoek. Principles of Computer System Design: An Introduction, Part I. San Francisco, CA: Morgan Kaufmann, 2009. ISBN: 9780123749574.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Morgan Kauffman, 4th edition, 2011.
3. Jovan Đorđević, Arhitektura računara, Akademska misao, Beograd, 2003. god.
4. J. Đorđević , V. Nikolić, Z. Radivojević, Arhitektura računara–edukacioni računarski sismeti, priručnik za simulaciju sa zadacima, Akademska misao, Beograd 2004. god.

Number of active teaching classes (weekly)				Other classes:
Lectures: 3	Practical classes: 2	Other forms of teaching:	Study research work:	Development project: 1

Teaching methods

Classical teaching methods with the use of modern technology are used in lectures and exercises. The seminar paper is performed in the form of a development project, which is performed in groups and publicly defended before a committee.

Knowledge evaluation (maximum 100 points)

Pre-examination	Number of points	Final exam	Number of points
Lecture attendance and activity		Written exam	35
Exercise attendance and project			
Colloquium exam	30		
Seminary	35		

Course: Discrete mathematics

Teacher: Duško Bogdanić, assistant: Zorica Savanović

Course status: Mandatory, second year, third semester

Number of ECTS: 6

Precondition courses: None

Educational goal: Introduction to basic concepts from the elements of number theory and combinatorics.

Educational outcomes (acquired knowledge): Upon completion of the course, the student has basic knowledge of the elements of number theory and combinatorics. He is able to follow courses in professional fields in which the concepts and techniques he has mastered are applied and to identify problems to which he can apply the acquired knowledge.

Course content/structure

Theoretical classes

Elements of number theory: Introduction of a set of natural numbers. Mathematical induction. Divisibility relation. Prime numbers. Fundamental theorem of arithmetic. Chinese remainder theorem. Wilson's theorem. Diophantine equations. Recursion.

Combinatorics: Counting. Permutations. Combinations. Binomial formula. Permutations and combinations of multisets. Polynomial formula. Pigeonhole (Dirichlet's) principle. Breaking apart numbers into adds. Number of surjections. Stirling numbers of the second and first kind. Bell numbers. Generating functions. Differential equations. Fibonacci numbers.

Practical classes

Tasks from the stated theoretical areas.

Literature:

1. D. Veljan, Kombinatorika s teorijom grafova, Školska knjiga, Zagreb, 1989.
2. Ž. Mijajlović, Algebra, Milgor, Beograd, 1998.
3. J. A. Anderson, Diskretna matematika sa kombinatorikom, Računarski fakultet, Beograd, 2005.

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching:	Study research work:	

Teaching methods

Classical teaching methods with the use of modern technology are used in lectures and exercises.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	10	Oral exam	30
Practical teaching	20		
Colloquium exam	30		
Seminar paper	10		

Course: English language 2

Teacher: Aferdita Crnišanin

Course status: Mandatory, second year, third semester

Number of ECTS: 5

Precondition courses: English language 1

Educational goal

The aim of the course is to provide students with sufficient prior knowledge for independent work in the profession and for further training in a global context.

Educational outcomes (acquired knowledge):

Students are able to use spoken and written English in simpler, everyday situations.

Course content/structure

Theoretical classes

Course content English 2 is English for academic and professional purposes in the field of informatics. Knowledge of general English at the intermediate level is assumed and professional English is processed. The main goals of teaching are methodical processing of modern professional texts and the adoption and expansion of knowledge about IT terminology, introducing students to the specific structures of the language of science and technology, as well as the systematization of relevant grammar. The most common skills are reading, understanding original English, speaking, and translating. At the end of the course, students should be able to present / understand basic topics related to their profession.

Practical classes: Exercises, Other forms of teaching, Study research work
Analysis of texts from the processed areas.

Literature

• (2004): Oxford Oxford Dictionary of Business Oxford, University Press
• Mitic, G. (2005): "Reading Texts, Short English Grammar Book," FON, Belgrade
• Prnjat, Z. & Petkovic, V .. (2006): "English Language 1", FTB University "BK", Belgrade
• Murphy, R. (2007): “English Grammar in Use”. Third Edition. CUP
• "Business English Reader 1" (collection of professional texts adapted to the curriculum in electronic edition)
monolingual and bilingual dictionaries

Number of active teaching classes (weekly)	Lectures: 2	Practical classes: 1

Teaching methods

Classes are realized with the help of modern technology and are supported by a series of practical examples with the aim that students master the subject as well as possible. Workshops for the exchange of ideas and knowledge through group discussion are also applied. Mentoring and team work are used in the preparation of seminar papers on the agreed topic.

Knowledge evaluation (maximum 100 points)

Pre-exam obligations	Points	final exam	*Points*
activity during the lecture	10	*written exam*	20
practical teaching	10	*oral exam*	20
colloquia	30		
seminars	10		

Course: Fundamentals of Telecommunications

Lecturer: Rade Božović, assistant: Stefan Popović

Status: Mandatory, second year, fourth semester

Number of ECTS: 5

Precondition courses: None

Educational goal

Introduction to fundamental principles, methods and definitions in telecommuncations.

Educational outcome (acquired knowledge)

Students will be able to understand terms, principles and to solve problems during signal transmission in baseband and transpondsed band.

Course content/structure

Lessons:

Analysis of periodic and aperiodic deterministic signals in the time and frequency domain. Random signal analysis. Thermal noise, noise of active circuits, narrowband noise. Ideal transmission. Linear amplitude distortions. Linear phase distortions. Linear amplitude-phase distortions. Nonlinear systems and nonlinear distortions. Baseband signal transmission analysis. Analog modulations - amplitude, frequency and phase. Symbol interference and Nyquist criteria. Eye diagram. Controlled symbol interference. Probability of error in channels with noise.

Practical classes:

Application of theoretical knowledge to signal analysis in the time and frequency domain and assessment of the impact of noise, interference and distortion on the performance of telecommunication systems.

Literature:

1. M. Dukić, *Principi telekomunikacija*, Akademska misao, 2008.
2. Z. Stojanović, H. Beća, M. Dukić, Z. Petrović, *Osnovi telekomunikacija – Zbornik rešenih problema*, Građevinska knjiga, 1979.
3. I. Stojanović, *Osnovi telekomunikacija*, Građevinska knjiga, 1973.
4. Nikolić, *Osnovi telekomunikacija*, Čuperak plavi, 1994.

Number of active teaching classes (weekly)				Other classes:
Lectures: 2	Practical classes: 1	Other type of classes:	Study and research:	

Methodology: Frontal, group

Knowledge score (maximum points 100)

Preobligations:	**Points**	**Final exam**	**Points**
Activity during lectures		Test paper	30
Practical classes		Oral exam	40
Colloquia	30		
Seminar paper			

Course: Operational research

Teacher: Marija Paunović, Danijela Karaklić

Course status: Mandatory, second year, forth semester

Number of ECTS: 4

Precondition courses: None

Educational goal

Introduction to the basics of theory and algorithmic approach in solving optimization problems and resource allocation in conditions of physical constraints.

Educational outcomes (acquired knowledge):

Ability to analyze and solve real optimization problems whose criterion function is (non) linear, in conditions of (non) linear constraints of the type of (in) equality.

Course content/structure

Theoretical classes: Operational research and information systems. Linear programming and applications. Transport problem. Nonlinear programming, methods and algorithms for unconditional and conditional optimization. Integer programming. Network planning. Inventory management.
Practical classes: Exercises, Other forms of teaching, Study research work. In addition to lectures and classroom exercises, the application of mathematical algorithms to solve real optimization problems using computers.

Literature

- Krčevinac, S. i dr.(2006): „Operaciona istraživanja 1 i 2," Fakultet organizacionih nauka, Beograd.
- Grupa autora .(2012): „Operaciona istraživanja 1 i 2", Fakultet organizacionih nauka, Beograd.
- Hillier S.F., Lieberman G.J.(2001): „*Introduction to operations research"*, 7th Ed. McGrow Hill.

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching	Study research:	

Teaching methods

In addition to lectures and classroom exercises, in the presence of an assistant, with application of mathematical algorithms, real optimization problems are solved using computers and available software optimization packages.

Knowledge evaluation (maximum 100 points)

Pre obligations	**Points**	**Final exam**	**Points**
Lecture attendance	10	Written exam	30
Laboratory exercise attendance	10	Oral exam	
Colloquia	30	.....	
Seminar paper	20		

Course: Object-Oriented Programming

Teacher: Goran Keković, assistant: Miloš Ilić

Course Status: Mandatory, second year, fourth semester

Number of ECTS: 5

Precondition courses: no

Educational goal

Understanding and mastering the principles of object-oriented programming, such as abstraction, encapsulation, inheritance and polymorphism. Understanding the concepts of exceptions and templates, as well as the basic concepts of competitive and event-driven programming. Acquiring the skill of object-oriented programming in C ++. Using the standard template library (STL). Getting to know the Java language.

Educational outcomes (acquired knowledge)

Upon successful completion of the course, students will be able to:
- interpret and apply the paradigm of object-oriented programming;
- demonstrate the principles of object-oriented programming in C ++;
- solve practical problems in C ++;
- use the standard template library (STL).
- develops object-oriented multithreaded applications with a graphical user interface in Java.

Course content/structure

Lectures

An overview of OO programming concepts in C ++. Classes and objects. Constructors and destructors. Static members. Friends. Nested and local classes. Operator overlap. Derivation and inheritance. Polymorphism and dynamic binding. Abstract classes. Multiple inheritance. Exceptions. Template functions and classes. Standard Template Library (STL). Input and output flows. An overview of Java programming concepts.

Exercises

Auditory practises, laboratory demonstration and laboratory control exercises. Home works.

Literature

1. L. Kraus, *Programming language C ++ with solved tasks*, Akademska misao, Belgrade, 2011.
2. D. Milicev, Lj. Lazarević, Marušić, *Object Oriented Programming in C ++*, Script with Practicum, Mikro knjiga, Belgrade, 2001.
3. M. Stanković, *Programming Languages*, Faculty of Electronics in Niš, Edition: basic textbooks, 2000.
4. Martin Fowler, Kendall Scott: *UML Distilled: A Brief Guide to the Standard Object Modeling Language*, Second Edition. August 1999. Addison-Wesley Professional, ISBN: 020165783X
5. Kraus, L., *Solved problems in the Java programming language*, 3rd edition, Academic Thought, Belgrade, 2012,

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching	Study research	

Teaching methods

Classical teaching methods with the use of modern technology in lectures and exercises.

Knowledge evaluation (maximum 100 points)

Pre obligations	points	**Final exam**	points
Exercise attendance	20	Oral exam	30
Lecture attendance	10		
Colloquia	30		
Seminar paper	10		

Course: Computer Graphic

Teacher: Danijela Karaklić

Course status: Elective, second year, fourth semester

Number of ECTS: 8

Precondition courses: none

Educational goal

The aim of the course is for students to acquire knowledge of the basics of computer graphics, such as color theory, the basics of graphic design, TV design, web design, virtual reality, 3D modeling, illumination and animation of computer models. Acquiring knowledge of computer graphics, which is used to create processed web solutions in graphics and video presentations. Mastering the basic concepts of computer graphics and getting acquainted with bitmapped and vector graphics.

Educational outcomes:

The student is trained to use software packages for 3D modeling and animation, image processing, editing and visual effects, web design, video and multimedia. The student has mastered the basic apparatus used in web solutions in graphic and video presentations.

Course content

Theoretical part - Introduction to interactive computer graphics and computer graphics systems. Hardware and software architecture (Open GL, DirectX, X3D) of graphic computer systems. Color theory. Raster graphics algorithms for drawing 2D primitives. 2D and 3D geometric transformations. Algorithms for realizing the reality of the display. Computer graphics tools and software. Basics of HTML. Web design. Basics of graphic design. Basics of VRML. Principles of 3D modeling. Integration of text, images and web solutions into a software application. Interactive graphic programming. Computer animation.

Practical part / Exercises - Introduction to basic programs for computer graphics processing (bitmapped and vector). Introduction and work with programs for image conversion and compression. Working with graphic design programs.

Literature

- Denić N. (2013): Authorized lectures: Computer Graphics, FIT, Alpha University, Belgrade
- Watt, A., (2000): 3D Computer Graphics (3rd edition), Addison-Wesley
- Brinkmann, R. (1999): "*The Art and Science of Digital Compositing*", Academic Press
- Foley, Vam Damm (1995): "*Computer Graphics, Principles and Practice*," Addison-Wesley Publishers
- Starčević et al. (2009): *Computer graphics - practicum for laboratory exercises*, VISER, Belgrade.

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching classes:	Study research:	

Teaching methods

Lectures. Computer exercises. Consultations. Knowledge tests. Classical teaching methods with the use of modern technology. The set-out principles are practiced in the exercises and typical problems and their solutions are analyzed. During the practical classes, students apply the mastered techniques.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	**points**	**Final exam**	**points**
Student's participation in the classroom	15	Written exam	
Practical teaching	15	Oral exam	30
Colloquium	25		
Seminar	15		

Course: ERP systems

Teacher: Vojkan Nikolić, assistant: Vuk Vujović

Course status: Elective, second year, fourth semester

Number of ECTS: 8

Precondition courses: None

Educational goal

The aim of the course is to acquaint students with the role of ERP systems in modern companies. Introduction to ERP functions. Analyzing the structure of ERP systems on a theoretical and practical level. The importance of organizational preparation for the introduction of the ERP system is also emphasized.

Educational outcomes (acquired knowledge)

Students are introduced to methods and tools for evaluating the organization and implementation of ERP systems. Also, students have mastered the project structure as well as the resources necessary for the efficient implementation of the ERP system.

Course content/structure

Theoretical classes

Introduction to the subject. Methods of work. ERP system architecture. Limitations of ERP systems and the need to develop special software modules. Reasons for the introduction of ERP systems. Identification and quantification of the effect. Cost analysis related to program licenses and deployment. Calculation of return on investment and all costs related to the introduction and maintenance of ERP systems. Strategic goals and their impact on business processes. Organizational infrastructure and support for key business processes. Business process analysis. Increasing the efficiency of business processes and reengineering of business processes related to the introduction of ERP systems. Change management during ERP system implementation. Definition and analysis of organizational readiness. Methods and tools for organizational readiness analysis. Organization preparation. Introduction of ERP system. Analysis of technological infrastructure required for the introduction of ERP systems. Project management and dynamics of project activities. Key beneficiaries and their education. Setting up an ERP system. ERP system configuration management. Key parameters and the possibility of changing them. Monitoring of organizational changes and their entry into the system. Connecting ERP systems with external program modules. Connecting to e-business support systems. Analysis of different approaches to connecting ERP systems. Connecting ERP systems and relevant standards. Technical and semantic problems of connection.

Practical classes: Exercises, Other forms of teaching, Study research work

As part of the exercises, students will use a standard commercial ERP system and get acquainted with its parameters, setup principles and how to use it. They will also get acquainted with the logic of basic business modules and how to connect them.

Literature

- Денић Н. (2014): Ауторизована предавања: ЕРП системи, ФИТ, Алфа Универзитет, Београд
- Schimitzek, P. (2002): „*Industry-Specific ERP Systems: Integrating Information and Business Processes in the Enterprise*“, CRC Press

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching:	Study research work:	

Teaching methods

Lectures with presentations. Practical work in a computer classroom. Case study analysis - presentation of concrete examples from practice. Seminar papers.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	5	Written exam	30
Practical teaching	5	Oral exam	20
Colloquium exam	20	.....	
Seminar paper	20		

Course: Modeling and simulation

Teacher: Rade Božović

Course status: Elective**,** second year, fourth semester

Number of ECTS: 8

Precondition courses: None

Educational goal

Education of students in modeling and analysis of systems using computer resources.

Educational outcomes (acquired knowledge)

At the end of the course, the student is able to independently model and analyze a system of diverse physical characteristics using a computer.

Course content/structure

Theoretical classes

Brief introduction to Matlab and analysis of basic signal and system properties. Data structures, variables, operators and basic functions, vectors and matrices. Graphical representation of discrete and analog signals. Matlab programs - scripts. Time signal transformations. Basic system features. Basics Matlab - Simulink. Connecting C with Simulink.

Practical classes: Exercises, Other forms of teaching, Study research work

The exercises are a group analysis and discussion of individual topics in the modeling of heterogeneous physical processes. Permanent solution of assigned tasks and problems, independently, and under the supervision of teachers.

Literature

1. Petrović T., Rakić A., Signali i sistemi, Deksin, 2005.
2. Arnos G., MATLAB, An introduction with applications, John Wiley, 2004.
3. Stephen L., Dynamical systems with applications using MATLAB, Birkhauser, 2004.

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 3	Other forms of teaching:	Study research work:	

Teaching methods

The lectures present the theoretical part of the material followed by examples that illustrate the application of theory to solving problems. Exercises include assignments from lecture materials. Parts of the material that can be combined into logical wholes can be taken during the semester through a colloquium.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	15	Written exam	
Practical teaching	15	Oral exam	30
Colloquium exam	25	.....	
Seminar paper	15		

Course: Human-Computer Interaction

Teacher: Goran Keković

Course Status: Elective, second year, forth semester

Number of ECTS: 8

Precondition courses: None

Educational goal

The course considers the concepts of human-computer interaction on both sides of the user interface, including human factors, performance analysis, cognition processes, usage studies, interaction styles. The process of user interface development is also covered, with an emphasis on user - friendly design and interface evaluation methodology.

Educational outcomes (acquired knowledge)

At the end of the course, the student understands the importance of the human factor, cognitive processes, environment and user training and successfully applies them in the development, implementation and analysis of performance and usability of the user interface for various purposes.

Course content/structure

Lectures

Concepts of interaction and interface. Evolution of computer interface. Problems of human-computer interaction. User understanding: cognitive principles and cognitive ergonomics. Types and examples of user interfaces. Graphical user interfaces. Perceptual user interfaces. Attention-based user interfaces. Web-oriented user interfaces. Intelligent user interfaces and adaptation to user needs. User interface development methodology. The importance of good design and knowledge of user models. User-oriented task modeling. Organization of graphical display of the interface. Menu and window systems. Evaluation, heuristic evaluation, usability testing, usability standards. Evaluating the usability of user interfaces. Case studies. Software tools for user interface development. New technologies, alternative input and output devices, alternative displays, mobile computing.

Exercises

The exercises include group analysis and discussion of individual topics, selected articles and seminar papers. Also in the exercises, students are trained to work with software tools for user interface development. Permanent solution of assigned tasks and problems, independently, and under the supervision of a teacher.

Literature

1. Shnajderman, J., Plaisant, C. (2006): „Dizajniranje korisničkog interfejsa“, CET, Beograd
2. Sears, J.A. Jacko (Eds.) (2008): „The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications", 2nd edition, CRC Press

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Exercises: 3	Other forms of teaching	Study research	

Teaching methods

The lectures present the theoretical part of the material, followed by examples that illustrate the application of theory to solving problems. Laboratory exercises include experiments in the areas given by the plan and program. Exercises include assignments from lecture materials. Parts of the material that can be combined into logical units can be taken during the semester via a colloquium.

Knowledge evaluation (maximum 100 points)

Pre obligations	points	**Final exam**	points
Lecture attendance	15	Oral exam	30
Laboratory exercise attendance	15		
Colloquia	25		
Seminar paper	15		

Course: Probability and statistics

Teacher: Dragiša Žunić, assistant: Bojan Stoiljković

Course status: Mandatory, third year, fifth semester

Number of ECTS: 5

Precondition courses: none

Educational goal

Acquiring basic knowledge of probability theory and training for the application of that knowledge in solving problems from practice. Introduction to the basic methods of descriptive and analytical statistics and training for the application of these methods in solving problems in practice. Knowledge of probability theory is the basis for understanding the methods and models of statistical analysis

Educational outcomes (acquired knowledge):

At the end of the course, the successful student is expected to fully master the basic concepts and applications of probability and statistics. He is able to apply statistical tests and simulation methods to study real phenomena. Special emphasis is placed on understanding descriptive statistics and statistical inference.

Course content/structure:

Theoretical classes:

Probability theory-space of elementary events. Definition of probability and basic properties. Conditional probability and independence of events. The formula of total probability. Bayesian formula. Random events, traits. Operations and relations with random events. One-dimensional random variables of discrete type. One-dimensional random variables of continuous type, parameters of a random variable. Discrete distribution models. Continuous distribution models. Boundary value theorems in probability. Two-dimensional random variables of discrete type. Two-dimensional random variables of continuous type. Marginal distributions. Conditional distributions. Regression analysis. Statistical inference, population, sample. Descriptive statistics, statistical features. Frequency distribution, graphical display of frequency distribution. Landmark parameters, indices. Statistics and their distributions. Evaluation theory, evaluation selection criteria. Confidence intervals. Hypothesis testing. Parametric tests. Nonparametric tests. Regression models. Methods of analysis of variance. Statistical packages (SPSS).

Practical classes:

Tasks in the above areas.

Literature

1. Vuković, N. (2006): „Osnove verovatnoće“, FON, Beograd,
2. Vuković, N (2007): „Statističko zaključivanje“, FON, Beograd
3. Stojanović, V: „Statistika i verovatnoća – za nženjere“FIM, Beograd, 2012.

Number of active teaching classes (weekly)	Lectures: 2	Practical classes: 2

Teaching methods

The lectures use classical teaching methods with the use of modern technology. The principles of descriptive and analytical statistics are explained. Illustrative examples are analyzed in the exercises using classical teaching methods. Computers solve problems by creating tasks in an appropriate environment.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations:	Final exam:
Colloquium exam: 50 Activity: 10 Lecture attendance: Exercise attendance:	Written exam: 20 Oral exam: 20

Course: Operating Systems

Teacher: Goran Keković

Course Status: Mandatory, third year, fifth semester

Number of ECTS: 6

Precondition courses: None

Educational goal

The course is an introductory course in system software. Introduction to operating systems. Principles of operating systems. Deepening theoretical knowledge of Linux and Windows, operating systems. Training to use the Linux + network operating system.

Educational outcomes (acquired knowledge)

At the end of the course, students are expected to successfully master the basic concepts of operating systems, and fully master data protection techniques.

Course content/structure

Lectures

The role and tasks of operating systems. Development, structure and overview of operating systems. Hardware basics for performing operating system functions. Functioning of a typical operating system. Programs, program tasks, processes and threads within a computer system. Mutual exclusion of threads. Operating system kernel. Communication between threads, synchronization mechanisms. Ways to assign processors to threads. Communication between processes. Respect for time limits. Hierarchy of memory space. Memory management. File management. Input / output control. Operating system interfaces. Examples of operating systems: UNIX / Linux, Windows.

Practical classes: Exercises, Other forms of teaching, Study research work

Verification of concepts introduced in lectures on specific systems in use today, primarily Windows and Linux. Installation, administration and maintenance.

Literature

1. Đorđević B. (2005), *Operating Systems*, Mikro knjiga, Belgrade,
2. Archer Harris J. (2001), *Operating Systems*, McGraw-Hill, USA,

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching	Study research	

Teaching methods

The lectures use classical teaching methods with the use of modern information technology. The principles of operating systems are explained. Illustrative examples are analyzed in the exercises using classical teaching methods. Computers solve problems by creating tasks in an appropriate environment.

Knowledge evaluation (maximum 100 points)

Pre obligations	**Points**	**Final exam**	**Points**
Lecture attendance	10	Oral exam	40
Laboratory exercise attendance	15		
Colloquia	20		
Seminar paper	15		

Course: Databases

Teacher: Kopanja S. Lazar, assistant: Ilić Miloš

Course status: mandatory, third year, fifth semester

Number of ECTS: 6

Precondition courses: None

Educational goal

The aim of the course is understanding and adopting the basic concepts and techniques of relational databases.

Educational outcome (acquired knowledge)

Upon completion of the course, students acquired the basic concepts and techniques of data modeling. They are able to:

- represent simpler databases by creating relational connections between entities
- convert entity relationship diagrams (ER diagrams) into the relational schema model in standard normal form
- interactively use the SQL language

Course content/structure

Therory classes

Database systems: history and motivation; components. Database management systems; functions; database architecture and data organization; data independence. Data modeling: conceptual models; entity-relationship data model. Relational data model; relational algebra and relational calculus. Database query languages; review; SQL. Designing relational databases; functional and ambiguous dependency; normal forms.

Practical classes: Practicing the basic principles of relational algebra and relational calculus. Practicing database representation by creating relationships between entities. Mastering basic SQL techniques by writing and performing queries on a given database.

Literature

1. Pavlović Lažetić, G.(1999), „Osnove relacionih baza podataka“, Matematički fakultet u Beogradu
2. Ulman, J & Widom,J. (2008), "A First Course in Database Systems", Prentice Hall (3rd edition)
3. Silberschatz, A., Korth, H.F. & Sudarshan, S.(2002), "Database system concepts", McGraw-Hill (4th edition)
4. Date, C.J. (2004). "An introduction to database systems", Addison-Wesley (8th edition).

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching:	Study research work:	

Teaching methods

Classical teaching methods with the use of a projector are used in the lectures. The presented principles and analyzing typical problems are practiced in the exercises. During the practical classes, students apply the learned techniques.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Number of points**	**Final exam**	**Number of points**
Practical tasks	50	Oral exam	50

Course: English language 3

Teacher: Aferdita Crnisanin

Course status: Mandatory, fourth year, fifth semester

Number of ECTS: 5

Precondition courses: English language 2

Educational goal

Students are introduced to the basic concepts from the narrower field of profession in English, where the main goal is to provide students with knowledge of the professional language for quality monitoring of information literature in English. Since, in order to achieve that goal, it is equally necessary to know the vocabulary, ie. the contents of the English language itself, as well as the language structures, have a significant place in grammar.

Educational outcomes (acquired knowledge):

The student understands texts and has the ability to present professional content with special emphasis on communication skills. The student can use professional literature and express his ideas as well as new knowledge in English in written and oral communication

Course content/structure

Theoretical classes

English language lingua franca of the information age. Means of communication and communication globalization, mass media. Electronic computer: historical development of computers and their application. Types of computers, main parts of computers, computer management. Computer education in English-speaking countries. Dynamics of information language development. Internet. Use of English on the Internet, abbreviations and acronyms. Rules of conduct on the Internet, computer crime. Expressing mathematical concepts in English.

Practical classes: Exercises, Other forms of teaching, Study research work

The exercises practice the comparative pronunciation of internationalism in the field of information systems in English and Serbian. Practicing with verbs and verb tenses in active and passive. Also in the exercises, students prepare teaching materials that are successively published on the course website.

Literature

(2004): Oxford Oxford Dictionary of Business Oxford, University Press

Mitic, G. (2005): "Reading Texts, Short English Grammar Book," FON, Belgrade

Prnjat, Z. & Petkovic, V .. (2006): "English Language 1", FTB University "BK", Belgrade

Murphy, R. (2007): “English Grammar in Use”. Third Edition. CUP

"Business English Reader 1" (collection of professional texts adapted to the curriculum in electronic edition)

Thomson, A.J., Martinet, A.V. (2003). A Practical English Grammar, Oxford University Press

monolingual and bilingual dictionaries

Number of active teaching classes (weekly)	Lectures: 2	Practical classes: 1

Teaching methods

Communicative and grammatical-translation method in combination.

Knowledge evaluation (maximum 100 points)

Pre-exam obligations	Points	final exam	*Points*
activity during the lecture	10	written exam	
practical teaching	15	oral exam	40
colloquia	20		
Seminar paper	15		

Course: Quality management

Teacher: Dražen Jovanović

Course status: Elective, third year, fifth semester

Number of ECTS: 8

Precondition courses: None

Educational goal

The aim of this course is for students to master the knowledge of quality (which includes all areas of human activity: product quality - services, management, government and life), metrology, standardization, accreditation, certification, quality management systems, their implementation and certification.

Educational outcomes (acquired knowledge)

By studying the subject, knowledge is acquired that can be successfully applied in all business organizations. Their application would improve business and the organization would thus gain a competitive advantage in both domestic and foreign markets.

Course content/structure

Theoretical classes

The roots of thought are about quality and management. Scientific approach to quality. Quality gurus (Deming, Juran, Ishikawa, Taguchi, Feigenbaum, Crosby). Quality history. Basic elements of quality. Metrology. Standardization. Accreditation. Certification. Market control. National accreditation system. Regional and world accreditation system. Quality to the single market. World quality control. Concepts of quality management system. PDCA cycle. QMS according to the ISO 9000 series of standards. EMS according to the ISO 14000 series of standards. Integrated management systems. Standards and points of standards on training and education. Tools and methods for quality improvement. Quality and education. Concepts of quality management system. Implementation and certification of QMS. Information systems quality management. Standards ISO / IEC 20000 and ISO / IEC 27000. Professional standards

Practical classes

Exercises with practical examples, case studies, discussions.

Literature

- Vulanović V., Kamberović B.,Stanivuković D., Sistem kvaliteta 9001:2000 FTN, ITC, Novi Sad, 2002.
- Majstorović, V., Model menadžmenta totalnim kvalitetom, Poslovna politika, Beograd, 2000.
- Đorđević D., Ćoćkalo D., Osnove upravljanja kvalitetom, Teagraf, Beograd, 2001.
- Moračanin V. Unapređenje nacionalnog sistema akreditacije zasnovanog na stalnom obrazovanju za kvalitet, Novi Sad, 2011.
- Standardi ISO
- Moracanin V., "Total Quality Management and Six Sigma", chapter 8: Competence Education and Training for Quality book edited by Tauseef Aized, ISBN 978-953-51-0688-3, Published: August 1,2012.

Number of active teaching classes (weekly)				Other classes
Lectures: 3	Practical classes: 3	Other forms of teaching:	Study research work:	

Teaching methods

The course is performed according to standard methods of higher education, ie university teaching in the form of theoretical lectures and practical exercises, combined with examples from practice, independent and team work and mandatory preparation of seminar paper (project assignment) during the semester.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	10	Written exam	
Practical teaching		Oral exam	40
Colloquium exam	25	.....	
Seminar paper	25		

Course: Internet Marketing

Teacher: Aleksandar D. Stokić

Course status: Elective, third year, fifth semester

Number of ECTS: 8

Precondition courses: none

Educational goal

The course enables students to understand the business use of the Internet as well as to acquire basic knowledge about how Internet technologies and information systems are used in marketing.

Educational outcomes (acquired knowledge):

By studying the course, students acquire knowledge of three complementary topics - e-marketing, Internet business and mobile trading, which enables them to apply marketing and Internet marketing in modern companies and economic organizations.

Course content

Theoretical part - Introduction to marketing: past, present, future. General marketing strategies-segmentation, targeting, positioning and differentiation. The marketing mix (4P). Understanding e-marketing context: e-business models and the role of strategic marketing planning. Strategic e-marketing and performance measures. E-marketing plan. Identifying profitable e-marketing strategies. The Four Pillars of Internet Marketing (4C / W.I.S.E. Model).

E-marketing techniques (email marketing, online PR, banners, viral marketing, online advertising). The use of E-marketing: Web Content - creating quality Web site content, Search Engines - strategies for achieving visibility on searches, CRM. Internet PR as a part of e-marketing: image management, publicity, reputation creation, basic elements of PR activities on the Internet.

Practical part / Exercises - Online Case Studies (examples of sustainable online business models). Creating an Internet marketing plan. Application of Web 2.0 technologies in improving the appearance on the Internet. Marketing on social networks and social media. Improving the level of the company's presence on the Internet.

Literature

1. Strauss, J., El-Asary, A. & Frost, R. (2007). *E-marketing (IV izdanje).* Sarajevo, BiH: Sahinpasic, ISSN-13: 9789958411731.

2. Varagić, D. (2002). *A guide trough the heaven and hell of Internet marketing.* Novi Sad: P2 Internet and Prometej.

1. Rosen, D. E. & Purinton (2004). Website design: Viewing the web as a cognitive landscape. *Journal of Business Research, 57,* pp. 787-794.

2.Parasuraman, A. & Zinkhan, G. M. (2003). Marketing to and serving customers through the Internet: An overview and research agenda. *Journal of the Academy of Marketing Science, 30(4),* pp. 286-295.

Number of active teaching classes (weekly)				Other classes
Lectures: 3	Practical classes: 3	Other forms of teaching classes:	Study research:	

Teaching methods

The course is taught according to standard methods of higher education, ie university teaching in the form of theoretical lectures and practical exercises, combining independent and teamwork and mandatory seminar paper (project assignment) during the semester under the mentorship of the subject professor.

Knowledge evaluation (maximum 100 points)

Pre-examination obligations	**Points**	**Final exam**	**Points**
Practical tasks		Oral exam	30
Student's participation in the classroom	10		
Laboratory exercise	20		
Colloquium (2)	20+20		

Course: Computer networks

Teacher: Aleksandar Zakić, assistant: Vladimir Šašo

Course status: Mandatory, third year, sixth semester

Number of ECTS: 6

Precondition courses: None

Educational goal

Introduce the student to the principles and applications of computer networks.

Educational outcomes (acquired knowledge)

Ability to work on computer networks, based on mastered principles and applications.

Course content/structure

Introduction to the work program, assessment methods and exams. Computer-basic concepts. Layered architecture, OSI model, TCP / IP model. General terms related to computer communication. Client-server model. Connecting two computers, direct connection, modem connection. Connecting multiple computers, bus, star, tree and ring topologies. Local area networks. City networks. Broadband networks. Media access methods. Addressing. Protocols. Switching networks. Routing algorithms. Traffic congestion control algorithms. Computer networks and the Internet. Internet services. Network devices. IP addressing. Routing. BGP and adaptive routing. MPLS architecture. Protocols. Point-to-point and point-to-multipoint communication. Error detection and correction. Multiple approach techniques. QoS. Virtual private networks (L2, L3 and hybrid). Ethernet Metro. Optical networks. GMPLS. Networks with sensors. Triple play / IPTV.

Literature

[1] З. М. Урошевић (2004), *Увод у рачунарске телекомуникације и мреже*, Технички факултет, Чачак.

[2] М. Стојчев (2005), *Рачунарске мреже и пренос података*, Електронски факултет, Ниш.

[3] Р. Куросе, К. Рос, С. Кошћал, Р. Јанковић (2005), *Умрежавање рачунара*, СЕТ Београд. [4] A. S. Tanenbaum (2003), *Computer Networks*, 4th ed. Prentice Hall PTR.

[5] K. M. Sivalingham, S. Subramaniam (2005), *Emerging Optical Network Technologies-Architectures, Protocols and Performance*, Springer.

[6] L. L. Peterson, B. S. Davie (2012), *Computer Networks: A Systems Approach*, 5th ed., Elsevier.

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching:	Study research work:	

Teaching methods

Lectures, tutorials, colloquia, consultations, tests, homework.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	10	Written exam	20
Practical teaching		Oral exam	30
Colloquium exam	20	.....	
Seminar paper	20		

Course: Web programming

Teacher: Negovan Stamenković, assistant: Miloš Ilić

Course status: Mandatory, third year, sixth semester

Number of ECTS: 6

Precondition courses: None

Educational goal

Introduce the student to the principles and applications of programming on the Web, as well as the technology of designing and testing presentations.

Educational outcomes (acquired knowledge)

Ability to design modern structures of Web sites, testing and its promotion.

Course content/structure

Introduction to theory of web design. Rules. Concepts. Briefing and planning. Domains. Information about domains. Structure of the website. Website navigation. Principles of effective navigation. Accessibility. Web design problems. Technologies of web design and programming languages: HTML, Javascript, DHTML, CGI, PHP, Java Servlets, JSP, form styles, formatting, positioning, standards. Testing of web applications. Website promotion. Submitting website to search engines. Updating presentations.

Literature:

[1] J. N. Robbins (2008), *Naučite Web dizajn – vodič kroz (X)HTML, CSS i Web grafiku*, Mikroknjiga, Beograd, 2008.

[2]. J. Niederst (2001), *Learning Web Design: A Beginner's Guide to HTML, Graphics, and Beyond*, O'Reilly.

[3] P.J. Lynch, S. Horton (2002), *Web Style Guide: Basic Design Principles for Creating Web Sites*, 2nd Edition, Univ Press.

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching:	Study research work:	

Teaching methods

Lectures, tutorials, colloquia, consultations, tests, homeworks.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	10	Written exam	20
Practical teaching		Oral exam	30
Colloquium exam	20	.....	
Seminar paper	20		

Course: Multimedia Communication Systems

Teacher: Aleksandar Stokić, assistant: Vladimir Mikić

Course status: Mandatory, third year, sixth semester

Number of ECTS: 5

Precondition courses: None

Educational goal is to provide knowledge about principles, technology, devices, that are being used in development of multimedia projects. The goal is to familiarize with processes and software for processing and compression of multimedia signal. Implementation of standards for data transmission and multimedia signal.

Educational outcomes (acquired knowledge)

The students completing the Multimedia system design course will be capable to use software for signal processing, development of multimedia content in form of web pages, DVD, video tutorials and understanding communication techniques that are being used for transmission and distribution of the multimedia signal.

Course content/structure

Theoretical lectures

Introduction to multimedia. Multimedia hardware technologies. Platforms. Interfaces. Devices for memory and storage. Input devices. Output devices. Architecture of multimedia systems. Multimedia devices for processing of video and audio signals. Format of text, graphic, sound, and motion picture.

Communication in multimedia technology. Multimedia software and tools. Use of tools: Adobe Photoshop, Adobe Premier, Adobe After Effects. Synchronization of image and sound. Methods for processing and compression of multimedia signals. JPEG compression. H261, H263, H264, MPEG1, MPEG2 and MPEG4 standards. Distribution of multimedia signal. Transmission of multimedia signal over the Internet. Projection of multimedia systems.

Laboratory exercises

- Input of audio/video material in different formats to computer.
- Sound software. Sound recording, environmental sound. Sound editing.
- Work with image processing software
- Image editing.
- Correction of recorded video material and application of special effects.
- Unifying software for sound and picture.
- Combination of motion graphic video live audio/ video material.
- Combination of live image with 3D.
- Development of multimedia interactive projects.

Literature

1. Ze-Nian Li, Mark Drew, *Fundamentals of Multimedia*, Prentice-Hall, 2004.
2. R. M. Perea, *Internet Multimedia Communications Using SIP*, Elsevier, Inc., 2008.
3. M. Petrović, I. Petrović, Priručnik za laboratorijske vežbe, Viser, Beograd, 2010.

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching	Study research work:	

Teaching methods: Lectures and laboratory practice are based on frontal, group methods, as well as using laboratory-experimental methods facilitating information communication technologies.

Knowledge evaluation (maximum 100 points)			
Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	10	Written exam	
Practical teaching	20	Oral exam	30
Colloquium exam	30	.....	
Seminar paper	10		

Course: Software engineering

Teacher: Nenad Gligorić, assistant: Miloš Ilić

Course status: Mandatory, third year, sixth semester

Number of ECTS: 5

Precondition courses: None

Educational goal

Introduction to the basics of software development and software product development methodology.

Educational outcomes (acquired knowledge)

Ability to apply the acquired knowledge through the development of a specific project task, including the development of project and user documentation.

Course content/structure

Theoretical classes

Introduction to information engineering. Genesis of software engineering development.
Principles of software engineering. Software engineer. Developing a process component within an information system. Methods of developing a process component. Decomposition of the problem. Decomposition diagrams. Data flow diagrams. Process structure diagrams. Software product development methodology. Software product life cycle development models. Requirements analysis, development of specifications. Shaping the internal logic of the process. Diagram techniques. Object-oriented design. User interface design.

Practical teaching:

Exercises, Other forms of teaching, Study research work: Working environments for writing programs, Basic concepts of Java, graphical user interface and the process of creating seminar papers with examples

Literature

1. Sommerville, I. (2001): „Software Engineering, 6th Edition“, Addison-Wesley
2. Finkelstein, A. (2000): „The Future of Software Engineering“, IEEE Computer Society
3. Денић Н. (2014): Ауторизована предавања: Софтверско инжењерство, ФИТ, Алфа Универзитет, Београд
4.Влајић С. (2012): Пројектовање софтера, ФОН, Универзитет у Београду, Београд

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching:	Study research work:	

Teaching methods

Lectures, exercises in the classroom, example analysis in an online environment.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	15	Written exam	
Practical teaching	15	Oral exam	30
Colloquium exam	25	.....	
Seminar paper	15		

Course: Software project management

Teacher: Nenad Gligorić, assistant: Miloš Ilić

Course status: Elective, third year, sixth semester

Number of ECTS: 8

Precondition courses: None

Educational goal

Educational goal is to provide skills and knowledge in project management in scope of software development of information systems. Student will be introduced with basic principles in scope of project management. Project approach and application in the business processes. Basic conditions of successful management of project with special focus on importance of the project domain definition, planning, project management, and resources.

Educational outcomes (acquired knowledge)

The students will be capable to work on the projects, and they will be introduced with most common problems and existing solutions for management of different types of the projects. The focus is on the teamwork and execution of processes using empirical methods.

Course content/structure

Theoretical classes

Introduction to projects. The concept and importance of project management. Historical approach to the development of project management. Significant factors of success or failure of project implementation. Project life cycle. Project organization. Project management processes: initiation, planning, execution, management, and conclusion. The role and profession of project manager. Authority, responsibilities, negotiation and communication management. Psychology in project management. Conflict management. Project management support tools. Project documentation. Project evaluation. Project management software. MS Project 2010 (2013). User interface. Work environment. Gantt chart. Creating a new project. Project information. Calendars. Resources. Monitoring project progress. Group work on the project. Reporting Formatting for display and printing.

Practical classes: Exercises, Other forms of teaching, Study research work

The exercises provide a framework of the problem, analyze the facts and theoretical approaches, and the exercises teach in an interactive form. Students are introduced to standard IT solutions for project management. Each chapter covered in the lectures is accompanied by a task to be solved within the project. Students themselves choose the area of work of the project and implement it in a team. In this way, students will learn how to use the knowledge gained in real life lectures.

Literature

• Kerzner, H. (2003): „Project Management a system approach to planning“, scheduling and controlling, John Wiley

• Jovanović, P. (2007): „Upravljanje projektima“, FON, Beograd

• Gray, C.F., Larson, E.W. (2009): “Project management”, McGraw Hill, Boston

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 3	Other forms of teaching:	Study research work:	

Teaching methods

Presentations and discussions, computer exercises, consultations, independent preparation of obligatory tasks, knowledge testing. Lectures consist of presentation descriptive examples, genesis and solving certain tasks. Additional examples and exam tasks are considered and solved during laboratory exercises.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	15	Written exam	
Practical teaching	15	Oral exam	30
Colloquium exam	25	.....	
Seminar paper	15		

Course: Decision Support Systems

Teacher: Rade Božović, assistant: Vladimir Šašo

Course status: Elective, third year, sixth semester

Number of ECTS: 8

Precondition courses: None

Educational goal

The aim of the course is to introduce the student to the field of business decision support. The course provides a distinction between IT support for business decision making and other managerial functions such as management, leadership and planning. Also, the aim of the course is to get acquainted with different models of decision-making, different classes of decision support systems, as well as different models for the development of decision support systems.

Educational outcomes (acquired knowledge)

At the end of the course, the student understands the distinction between different managerial levels and relevant business information at those levels. Accordingly, the student has acquired systematic knowledge of information systems classes to support different managerial levels of decision making.

Course content/structure

Theoretical classes

Models and methods to support decision making: models for "capacitated facility location" problems, models for "uncapacitated facility location" problems, set partition problem, strong and weak models, methods for designing strong models, implications for problem solving, models with exponential number of variables, problems of maximum flow, application of methods in planning, design of different schedules.

Software models of decision support systems: levels, models and processes of business decision making, classes of information systems to support different managerial levels of decision making, architecture of decision support systems, model driven decision support systems, document driven decision support systems, communication driven / group systems for decision support, group decision models; electronic meeting management support systems, knowledge driven decision support systems, decision support system development process.

Business intelligence: knowledge acquisition, information integration (combining data from different sources, connecting heterogeneous business systems and data warehouses, the presence of lexical and semantic incompatibility, using mediators and metadata management to connect heterogeneous and autonomous data sources), business analysis and visualization.

Practical classes: Exercises, Other forms of teaching, Study research work

The exercises include assignments from the processed models and classes of excellence. During the exercises, students create a model of a decision support system.

Literature

- Laudon, C.K., Laudon, J.P.(2001): „*Essentials of Management Information Systems: Organization and Technology in the Networked Enterprise*“, Prentice Hall

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 3	Other forms of teaching:	Study research work:	

Teaching methods

Presentations and discussions, computer exercises, consultations, independent preparation of obligatory tasks, knowledge testing. Lectures consist of presentation descriptive examples, genesis and solving certain tasks. Additional examples and exam tasks are considered and solved during laboratory exercises.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	15	Written exam	
Practical teaching	15	Oral exam	30
Colloquium exam	25	.....	
Seminar paper	15		

Course: Designing Information Systems

Teacher: Vojkan Nikolić, assistant: Vuk Vujović

Course status: Mandatory, fourth year, seventh semester

Number of ECTS: 8

Precondition courses: None

Educational goal: The aim of the course is for the student to master the structural and object methods for planning, analysis and design of IS, as well as with the methods of information engineering. Also, the aim of the course is that the student on the basis of acquired theoretical knowledge must be able to realize all phases of the life cycle of each IS by applying new information technologies and using CASE tools.

Educational outcomes (acquired knowledge): The student is able to analyze and model user requirements with object-oriented techniques. The student is also able to model a database and applications, using CASE tools.

Course content/structure

Theoretical classes: Business system and its information system. Information system life and development cycle. Nolan's paradigm of enterprise information development. Business system analysis of object system technology. Optimal organization and information system architecture. Optimization criteria. Data classes. Heuristic and exact IS structure optimization algorithms. An overview of modern methods and IS design methods. "Top-down" planning and "Bottom-up" version. Relationship between design methodology and techniques. Computer support for information system design. The term CASE (Computer Aided System Engineering) and areas of use. Overview of CASE tool and application generator functions. Standards for IS design methods. Process modeling techniques. Data Flow Diagram (DFD). Special methods and standards for data modeling. HIPO-diagram and structural diagram. IDEF standards for DFD. Data modeling techniques. Object-link-property model (ERA-model). An object type and an instance of a particular object type. Classifiers and identifiers. Martin and Chen notation. Generalization and abstraction. Object recognition. Type, type and cardinality of the connection. Semantics of data models. Relational data model. An objective approach to IS development. Information system resource modeling. System synthesis. IS construction project management.

Practical classes: Exercises, Other forms of teaching, Study research work

Exercises take place in a computer laboratory in several groups, respecting the principle of one student-one computer. With the gradual acquaintance of students with the modern methodology of system analysis and design, the goal is for students to be trained for the jobs of system analysts and information systems designers.

Literature

- Lazarević, B. i dr. (2005): „Projektovanje informacionih sistema“, Naučna knjiga, Beograd
- Roger S. Pressman (2000): „*Software Engineering/A Practitioner's Approach“*, McGraw-Hill
- Denić N. (2014): Autorizovana predavanja: Projektovanje informacionih sistema, FIT, Alfa Univerzitet, Beograd

Number of active teaching classes (weekly)				Other classes
Lectures: 3	Practical classes: 3	Other forms of teaching:	Study research work:	

Teaching methods

Lectures, exercises with intensive use of CASE tools. During the exercises, team work is organized in solving tasks from individual thematic units, which monitors the students' affinity for the areas of thematic units.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	10	Written exam	
Practical teaching	15	Oral exam	40
Colloquium exam	20	.....	
Seminar paper	15		

Course: **Wireless mobile communication**

Lecturer: Rade Bozovic, assistant: Vuk Vujovic

Status: Mandatory, fouth year, seventh semester

Number of ECTS: 8

Precondition courses: None

Educational goal

Introducing students to the basic methods, ideas and principles applied in mobile telecommunications systems.

Educational outcome (acquired knowledge)

Students will be able to understand celular concept, processing technique and signal modelling and protocols in wireless communication systems.

Course content/structure

Lessons:

Wireless telecommunication systems and standards. Celullar concept. Signal propagation. Channel inteference and noise impact. Modulations: QAM, PSK, OQPSK, π/4 DQPSK, OFDM. Diversity systems: time, frequency, space. MIMO.Equalization. Speech coding. Protection coding – block codes, convolution codes, turbo codes. Spread spectrum systems. Protocols in wireless communication networks. Development of the new technologies and standards in mobile communications.

Practical classes and exercises:

Modelling of the wireless systems in Simulink (MATLAB). Software overview of base stations functionalities.

Literature

1. T. S. Rappaport, *Wireless Communications, Principles and Practice*, Prentice Hall PTR, 2002.
2. Matias Toril, *Optimization of Handover Margins in GSM/GPRS Networks*, 2003.
3. N. Gospić, I. Tomić, D Popović, D. Bogojević, *Razvoj mobilnih komunikacija - od GSM do LTE* , Univerzitet u Beogrdu, Saobraćajni fakultet 2010.
4. M. L. Dukić, *Principi telekomunikacija*, Akademska misao, 2008.

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 3	Other types of classes:	Study and Research:	

Methodology

Lectures, exercises with intensive use of CASE tool. During the exercises, team work is organized in solving tasks from specific thematic units, which monitors the students' affinity for the areas of thematic units.

Knowledge score (maximum points 100)

Preobligations	**Points**	**Final exam**	**Points**
Activity during lectures	10	Test paper	
Practical classes	15	Oral exam	40
Colloquia	20	.....	
Seminar paper	15		

Course: English language 4

Teacher: Aferdita Crnišanin

Course status: Mandatory, fourth year, seventh semester

Number of ECTS: 5

Precondition courses: English language 3

Educational goal

The aim of the course is to acquaint students with concepts from the narrower field of profession in English, where the main goal is to provide students with knowledge of professional language necessary for quality monitoring of IT literature in English.

Educational outcomes (acquired knowledge)

The student is trained to write abstracts and abstracts and presentations in English.

Course content/structure

Theoretical classes

Structure, organization and data processing. Information systems. Information networks, data transmission and information. Data transmission systems. Kinds of programming and programming languages. Types of programs. Operating systems. Basics of written and oral communication. Basics of business correspondence. E-commerce. Application of modern technology in business communication. Review of grammatical structures: indefinite verb forms and their translation. Review of grammatical structures: noun and prepositional sets. An overview of grammatical structures: conjunctions and their role in a sentence. Types of complex sentences. Review of grammatical structures: types of dependent sentences. Participle in dependent sentences.

Practical classes: Exercises, Other forms of teaching, Study research work

Writing a summary and abstract, e-mail, presentation. Using the Internet, CDs and dictionaries for this purpose.

Literature

- (2004): „*Oxford Oxford Dictionary of Business Oxford*“, University Press
- Mitić, G. (2005): „Reading Texts, Short English Grammar Book,“ FON, Beograd
- Prnjat, Z.& Petković, V.. (2006): „Engleski jezik 4“, FTB Univerzitet „BK“, BeogradMurphy, R. (2007.): „*English Grammar in Use“*. Third Edition. CUP
- *„Business English Reader 2“ (*collection of professional texts adapted to the curriculum in electronic edition)
- monolingual and bilingual dictionaries

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 1	Other forms of teaching:	Study research work:	

Teaching methods

Communicative and grammatical-translation method in combination.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	10	Written exam	20
Practical teaching	10	Oral exam	30
Colloquium exam	20	.....	
Seminar paper	10		

Course: Digital signal processing

Lecturer: Rade Božović

Status: Mandatory, fourth year, seventh semester

Number of ECTS: 9

Precondition courses: None

Educational goal

Introduction to the theoretical and practical aspects necessary for the design of digital filters and training students to use appropriate hardware and software tools.

Educational outcome (acquired knowledge)

Students will be able to select an adequate circuit structure in order to meet the specifications of appropriate systems for digital signal processing, as well as to implement an algorithm for digital signal processing in software or hardware.

Course content/structure

Analysis of discrete signals and systems in the time and frequency domain. Fourier transformation. Z transformation. Digital processing of continuous signals. Discrete Fourier transformation (DFT). Fast Fourier Transformation (FFT). Transfer functions and frequency responses. Digital filters of infinite impulse response (IIR). Digital filters of finite impulse response (FIR). Digital filters realization. Discrete Random Signals. DSP Processor Basics. Assembler, higher programming languages. Digital signal processing with different sampling frequencies. Digital filter banks (QMF banks, multi-level filter banks). Application of digital signal processing (spectral analysis of sinusoidal, non-stationary and random signals, music signal processing, digital music signal synthesis, signal compression, transmultiplexers, discrete multitone digital data transmission, converters with oversampling). Discrete Hilbert transformer. Adaptive filters (equalization of telecommunication channels, echo cancellation). Analysis and processing of DSP systems using Matlab software.

Literature

1. Lj. Milic, Z. Dobrosavljevic: Introduction to Signal Processing (in Serbian), Akademska misao, Belgrade, 2015.
2. A. Antoniou, Digital signal processing –signals, systems and filters, McGrawHill, 2006.
3. Vidosav Stojanovic, Diskretne mreze i procesiranje signala, Univerzitet u Nišu, Elektronski fakultet, 2004.

Number of active teaching classes (weekly)				Other classes:
Lectures: 3	Excersises: 3	Other type of classes:	Study and Research:	

Methodology

Lectures, exercises, colloquia, consultation, homeworks and test paper examination.

Knowledge score (maximum points 100)

Preobligations	**Points**	**Final exam**	**Points**
Activity during lectures	15	Test paper	20
Practical classes		Oral exam	20
Colloquia	25	.....	
Seminar paper	20		

Course: Management information systems

Teacher: Dražen Jovanović

Course status: Elective, fourth year, seventh semester

Number of ECTS: 9

Precondition courses: None

Educational goal: Introducing students to the role of technology in creating wealth and achieving competitiveness. Introducing students to the knowledge of how to integrate technology and management. Introducing students to the basics of technology management, technological strategy, technological planning, acquisition and exploitation of technology and technology transfer.

Educational outcomes (acquired knowledge): The student is able to get acquainted with important examples of information technology management through case studies. Ability to use modern information systems in the function of making business decisions. Adoption and application of standards for process and data modeling. Knowledge of the structure and ability to independently apply methods of analysis and improvement of existing MIS. Ability to design and maintain MIS.

Course content/structure

Theoretical classes: Introduction and general theory of systems, MIS - definition, structure, task, functions, significance, focus on managerial information, Human resources in the development and functioning of MIS: the role and relationship of managers and IT. Significance and functioning of MIS in business system management. MIS for decision support: decision making, concept, goals, models, team support. MIS and business system: vertical and horizontal levels, ways of support and data integration. Types of MIS: ESS, MSS, DSS, GDSS, MIS. Information management: management of basic types of resources, information needs and users. MIS development: structural and object approach. MIS models: physical and conceptual model, problem solving using models. Evolution of MIS with emphasis on information and knowledge, development trends. Modeling of information management requirements, Data Warehouses, Olap systems, Data mining - knowledge discovery, MIS in E-comercce environment.
Practical classes: Exercises, Other forms of teaching, Study research work
The exercises practice methods of designing information systems (Feasibility analysis and proposal of system solution. Modeling and analysis of systems. System design. Realization of systems.) Areas of application of information systems in case of solutions with available source code (Open Source).

Literature

- Denić N. (2010): Menadžment informacioni sistemi, FIT, Alfa Univerzitet, Beograd
- Levi-Jakšić, M. (2008): „Menadžment tehnologije i razvoja“, FON, Beograd.
- Laudon, K., Laudon, L. (2001): „*Management Information Systems“*, IV Edition, Prentice Hall

Number of active teaching classes (weekly)				Other classes
Lectures: 3	Practical classes: 3	Other forms of teaching:	Study research work:	

Teaching methods

Classes are conducted through audit lectures that are accompanied by slides and laboratory exercises that solve certain problems more deeply. Lectures and exercises were followed with a large number of examples from practice. In addition to this, the development of independent work is envisaged, whereby students are practically introduced to the beginners of the evaluation of the quality of a software or to the developed project additions for the information system project.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	15	Written exam	
Practical teaching	15	Oral exam	30
Colloquium exam	25	.....	
Seminar paper	15		

Course: Cyber security

Teacher: Aleksandar Zakić

Course status: Mandatory, fourth year, seventh semester

Number of ECTS: 6

Precondition courses: None

Educational goal

The aim of the course is to study the existing security problems of computer systems, such as and techniques and approaches that enable better protection of these systems and prevention of attacks.

Educational outcomes (acquired knowledge)

Mastering all aspects of security and protection of computer systems and networks.

Course content/structure

The course covers the following areas: Introduction to Computer Systems Security, Securityhardware, Software security, Network security, Mobile wireless network security, Web security, Privacy, Anonymity, Principles of cryptography.

Literature

- Computer Security. Dieter Gollmann, 2nd edition (Amazon)
- Security Engineering. Ross Anderson (Available online)

Number of active teaching classes (weekly)				Other classes
Lectures: 2	Practical classes: 2	Other forms of teaching:	Study research work:	

Teaching methods

Lectures, tutorials, colloquia, consultations, tests, homework and written exams.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	10	Written exam	20
Practical teaching		Oral exam	30
Colloquium exam	20	.....	
Seminar paper	20		

Course: Information Theory and Coding

Lecturer: Rade Božović

Status: mandatory, fourth year, eighth semester

Number of ECTS: 6

Precondition courses: None

Educational goal

Introduction to the theoretical foundation in the theory of information and coding.

Educational outcome (acquired knowledge)

Students will be able to do theoretical analysis of information, to recognize used codes, to select appropriate decoding scheme, as well as to understand the basic principles of cryptography.

Course content/structure

Introduction to the course program, references, assessment methods and exams. The concept of information. Introduction to information theory. The entropy. Sources of information. Discrete sources of information without memory. Discrete sources of information with memory. Continuous sources of information. The concept of coding. Linear block codes. Hamming code. Cyclic codes. Convolutional codes. Digital composing. Optimal decoding. Principles of cryptography.

Literature

- M. Dukić (2008), *Principi telekomunikiacija*, Akademska misao, Beograd.
- G. Lukatela, D. Drajić, G. Petrović (1978), *Digitalne telekomunikacije*, Građevinska knjiga, Beograd.
- L. Brillouin (1956), *Science and information theory*, Academic Press, New York.
  J. Pierce (1980), *An Introduction to Information Theory - Symbols, Signals and Noise*, (second revised edition), Dover Publications, New York.
- Ž. Ilić, A. Bažant, T. Beriša (2013), *Teorija informacija i kodiranje*, zbirka zadataka, Zagreb.

Number of active teaching classes (weekly)				Other classes
Lectures: 3	Excersises: 3	Other types of classes:	Study and research:	

Methodology

Lectures, exercises, colloquia, consultation, homeworks and test paper examination.

Knowledge score (maximum points 100)

Preobligations	**Points**	**Final exam**	**Points**
Activity during lectures	15	Test paper	20
Practical classes		Oral exam	20
Colloquia	25	.....	
Seminar paper	20		

Course: Artificial intelligence

Teacher: Dejan Djukic

Course status: Mandatory, fourth year, eighth semester

Number of ECTS: 6

Precondition courses: Object-Oriented Programming, Databases

Learning goal

Understanding notions of artificial intelligence, its methods, its applications. Understanding artificial neuronal networks, understanding parametric optimisation and machine learning. Understandig formal logical inference, basic programming in Prolog

Educational outcome (acquired knowledge)

Ability to use Matlab to implement multilayer perceptron networks and gradient backpropagation algorithm in Matlab; ability to apply supervised learning in multilayer perceptron networks to model relations in data sets or time series; Ability to implement query methods and recursive methods in Prolog.

Course content/structure

Lectures

Artificial intelligence, history, development, applications, achievements, deficiencies, future. Optimisation, least squares optimisation, non-linear parametric optimisation, steepest descent method, variants of gradient descent method. Artificial neuronal networks, emergence, history, development, applications. Perceptrons, multilayer perceptron networks, biological justification and mathematical model. Vector and matrix representation of multilayer perceptron networks. Implementation of multilayer perceptron networks in Matlab. Machine learning, supervised and nonsupervised learning. Data sets for machine learning, trainint set, evaluation sets, testing sets. Supervised learning in multilayer perceptron networks. Backpropagation algorithm. Vector and matrix representation of backpropagation algorithm. Implementation of backpropagation algorithm in Matlab.

Logical inference and statement proving. Automated tatement proving using computers. Prolog programming language origins. Basic properties of Prolog. Prolog programmes, statemets, conditions, queries. Data structures in Prolog, atoms, symbols, variables, sets, lists. Recursion in Prolog. Application of Prolog for data searching and selection.

Tutorials related to the lectures

Programming in Matlab, implementation of algorithms for multilayer perceptron networks in Matlab. Programming in Prolog.

Learning resources

1. Russel & Norvig: Artificial Intelligence: A Modern approach, Prentice Hall, 2009.
2. Bishop, C.M, Pattern Recognition and Machine Learning, Springer, New York, 2006.
3. Richard O. Duda, Peter E.Hart, David G. Stork, Pattern Classification, 2nd Edition, Wiley, 2001.
4. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.

Number of active teaching classes (weekly)				Other classes
Lectures 2	Practical classes 3	Programming demonstrations	Project work	

Teaching and learning methods

Lectures and tutorials: classroom work with contemporary IT learning aids

Programming exercises in a computer laboratory.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Classroom attendance		Written exam	30
Practical work	40	Oral exam	
Assignments			
Tests	30		

Course: Marketing information systems

Teacher: Nenad Gligorić, assistant: Vuk Vujović

Course status: Elective, fourth year, eighth semester

Number of ECTS: 5

Precondition courses: None

Educational goal

The aim of the course is to acquaint students with modern theoretical and practical aspects of marketing information system and its importance for the business of companies and business entities.

Educational outcomes (acquired knowledge)

With the acquired knowledge, students will be able to apply modern achievements of marketing information system when making decisions about entering the market.

Course content/structure

Theoretical classes:

Components of the marketing information system. Goals of business entities and marketing decisions. Defining the structure of the marketing information system. Determining databases (internal, external) and computer applications, and solving organizational problems related to the establishment of marketing information systems. Evolutionary levels of marketing information systems. Marketing research. Market research. Market research process. Data sources. Problem identification, defining the research goal, sample selection, data collection, data preparation and processing, hypothesis testing and presentation of research results. Test methods, observation methods and experimental methods. Forecasting market trends. Application of market research.

Practical classes: Methods of marketing information systems are practiced in exercises (Feasibility analysis and proposal of system solution. Modeling and analysis of marketing information systems. Design of marketing information systems. Realization of systems). Areas of application of marketing information systems in case of solutions with available source code (Open Source).

Literature

- Denić N. Menadžment informacioni sistemi, FIT, Alfa Univerzitet, Beograd, 2010.
- Hanić, H.: Istraživanje tržišta i marketing informacioni sistem, Ekonomski fakultet, Beograd, 2005.
- Macura, P.: Modeli marketinških informacionih sistema, Ekonomski fakultet, Banja Luka, 2003.

Number of active teaching classes (weekly)				Other classes
Lectures: 3	Practical classes: 2	Other forms of teaching:	Study research work:	

Teaching methods

Lectures: Classes are conducted through classroom lectures that are accompanied by slides and laboratory exercises that elaborate on solving certain problems. Lectures and exercises were followed with a large number of examples from practice. In addition to this, it is planned to create an independent paper, where students are practically introduced to the methods of assessing the quality of a software or to the development of a project task for information system marketing.

Practical classes: Exercises practice marketing information systems methods (Feasibility analysis and system solution proposal. Modeling and analysis of marketing systems. Design of marketing information systems. System implementation.) Areas of application of marketing information systems in case of solutions with available source code (Open Source).

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	15	Written exam	
Practical teaching	15	Oral exam	30
Colloquium exam	25	.....	
Seminar paper	15		

Course: Statistical Theory of Communication

Teacher: Dragiša Žunić

Course status: Elective, fourth year, eighth semester

Number of ECTS: 5

Precondition courses: None

Educational goal

Introducing students to the basic terms from the theory of probability and application in the statistical theory of telecommunications.

Educational outcomes (acquired knowledge)

Based on the acquired knowledge, the student will be able to determine the characteristics of signals and systems for a given system in given conditions, which has an important role in the design of telecommunication systems.

Course content/structure

Theoretical classes:

Defining the field of statistical theory of telecommunications. Random processes. Probability, distribution functions, cumulative distribution function. Basic types of probability distribution. Probability density transformation. Statistical ensemble. Moments. Characteristic function. Correlation function of a random process. Spectral analysis of deterministic signals. Spectral analysis of random signals. Spectral power density, Wiener-Khinchin theorem. Quantities that describe the characteristics of the system: error probability, failure probability, channel capacity.

Practical teaching:

Application of theoretical knowledge in the analysis of telecommunication systems in which the signal has Gaussian, Poisson, Reilly, Rice and Nakagami distributions.

Literature

1. G. Lukatela, Statistička teorija telekomunikacija i teorija informacija, Građevinska knjiga, Beograd, 1981.
2. M. Stefanović, Teorija telekomunikacija, Elektronski fakultet u Nišu, 2005.
3. D. Middleton, An introduction to Statistical Communication theory, IEEE Press, 1987.
4. M. Dukić, Principi telekomunikacija, Akademska misao, 2008.

Number of active teaching classes (weekly)				Other classes
Lectures: 3	Practical classes: 2	Other forms of teaching:	Study research work:	

Teaching methods

Combined, interactive with solving examples from practice.

Knowledge evaluation (maximum 100 points)

Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity	20	Written exam	10
Practical teaching	10	Oral exam	20
Colloquium exam	30	.....	
Seminar paper	10		

Course: Professional Practice				
Teacher: The area of professional practice determines the teacher				
Course status: Mandatory, fourth year, eighth semester				
Number of ECTS: 2				
Precondition courses:				
Educational goal Introduction to working conditions in the selected work organization.				
Educational outcomes (acquired knowledge) Ability to apply the acquired theoretical and applied knowledge in the work organization.				
Course content/structure Work in a work organization is conditioned by the jobs in which the student is engaged.				
Literature Materials and project solutions within the work organization.				
Number of active teaching classes (weekly)				Other classes
Lectures:	Practical classes:	Other forms of teaching:	Study research work:	
Teaching methods Practice diary, including available technical solutions.				

Knowledge evaluation (maximum 100 points)			
Pre-examination	**Points**	**Final exam**	**Points**
Lecture attendance and activity		Written exam	
Practical teaching		Oral exam- practice diary	100
Colloquium exam		.....	
Seminar paper			

Course: Final Thesis
Teacher: Mentor and Committee
Course status: Mandatory, fourth year, eighth semester
Number of ECTS: 5
Precondition courses: Submission and defense of the Final thesis is possible upon passing all exams students had during the undergraduate academic studies.
The Aims of the Final Thesis: The aim of the Final thesis is for the student to show the ability to engage in professional (or scientific) research, apply adequate methods of data collection and processing, as well as the ability to independently write professional or scientific papers, present professional problems and represent certain professional ideas.
Educational outcomes (acquired knowledge): By preparing and defending the Final thesis, students are able to solve real applicable problems, as well as to consider and analyze theoretical solutions. This includes developed critical thinking, the ability to analyze problems, synthesize solutions, and predict the consequences of the selected solution, using scientific methods and procedures. Especially important is the ability to adopt relevant innovations in the profession, their connection with the acquired knowledge, application in practice and clear transmission to the professional and general public.
Course content/structure: The Supervisor of the Final thesis assigns a topic from the area covered by the curriculum, which the candidate can successfully process within three months, based on the acquired knowledge, study of the relevant literature, practical or experimental work.
Literature Relevant literature in the field of research, which is directly related to the topic of the Final thesis.
Методе извођења: The student can write the Final thesis from all professional subjects passed with the lowest grade 8. The Rulebook on writing the Final thesis at undergraduate or master academic (master) studies at Alfa BK University in Belgrade stipulates the procedure for applying for, writing and defending the Final thesis.
Knowledge evaluation (maximum 100 points) The Committee (consisting of the supervisor and two members) gives a single grade for the Final Thesis and its defense.