Study Programme	Information Technology
Qualifications awarded	First degree
Professional title	Bachelor (appl.) in Information Technology and Systems Engineering
Number of ECTS credits	180
Level of qualification according to the National Qualification Framework and the European Qualifications Framework	VS-1 (NQF) First cycle (EQF)
Field of study	Engineering and technology
Mode of study	Full-time
Language of instruction	Serbian
Head of the study programme	Slobodan Petrović, MSc

Programme objectives

The main objective of this study programme is to ensure high quality, up-to-date theoretical and practical IT education of students, as well as to develop competencies necessary for using state-of-the-art software tools. It allows students to develop strong written and verbal business communication skills, teamwork skills and prepares them for work in real-world settings.

Programme outcomes

General outcomes:

- students acquire high-quality general and professional education in the field of information technology;
- students develop critical and self-critical thinking skills necessary for tackling and solving practical problems;
- students develop creativity and problem-solving skills enabling them to find optimal solutions for practical problems in the field of accounting and audit;
- students develop teamwork skills, as well as those required for successful work in multicultural environments;
- students are trained how to perform practical tasks that require both IT knowledge and IT technology usage;
- students acquire the basic knowledge necessary for further education;
- students develop the awareness of the importance of lifelong education;
- students are able to understand modern trends in the IT field and to use professional literature in order to keep improving the acquired knowledge.

Specific outcomes:

- learning about computer setup, use and maintenance;
- successful using of appropriate programme tools;
- programming in the procedural and logical, structural and object-oriented environment;
- understanding the principles of data base designing and maintenance;
- design and maintenance of Internet presentations;
- understanding the functioning and applications of computer networks;

- understanding the functioning of operating systems; their setup and maintenance;
- e-business types;
- understanding the accomplishments of artificial intelligence and expert system uses;
- understanding and using computer system protection measures;
- the design and maintenance of multimedia materials;
- learning how to put theoretically acquired IT knowledge, skills, methods and procedures to practice in a real-world IT environment;
- developing the ability to use the IT logic acquired during the studies through solving different types of practical problems;
- developing a multidisciplinary approach to performing different types of IT tasks;
- learning how to apply the acquired knowledge relating to graphic design, sound and video design in order to produce multimedia materials;
- learning about valid regulations in the field of aesthetics, ethics and general cultural values necessary for the production of public multimedia materials;
- learning how to successfully integrate and coordinate all the elements necessary for the production of multimedia materials;
- becoming familiar with international and national standards relating to occupational safety and health.

COURSE SPECIFICATIONS
Undergraduate Study Programme: INFORMATION TECHNOLOGY

No.	Code	Course title	Semester	Course status	Active teaching classes			Other classes	ECTS
					Lectures	Practical classes	Other forms of instruction		
1	45101	Computer Technique	1	C	2	2	0		6
2	45102	Mathematics 1	1	C	2	2	0		6
3	45103	Electrical and Electronic Engineering	1	C	2	1	1		6
4	45104	Software Tools	1	C	2	2	0		6
5	45105	Operating Systems	1	C	2	3	1		6
6	45201	Mathematics 2	2	C	2	2	0		6
7	45202	Graphic Design Tools	2	C	2	2	0		6
8	45203	Algorithms and Data Structures	2	C	3	2	0		6
9	45204	Databases, SQL, MySQL	2	C	2	2	0		6
10		Elective Course 1	2	E	2	2	0		6
	45205	Russian 1							
	45206	English 1							
11	45301	Application Software	3	C	2	2	0		6
12	45302	Web Design (HTML + JavaScript)	3	C	2	2	0		6
13	45303	Introduction to Object-Oriented Programming (C# + Java)	3	C	2	2	0		6
14	45304	Information System Programming	3	C	2	2	0		
15		Elective Course 2	3	E	2	2	0		6
	45305	Russian 2							
	45306	English 2							
16	45401	Mathematical Modeling	4	C	2	2	0		6
17	45402	C/C++	4	C	2	2	0		6
18	45403	Digital and HD Television	4	C	2	2	0		6
19	45404	Computer Networks	4	C	2	2	0		6
20		Elective Course 3	4	E	2	2	0		6
	45405	PHP Programming Language							
	45406	Multimedia Data Processing Software							
21	45501	Computer Control	5	C	2	2	0		6

22	45202	Accounting Information Systems	5	C	2	2	0		6
23	45503	Audio and Video Technology	5	C	2	2	0		6
24		Elective Course 4	5	E	2	2	0		6
	45504	Discrete Structures							
	45505	Statistics							
25		Elective Course 5	5	E	2	3	0		6
	45506	Object-Oriented Programming (C#)							
	45507	Mobile Application Development							
26	45601	Multimedia Technology	6	C	3	3	0		6
27	45602	Web-Based Information Systems Development	6	C	3	3	0		6
28		Elective Course 6	6	E	3	3	0		6
	45603	Electronic Business							
	45604	Information Security Fundamentals							
30	45605	Professional Practice	6	C				6	4
31	45606	Final Thesis	6	C					8

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Algorithms and Data Structures

Teacher: Milovan S. Milivojević

Course status: Compulsory

Number of ECTS credits: 6

Prerequisites: None

Course aim: Providing students with basic knowledge on fundamental concepts of data structures and algorithms used in application design and programming.

Course outcomes: Students will be able to use the acquired knowledge in problem solving situations, as well as to identify, formulate and solve problems with practical implications.

Syllabus:

Theoretical instruction:

Introduction. Algorithms. Definition of algorithms. Writing algorithms. Examples of algorithms: line algorihtms. Branching algorithms. Algorithms with multi-way branching. Algorithms with knots/cycles. Complex algorithms. Algorithm design and analysis. Running time of algorithm. Asymptotic running time of algorithm. Asymptotic notation. Basic data structures. Simple and complex structures. Strings. Strings– types and operations. In-memory representation of strings. Optimizing string storage. Sorting strings. Comparison-based sorting. Linear complexitz sorting methods. Searching. Sequential and binary search. Lists. Singly linked, doubly linked and circular lists – definitions and operations. Queues. Implementation and basic operations. Stacks . Definition, implementation and basic operations. Recursive algorithms. Iterative and recursive algorithms. Analysis of recursive algorithms. Reccurent equations. Selected examples: Stable marriages, Towers of Hanoi... Trees. Root trees. Binary trees. Binary search trees. Binary HIPS. Tree applications. Graphs. Concepts and definitions. Graph representations. Graph traversal. Directed graphs. Weighted graphs. Basic concepts. Minimum spanning tree. Shortest path from a node. Shortest paths between all nodes.

Practical instruction:

Practical classes are based on the theoretical instruction and include the programming of the selected examples in C# programme environment, using the concepts of data type and structure declaration, dimensioning, wirk with input/output, programming expressions (if …then … else, while …, for…, do…, switch …case…), strings, matrices, lists, enumerations, catalogues...

Literature:

1. Milo Tomašević, Algoritmi i strukture podataka, Akademska misao, Beograd, 2008.
2. Dejan Živković, Osnove dizajna i analize algoritama, Računarski fakultet i CET, Beograd , 2007.
3. Dejan Živković, Foundation of Algorithm Design and Analysis, VDM, Verlag, 2009.
4. John Sharp, Microsoft Visual C# 2012 korak po korak, CET, Београд, 2013.
5. Rob Miles, C# osnove programiranja, CET, 2017.

Number of active teaching classes: 75				Other classes:
Lectures: 3x15	Practical classes: 2x15	Other forms of instruction:	Study research work:	

Teaching methods: lectures, classroom and laboratory exercises with active participation of students, consultations, colloquia, homework assignments and a written exam.

Knowledge evaluation (maximum number of point: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	15	Written exam	30
Practical classes	20	Oral exam	0
Colloquia	15		
Seminar papers	20		

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course code and title: Application Software

Teacher: Milovan S. Milivojević

Course status: Compulsory

Number of ECTS: 6

Prerequisites: Exercises, colloquium, seminar paper.

Course aim:

Teaching students how to recognize standard IT models of real objects suitable for the efficient processing and analysis using spreadsheet recalculation programmes.

Applying matrix calculations, statistics and feasibility, regression and dispersion analyses, numerical and mathematical methods, data base theory, techno-economic optimization theory and linear programming to typical examples from practice.

Course outcomes:

Students will acquire theoretical knowledge and develop practical skills required to perform advanced functions relating to What-If-Analysis, pivot tables, scenarios, matrix calculation, statistics, flat databases, techno-economic optimization and linear programming on typical examples from practice, using the general purpose application software.

Syllabus:

Theoretical instruction:

Introduction. Overview of application software, general and specific applications in different domains: informatics, mechanical engineering, management, tourism... Possibilities and practical application. History of spreadsheets. Excel. Interface. Fields of application. Performance and usability. Data types. Organising data. Dynamic recalculation. Mixed references. Examples. Key concepts of cross-tables. Naming yones. Validation. Conditional formatting. Examples in different domains. Basic functions: Sum, Average, IF, SumIf, CountIf. Date and time functions. Text functions. Text functions. Profesional diagrams. Protection. Dala lists – Table. Advanced functions: Vlookup, Match, Offset, Index, Indirect... Selected examples in different domains. Matrix formulas in programmes for precalculation tables (Minverse, Transpose...), determinants, inverse matrices. Solving szstems of linear equations. Application. Precalculating tables and project management. Dynamic Grantt charts. Dynamic resource optimization. Precalculating tables and data consolidation. Pivot tables. Pivot charts. Precalculating tables and statistics. Descriptive statistics. Examples of application in different domains. Distribution laws. Normal distribution. Testing statistical hypotheses. Regression analysis. Least squares method. Extrapolation. Examples in different domains. Data validation. Worksheet protection. Flat tables. Data lists in Excel. Sequences in Excel. Mathematical bases. Sorting. Filtration. Authomatic filters. Advanced filtration. Subtotals. Selected examples. Techno-economic optimization. Extreme values of functions. What-If-Analysis in precalculating tables. Limitations. Goal seek. Scenario generation. Scenario manager. What-if-Analysis. VBA programming elements in Excel. Examples from practice. Mathematical bases of linear programming. Use of Solver. Transportation problems. Stock optimization.. Optimization of product range. Selected chapters about practical applications of precalculating tables.

Application in economics and management: Price calculation. Shelf-life control. Stock management. Transportation problem. Procurement planning and optimization from the aspect of the lowest price. Market segmentation. Positioning. Using Solver for food processing optimization. Dynamic Grantt charts in project management. Resource engagement analysis. Critical paths. Project milestones.

Use in mechanical engineering. Mathematical and trigonometric functions. Tolerances and fits. Process stability control. Control cards. Chi-square test. Normative calculation.Summary of a lecture. Data mining. Data science.

Practical instruction:

The practical instruction is delivered in the form of practical exercises and tasks. Students work with computers in college laboratories to perform the selected tasks grouped in thematic units. The preparation of seminar papers is collaborative work, performed in groups of 3 students.

Literature:

1. Paul McFedries, Ecel 2016 Formule i funkcije, CET, Beograd, 2016.
2. J.Walkenbach, Excel 2010 Biblija, Mikro knjiga, Beograd, 2012.
3. P. Blattner i dr, Vodič kroz Excel 2003, CET, Beograd, 2004.
4. S. Opricović, Optimizacija sistema, Građevinski fakultet, Beograd, 1992
5. Slobodan Obradović, Branislav Pavić, Vesna Petković, Gabrijela Dimić, Projektovanje baza podataka i aplikacija – Access 2013, Visoka škola elektrotehnike i računarstva strukovnih studija, Beograd , 2015.
6. C. Cartfield, Timothy Johnson, Microsoft Project 2010 Korak po korak, Mikro knjiga, Beograd, 2011.

Number of active teaching classes : 60	Lectures: 15x2=30	Practical classes: 15x2=30

Teaching methods: Classical methods (didactic: oral presentations accompanied by overhead presentations, exercises and practical work, demonstration of computer-based tasks using an overhead projector). Specific methods (Step by Step). Interaction forms: whole class work, team work, mentorship.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	Points	Final exam	Points
Lectures	15	Computer-based practical work	30
20	15		
Colloquium	15		
Seminar paper	20		

Study programme: IT

Type and level of studies: Undergraduate Vocational Studies

Course title: Audio and Video Technologies

Teacher: Mile B. Petrović

Course status: Compulsory

Number of ECTS: 6

Prerequisites: Understanding basic concepts of TV technologies.

Course aim:
Acquiring fundamental knowledge on audio, video, computer and telecommunication technologies used in sound and image processing and transmission.

Course outcomes:
Qualifying students for employment as engineers, as well as training them to use audio and video devices.

Syllabus:

Theoretical instruction:

1 Introductory lecture. Analogue and digital audio/video technologies.
2 Audio and digital audio/video technology standards.
3 Analogue video signals. Composite and component video signals.
4 Digitization of analogue signals. Digital video signals. SDI signals. HD signals. 4K signals.
5 Monitoring in TV systems (CRT, LCD, plasma, LED, multi-viewer monitoring, measurement equipment).
6 Still image compression. Motion image compression. Image compression devices.
7 TV studio lighting.
8 Audio devices: analogue and digital audio mixers, microphones, speakers, sound recording, processing and producing devices. Producing short radio advertisements.
9 Video devices in TV studios (SD and HD). Analogue and digital HD video mixers, servers, switchers…
10 Connecting audio/video devices. Coaxial cables. Optical cables. UTP cables.
11 Designing analogue, digital and HD television systems.
12 Realization of TV systems using different format devices.
13 Power supply and grounding of audio/video devices. Synchronization of analogue and digital devices in TV systems.
14 OB vans.
15 Hardware and software for automatic TV broadcasting. Video servers. Elements, Channel in a Box, Playbox…

Practical instruction: exercises, other forms of instruction, study research work
Lectures are accompanied by practical exercises with students using devices to perform specific tasks.

Literature:

1. M. Petrović, Univerzitetski udžbenik - Osnovi televizije, FTN, Kosovska Mitrovica, 2006.
2. Mile Petrović, Ivana Milošević, Priručnik za laboratorijske vežbe iz Televizijskih sistema i video tehnologija, VISER, Beograd ISBN 978-86-7982-231-4, prvo izdanje, 2015.
3. M. S. De Alencarm, Digital Television systems, Cambridge University press, 2009.
4. Robert L. Hartwig, "Basic TV Technology: Digital and Analog", Fourth Edition, Focal Press, 2005.
5. M. Moshkovitz, The Virtual Studio Technology and Techniques, Focal Press, 2010.

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods: Lectures, laboratory exercises, colloquia, project preparation, consultations.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	5	Written exam	10
Practical classes	35	Oral exam	20
Colloquia	30		
Seminar papers			

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: C/C++

Teacher: Radosavljević D. Damnjan

Course status: Compulsory

Number of ECTS: 6

Prerequisites:

Course aim: The aim of the course is to teach students how to use all important elements of C++ programming language, and how to write, i.e. design complex C/C++ programmes, i.e. C/C++ applications (both object-oriented and procedural programmes). They will be able to use development environments for C/C++ programming. All important characteristics and features of this programming language will be discussed and illustrated. A carefully selected collection of examples of the application of C/C++ will be studies, with thorough explanations.

Learning outcome: Students will be able to design complex C/C++ applications, both object-oriented and procedural C/C++ programmes, and to use C/C++ programming development environments.

Syllabus:

Theoretical instruction:

Introduction to C/C++. Data types in C/C++. Variables and operators. Functions in C/C++. Conditionals and Loops. Vectors and strings. Pointers and references. C/C++ library and preprocessor. C/C++ classes. Data hiding. Inheritance and aggregation. Polymorphism and object pointers, C/C++ and UML. Overloading operators, Exceptions and debugging.

Practical instruction:

Tasks relating to functions, loops, vectors, pointers, inheritance, polymorphism, debugging, etc.

Literature:

1. Theory and problems of Programming with C++, Second edition, by J. Hubbard, ISBN 0-07- 135346-1.
2. M. Čabarkapa, " C++ osnove programiranja", Računska gimnazija, Beograd, 2007.
3. Radosavljević, D., Trajkovič S., Programiranje i programski jezici, (ISBN 978-86-86727-05-3), Visoka tehnička škola Uroševac, "Kvark" Kraljevo, 2009.
4. S. Đenić, J. Mitić, S. Štrbac, "Osnovi programiranja na jeziku C", Viša elektrotehnička škola u Beogradu, Beograd, 2006.
5. S. Đenić, J. Mitić, S. Štrbac, "Rešeni zadaci na programskim jezicima C i C++", Viša elektrotehnička škola u Beogradu, Beograd, 2006.
6. www.jhubbard.net/books.html

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: Lectures are held using PowerPoint presentations; in practical classes, students solve tasks working with computers.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	10	Written exam	25
Homework assignments	20	Oral exam	25
Project	20		

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Computer Control

Teacher: Milovan S. Milivojević

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: The aim of the course is to teach students how to design process and system control systems. The aim is also to provide them with the skills required to work with industrial computers, PLCs and microcomputers and teach them how to use these in different situations.

Course outcomes: Upon the completion of this course, students will be able to design and program PLC-based control systems, as well as microcomputers.

Syllabus:

Theoretical instruction:

Introduction - process control, aim, content, use. Types of control systems. Continuous systems. Digital systems. Numerical systems. Coding. Switching algebra. Minimization of logic functions. Implementation of control systems. Designing combinational and sequential control systems. Types of industrial PCs and their role in the process of control. Working principles. Hardware components.- central processing unit, memory, input/output systems. Data acquisition systems, A/D and D/A conversion. Programming industrial PCs. Programme languages. PLC – characteristics, working principle, hardware. PLC programming – relay diagram language, basic functions. PC-based control. Dedicated control and simulation systems. Examples: Labview. Microcomputers and control. Examples: Raspberry Pi, Arduino. Control programme languages. Examples: Python. Practial use examples. Robots. CNC control software.

Practical instruction:

Numerical systems, operations with logic functions. Minimization of logic functions. Combinational and sequential control systems. Basic components of control systems, simbols, functions and applications. Implementation of pneumatic, relay and electronic control systems. Computer simulation of pneumatic and hydraulic systems. Examples of programming PLC and CNC machines. PLC - components, connection, programming modes, monitoring. Implementation of the PLC-based control. Industrial PCs – components, connection, programming modes. Examples. PLC-based control implementation. PC-based industrial computers – components, connection, programming modes. Project implementation using PC-based industrial computers. Presentation of a developed robot. Control project implementation using Raspberry Pi computers. Students perform tasks working in groups of three.

Literature:

1. Zarić S., Automatizacija proizvodnje, Mašinski fakultet, Beograd, 1995.
2. Dragan M. Marinković, Programabilni logički kontroleri – uvod u programiranje i primenu, Mikroknjiga, Beograd, 2013.
3. Frank D. Petruzella, Programabilni logički kontroleri, prevod 4. Izdanja, Mikroknjiga, Beograd, 2 011.
4. Potkonjak V., Robotika, Naučna knjiga, Belgrade, 1989.
5. Drndarević D., Upravljanje procesima - priručnik, BTC, Užice, 2003.
6. Al Sweigart. Uvod u Python, automatizovanje dosadnih poslova, Mikroknjiga, Beograd, 2016.
7. Tim Cox, Raspberry Pi kuvar za Python programere, Mikroknjiga, Beograd, 2014.

Number of active teaching classes: 60				Other classes:
Lectures: 15x2=30	Practical classes: 15x2=30	Other forms of instruction:	Research study:	

Teaching methods: 1 Oral presentation (monologue), 2. Conversation (dialogue), 3. Examples from practice, brochures, instructions and other demonstration materials, 4. Laboratory work, 5. Examples of good practice /// visiting businesses that use computer control.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	Points	Final exam	Points
Activity during lectures	15	Written exam	30
Practical classes	20	Oral exam	-
Colloquia	15		
Seminar papers	20		

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Computer Networks

Lecturer: Slobodan M. Petrović

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course objectives: Introducing students to the technologies used in computer network design and implementation.

Course outcomes: Students will understand how computing networks work and will be able to apply the acquired knowledge and skills to the design and maintainance of Ethernet networks.

Syllabus:

Theoretical instruction:

Computer networks – the concept, distributed systems and computer networks, network sizes, LAN, WAN. The term *protocol*. ISO OSI reference models. Transmission media – copper wires, coaxial cables, fibre optics, radio waves; medium selection, typical use of a medium, examples. Data transmission - asynchronous communication, RS-232, synchronization during data transmission, measures for increasing data transmission rates, transmission modes, limitations, network bandwidth capacity. Distance communication, data encoding onto the carrier signal, modulation types, data transmission devices, multiplexing. Shared communication media, packets, packets and frames, transmission errors, error detection and correction, parity check, advanced error detection techniques.

"Point-to-point" communication, LAN technologies, networking topologies (star, ring, bus), advantages and disadvantages of different topologies, Ethernet technology, CSMA access method, collision detection – CD, CSMA/CD. Wireless LAN, CSMA/CA. IBM: Token ring, ATM. MAC address, broadcasting, multicasting. IP address structure. Calculating the network, broadcast and host addresses. ARP protocol. Ethernet frame format. Network analyzer operation. Network cards, RJ-45, 100Base-T Ethernet, 100Mbps and 1Gbps Ethernet, the length of a transmission medium. Hubs, repeaters, bridges, switches, routers and routing, gateways, proxies. Logical and physical topology.

Digital telecommunications, ISDN, DSL, ADSL, cable modems. Mobile telephone system (2G-5G).

Practical instruction:

Students use the GNS3 simulator (free software) to design and simulate computer network operations. They gain hands-on experience in cabling and identification of problems in computer network operations. Seminar paper: preparing a computer network project in a business facility.

Literature:

1. James F. Kurose, Keith W. Ross, Umrežavanje računara – Od vrha ka dnu sa Internetom u fokusu, CET and RAF Beograd, 2014, ISBN: 86-7991-372-2
2. Andrew S. Tanenbaum, David J. Wetherrall, Računarske mreže: prevod 5. izdanja, Mikro knjiga, Beograd, 2013, ISBN: 86-7555-382-3
3. Mladen Veinović, Aleksandar Jevremović, Računarske mreže, Univerzitet Singidunum Beograd, 2011, ISBN: 978-86-7912-368-8

Number of active teaching classes: 60				Other classes:
Lectures: 15*2=30	Practical classes: 15*2=30	Other forms of instruction:	Research study::	

Instruction methods::

1. Oral presentations (monologues) – Power Point presentations, 2. Conversation (dialogues), 3. Preparation of seminars and discussion of the completed work, 4. Examples from practice, instructions and other demonstration materials, 5. Practical work in a computer laboratory.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points: 70**	**Final exam**	**Points: 30**
Activity during lectures	10	Written exam	30
Active participation during practical classes	10	Oral exam	-
Colloquium 1 and 2	30	-	-
Seminar paper	20	-	-

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Computer Technics

Teacher: Nebojša V. Ivković

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim:

Introducing students to basic logical and arithmetic operations on binary numbers. Introducing students to hardware, computer components and their functions and performance, types of peripherals, types of computer networks, physical components of a network, LAN (WLAN, Ethernet), protocols and services, WAN and VPN networks.

Course outcomes:

Students will acquire the appropriate knowledge on PC hardware, peripheral equipment, computer networks and communications.

Syllabus:

Theoretical instruction:

Fundamentals of computer technology: Binary numeration system. Basic logical and arithmetic operations on binary numbers. Computer representation of numbers. Basic logic circuits. Realization of certain arithmetic operations using logic circuits. Basic sequential circuits. Basic principles of digital circuits. A/D conversion.

Computer system hardware: Pocessor (CPU) – processor registers, following instructions, processing interruptions. Memory – cache memory, RAM memory, magnetic memory (HDD), peripheral memory (optical disc, flash memory). I/O devices – keyboard, mouse, monitor, printer; I/O communication techniques. Motherboard – providing communication between the CPU, memory and O/I devices, buses (instruction buses, data buses, I/O buses), controllers. Standard computer ports. Computer power.

Computer networks: Network equipment (network cards, LAN switch, routers, cables). Physical addresses of controllers (MAC). Network topology. TCP/IP protocol fundamentals. Assigning an addresses to PCs (IPv4, Ipv6). Local and public IP addresses. Local network (WLAN, Ethernet). Connecting several local networks into a whole. Internet connection sharing in a local network. DNS servers. Router configuration. Global network (WAN, Internet). IP devices. Multimedia networks and communications.

Practical instruction:

Using computers and networks: Simulation of arithmetic operations in logic circuits, using software packages. PC hardware components and their performance. PC configuration. Installation and setup of PC peripherals. Determining how much the performance of hardware components influences the overall computer speed. Optimization of hardware performance. Examples of the setup of network hardware and protocols for the configuration of different types of Lan networks. Examples of connecting different LAN networks into one network. An example of the Internet connection setup in a local network. The configuration and setup of the equipment used to connect different IP devices through the Internet network, with examples (starting computers remotely, the remote IP video surveillance, videoconferencing, working hours control system through the local and Internet network), vehicle monitoring, monioring of air pollutants. WAN and VPN networks.

Literature:

1. R.White, Kako rade računari, CET, 2004.
2. S. Mueller, Nadogradnja i popravka mreža, CET, 2002.
3. B. Komar, Administracija TCP/IP mreže, Kompjuter biblioteka, 2004.
4. B. Lazić, Osnovi računarske tehnike - Prekidačke mreže, Akademska misao, 2006.

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods:: Demonstration, illustration, presentation and discussion, lectures, laboratory exercises, seminar papers, consultations			
Knowledge evaluation (maximum number of points: 100)			
Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	10	Written exam	
Practical classes attendance and active participation	25	Oral exam	45
Colloquium			
Seminar papers	20		
Different assessment methods can be used. Those given in the table above are only some of the possible options (written exam, oral exam, project presentations, seminar papers, etc.).			

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Databases, SQL, MySQL

Teacher: Milivojević S. Milovan

Course status: Compulsory

Number of ECTS: 6

Prerequisites: Exercises, colloquium, seminar paper

Course aim: Introducing students to the basic database terminology and the entity-relationship model (ER model). Entity design. Students master different types of links and joins. They develop the skills needed to generate a physical database model. The analysis of the *Queries* concept. Mastering of the syntax elements and the use of the SQL language. Creating reports. Mastering the programming environment for database application development (Access, SQL and MySQL).

Course outcomes: Students will be able to perform system analysis of real-world processes and to transfer the models of processes, information and documentation into informatics models. Students will learn how to use the relational database model. They will develop the skills to: create normal forms, generate entities, create relational model diagrams and logical database models for the chosen examples. They will acquire the knowledge required for creating forms, queries and reports. Creation of database applications in the development programming environment: Access, SQL, and MySQL.

Syllabus:

Theoretical instruction:

Databases – their history, significance, use. Information systems. System analysis. BSP method. Flow Chart Method. Analysis based on IDEF standard. CASE tools. Logical and physical data structures. Database management system - DBMS. Relational data model. Conception. Independency. Structural simplicity. RDBMS. Definition of first, second and third normal form.

Logical data model. Objects. Data types. Fields. Field properties. Entity types and domains. Keys. Indexes. Database integrity. Examples of using specific software tools (MS Access, MS SQL Server...). Relations. Relation attributes. Link types 1:1, 1:1, 1:∞, ∞:∞. Joins. Join types. Inner and outer joins. Examples. Relational diagram. Referential integrity. Graphical editor. Examples for chosen experimental models.

Physical data model. Data entry forms and formulas. Form views. Designing mode. Controls and objects. Properties of control objects. Connected and disconnected objects. Selected examples. Complex forms. Combination formulas.

Queries against database. Graphical editor for query generation. Queries against related tables. Selection queries. Parameter queries. Calculated fields in queries. Expression builder. Aggregate queries. Action queries. SQL. Examples of basic SQL commands. Dynamic sets - Dynaset. Mathematical foundations of set theory.

Reports. Report Wizard. Report types. Query-based reviews. Creating reports manually. Examples of using selected software tools (MS Access, MS SQL…).

Object-oriented data models. Event concept. Events for control objects and forms. Event programming examples. VBA elements. Event-driven applications.

Examples of applications in selected software tools.

Practical instruction:

Practical instruction is delivered in college laboratories where students work with computers in order to perform different tasks and prepare seminar papers. Seminar papers are prepared in groups of three students.

Literature:

1. Lazarević, B., Marjanović, Z., Aničić, N., Babarogić, S., Baze podataka, FON 2010.
2. P. Litvin, K. Getz, M. Gunderloy, Access 2002 priručnik za programere&Sybex, Beograd, 2003
3. Lary N. Prague, Michael R. Irwin, Jennifer Reardon, Access 2003 Biblija, Mikro knjiga & IDG Books, Beograd, 2004.
4. R. Jennings, Vodič kroz Access 2003, CET & QUE, Beograd, 2004
5. V. V. Agarwal, J. Huddleston , VB 2008 Baze podataka, Kompjuter biblioteka, Beograd, 2009.
6. S. Lambert, M. Dow Lambert III, J. Preppernau, MS Access 2007 korak po korak, 2007, CET, Beograd
7. P. Mogin, Strukture podataka i organizacija datoteka, 2008, CET, Beograd
8. Luke Welling, Laura Thomson, Priručnik za MySQL, Mikro knjiga, 2005. год.
9. S. Johnson, Access 2007 na dlanu, CET, Beograd, 2010
10. A. Molinaro, SQL Cookbook: Query Solutions and Techniques for Database Developers, O Reilly, 2005.

Number of active teaching classes: 60				Other classes:
Lectures: 15x2=30	Practical classes: 15x2=30	Other forms of instruction:	Research study:	

Teaching methods::

Classical (didactic: oral presentations accompanied by overhead projection presentations, exercises and practical work, demonstration of computer-based tasks using an overhead projector). Special methods (Step by step). Interaction forms: whole class work, team work, mentorship.

Knowledge evaluation (maximum number of points: 100)			
Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Lectures	15	Practical computer-based work	30
Practical classes	20		
Colloquium	15		
Seminar paper	20		

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Digital and HD Television

Teacher: Petrović B. Mile

Course status: Compulsory

Number of ECTS: 6

Prerequisites: Understanding the basic concepts of TV images.

Course aim: Introducing students to the principles, technologies and equipment used in digital and HD television.

Course outcome: Qualifying students for the employment as engineers in the field of digital and HD television.

Syllabus:

Theoretical instruction:

1 Introductory lecture. Digital TV systems and technology in Europe and worldwide.
2 HD-SDI signal generation.
3 Digitization of audio/video signals. Digitization formats.
4 Digital HDTV system structure. Digital image source synchronization in TV systems.
5 Compression of motion images. Standards: H.261, H.264, MPEG-2, MPEG-4, HEVC and MPEG -7.
6 Channel coding. TV signal multiplexing. Transport stream.
7 Modulations in digital TV broadcasting: OFDM, COFDM, APSK; QPSK.
8 International HD standards ITU – R BT 601/656, HDTV and multichannel sound 5:1.
9 Terrestrial digital TV broadcasting, DVB-T/T2: standards, SFN/MFN networks, signal transmission to receiver, digital TV transmitter. TV receivers. Transmission and receiving antennas.
10 Signal transmission over digital cable, DVB-C/C2: standards, modulators, Receiver Set-Top Box, optical, coaxial and NFC networks. DVB-C/C2 designing.
11 Digital transmission using satellites, DVB-S/S2: standards, system parametres, modulators, satellite transmission link, convolutional coding, satellite signal processing, receivers.
12 Digital mobile broadcasting: Digital Video Broadcasting – Handheld (DVB-H). Hzbrid television (HBBTV).
13 Signal transmission through IP network, IPTV: interactive TV, additional services (teletext, EPG, time shifting, VoD…)
14 Equipment and procedures for signal strength measuring at the time of transmission and receiving.
15 Digital signal distribution system designing, producing, using and maintenance.

Practical instruction:

Lectures are accompanied by practical exercises with students performing specific tasks. Students are divided into groups to work on specific mini projects.

Literature:

1. Dušan Marković „Terestička digitalna televizija, DVBT“, Akademska misao, Beograd, ISBN 978-86-7466-335-6
2. M. Petrović: Multimedijalni distributivni TV sistemi, priručnik, VISER, Beograd, ISBN 978-86-7982-055-6, COBISS.SR-ID 173102348, prvo izdanje 2009.
3. J. Arnold, M. Frater, and M. Pickering „Digital Television“, Tehnology and Standandards, 2007.
4. John Arnold, Michael Frater, Mark Pickering, Digital Television Technology and Standards, The University of New South Wales, ISBN 978-0-470-14783-2
5. J. Whitaker, “Mastering digital television”, London, 2006.
6. DVBT Standards, https://www.dvb.org/standards

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods::

Lectures, laboratory exercises, colloquia, project work, consultations and seminar papers.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	5	Written exam	20
Practical classes	30	Oral exam	20
Colloquia	15		
Seminar papers	10		

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Discrete Structures

Teacher: Diković Ž. Ljubica

Course status: Compulsory

Number of ECTS: 6

Prerequisites: defended colloquia and seminar papers, minimum 30 points

Course aim: The aim of the course is to provide students with logical thinking skills, teach them how to use logically correct conclusion-making forms, teach them to use discrete structures, as well as to realize how the results of discrete mathematics can be used in practice..

Course outcomes: Students will master fundamental mathematical knowledge necessary for keeping pace with IT development. They will be able to apply fundamental concepts and results of discrete mathematics in practice.

Syllabus:

Theoretical and practical instruction:

Sets, logic, relations, functions, Boolean algebra, groups, rings, fields, polynomials.

Elements of mathematical logic (statements, statement formulas, arguments and proofs, normal forms). Induction (empirical induction, mathematical induction). Sets (presenting sets, operations with sets, partial sets). Relations. Functions (Cartesian product, equivalence relations, order relations, compositions). Operations (group, field, Boolean algebra). Recurrent strings.

Literature:

1. S. Prešić, Elementi matematičke logike, Zavod za izdavanje udžbenika, Beograd, 1968.
2. G. Vojvodić, Predavanja iz matematike i algebre, PMF, Novi Sad, 2000.
3. S.S. Epp, Discrete Mathematics with Applications, Thomson-Brooks/Cole, 2004.
4. K.H.Rosen, Discrete Mathematics and Its Applications, Mc Graw Hill, 2003.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: Classial teaching methods are used during lectures, combined with overhead projector presentations and teacher-student interaction ocassionally. During practical classes, the explained principles, as well as typical problems and their solutions are analysed. Student knowledge is evaluated by means of colloquia and seminar papers. Through the accomplisment of tasks, both the level of acquaired theoretical knowledge and their ability to apply it are determined. In the final, written exam, their overall understanding of the course material is tested.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	Up to 10	Written exam	Up to 30
Colloquia	Up to 30		
Seminar papers	Up to 30		

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Electronic Business

Teacher: Petrović M. Slobodan

Course status: Elective

Number of ECTS: 6

Prerequisites: None

Course aim: Providing students with knowledge and skills in the field of electronic business and introducing them to the use of e-business in contemporary business world.

Course outcomes: Students can successfully apply the acquired e-business knowledge when performing different business tasks.

Syllabus:

Theoretical instruction:

Introduction to the Internet and electronic business. E-business development. Virtual organizations and virtual teams. Electronic commerce, its models and forms. Positioning and selecting e-business software. Computer networks and electronic business infrastructure. Social networks. Electronic banking and different ways of performing banking transactions. Payment models in business transactions. Electronic business and communication in public administration and electronic government. Types of electronic government. Internet marketing and creation of Internet marketing plans. Mobile business. E-business protection and security. E-business legislation in the Republic of Serbia.

Practical instruction:

The analysis and use of the Internet and WEB applications for business-related purposes. Public presentations of seminar papers using the software for creating business presentations and state-of-the-art computer equipment (PC, overhead projector).

Literature:

1. R. Stankić, Elektronsko poslovanje, Ekonomski fakultet, Beograd, 2014, ISBN 978-86-403-1376-6
2. B. Radenković, M. Despotović-Zrakić, Z. Bogdanović, D. Barać, A. Labus, Elektronsko poslovanje, Fakultet organizacionih nauka, Beograd, 2015, ISBN 978-86-7680-304-0
3. M. Ivković, B. Đorđević, Z. Subić, D. Milanov, Internet marketing i elektronsko poslovanje, Tehnički fakultet, Zrenjanin, 2011, ISBN 978-86-7672-144-3
4. D. Vidojević, Poreski informacioni sistemi – ePorezi, ПЈИАТΩ Б Beograd, 2013, ISBN 978-86-6335-096-8

Number of active teaching classes: 90				Other classes:
Lectures: 15*3=45	Practical classes: 15*3=45	Other forms of instruction:	Research study:	

Teaching methods:

1. Oral presentation (monologue), 2. Conversation (dialogue), 3. Text analysis and discussion of chosen topics, 4. Examples from practice, brochures, instructions and other demonstration materials, 5. Work in computer laboratories with the access to the Internet and KOBSON data basis.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points: 67**	**Final exam**	**Points: 33**
Active participation during lectures	0-6	Written exam	0-33
Practical classes	0-8	Oral exam	-
Colloquium	0-33	-	-
Seminar paper	0-20	-	-

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Electrical and Electronic Engineering

Teacher: Vidoje N. Milovanović

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Introducing students to the fundamental principles of electrical and electronic engineering; training them to use scientific and professional achievements in solving problems of environmental protection and improvement.

Course outcomes: Students can apply the acquired knowledge of electrical and electronic engineering to practice and thus develop the system of ecological behaviour and positive attitudes to the nature, which will lead to the protection and improvement of the environment. Through the acquisition of knowledge and skills, students gain professional competence in environmental protection.

Syllabus:

Theoretical instruction:

Electrical engineering: Electrostatics. Constant direct currents. Electromagnetism. Alternating currents. Electric machines and electrical measurements. Occupational safety and health. Electrical hazards and respective protective measures.

Electronic engineering: Semiconductors. Diodes. Transistors. Thyristors. Amplifiers. Integrated circuits. Non-ionizing electromagnetic radiation.

Practical instruction:

Laboratory exercises. Measuring resistance and power of receivers, using an oscilloscope to measure frequency, using an oscilloscope for time interval measurement, using an oscilloscope for voltage measurement, magnetic field measurement, diode characteristics, transistor characteristics, rectifiers, transistors as switches, measuring the radiation of mobile phones.

Literature:

1. Elektrotehnika sa elektronikom, Vidoje Milovanović, Užice, 2005.
2. Elektrotehnika sa elektronimkom zbirka zadataka, Vidoje Milovanović, Užice, 2006.
3. Elektrotehnika, Vidoje Milovanović, Užice, 2009.
4. Elektronika, Vidoje Milovanović, Užice, 2009.
5. Grupa autora: Bezbednost i zdravlje na radu - knjiga 1-modul 1-VPTŠ Užice, 2011.

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods::

Dialogue, monologue, practical work demonstration, work with texts, studying specialized literature.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	10	Written exam	0
Practical classes	20	Oral exam	40
Colloquia	20		
Seminar papers	10		

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: English 1

Teacher: Marinković M. Ivana

Course status: Elective

Number of ECTS: 6

Prerequisites: None

Course aim: Acquiring the necessary knowledge of English for General Purposes, as well as of English for Specific Purposes; further development of language skills; reading comprehension and conversation about general and vocation-related topics; providing students with the skills required for both oral and written business communication in English.

Course outcomes: Students will revise and improve the already acquired knowledge, acquire vocabulary related to their field of study and obtain the solid basis for further foreign language learning.

Syllabus:

Theoretical instruction:

Nouns (plural of nouns). Pronouns (personal, possessive, relative, reflexive). Relative clauses. Articles (types and use). Adjectives and adverbs (comparison). Verbs (tenses).

English for Specific Purposes – introduction to specialized vocabulary using specialized texts.

Business English – business correspondence rules and formal expressions.

Practical instruction:

Grammar exercises, listening and speaking exercises aimed at the integration of lexical and grammatical knowledge; oral and written translation; writing business letters, CVs, etc.

1. Naunton, J., 2005, ProFile 2, Oxford, Oxford University Press
2. Gledinning, E.H., McEwan J., 2017, Oxford English for Information Technology, Oxford, OUP
3. Murphy, R., 1990, English Grammar in Use, Cambridge University Press
4. Thompson A.J., Martinet, A.V., 1994, A Practical English Grammar, Oxford, OUP
5. Advanced Learner's Dictionary of Current English, 1998, OUP

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: Monologue, dialogue, combined teaching methods, working with text

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	10	Written exam	15
Practical classes	10	Oral exam	15
Colloquia	50		
Seminar papers			

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: English 2

Teacher: Marinković M. Ivana

Course status: Elective

Number of ECTS: 6

Prerequisites: Students must pass the English language 1 examination prior to this course.

Course aim:
Students will master General English, English for Specific Purposes and Business English. They will further develop four essential language skills, and improve reading comprehension and communication skills. They will master specialized vocabulary.

Course outcomes:
Students will be able to use English successfully in everyday and business situations, and they will obtain a solid basis for further acquisition of the English language.

Syllabus:

Theoretical instruction:
Modal verbs. Conditional sentences. Numbers. Passive. Reported speech (sequence of tenses). Future forms.
English for Specific Purposes: introduction to specialized vocabulary using specialized texts.
Business English – business correspondence rules and formal expressions.

Practical instruction:
Grammar exercises, listening and speaking exercises aimed at the integration of lexical and grammatical knowledge; oral and written translation; writing business letters, etc.

1. Naunton, J., 2005, ProFile 2, Oxford, Oxford University Press
2. Gledinning, E.H., McEwan J., 2017, Oxford English for Information Technology, Oxford, OUP
3. Murphy, R., 1990, English Grammar in Use, Cambridge University Press
4. Thompson A.J., Martinet, A.V., 1994, A Practical English Grammar, Oxford, OUP
5. Advanced Learner's Dictionary of Current English, 1998, OUP

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods: Monologue, dialogue, combined teaching methods, working with text.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	10	Written exam	15
Practical classes	10	Oral exam	15
Colloquia	40		
Seminar papers	10		

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course code and title: 45202 Graphic Design Tools

Teacher: Damnjan Radosavljević

Course status: Compulsory

Number of ECTS credits: 6

Prerequisites: Completed project and homework assignments and passed colloquium.

Course aims: The aim of the course is to introduce students to the basics of graphic design. Students will be able to use the specialized application software for the processing of vector and raster objects, to combine vector and raster graphics and apply this combination to different media. Students will achieve the aims by performing the tasks independently using computers, under the supervision of the professor and the teaching assistant. Through the simulation of working environment and practical application of the presented theoretical knowledge, students acquire knowledge, self-confidence and experience in both project implementation and project management, which rely upon the use of graphic design in technical and business informatics.

Learning outcomes: To create engineers with general knowledge, competencies and skills in the basics of graphic design, which they will be able to use in practice.

Syllabus

Theoretical instruction:

Introduction to drawing. Form as a shape and its requirements in a drawing. Composition. Illustration. Text. About colours. Typography. Type. Reproduction. Print. Areas of graphic design.

Packaging. Graphical representation of products. Graphic design methodology – the design process.

Software packages: Auto CAD 2D and 3D, Photo Shop and Corel DRAW.

Practical instruction (assignments and colloquia):

The first assignment and the first colloquium in AutoCAD 2D and 3D.

The second assignment and the second colloquium in Photo Shop.

The third assignment and the third colloquium in Corel Draw.

Literature:

1. Radosavljević, D., Alati grafičkog dizajna, (ISBN 978-86-83573-47-9), Visoka poslovno-tehnička škola Užice, „Grafičar“, Užice, 2014.
2. Radosavljević, D., Panić, S., Marković, N., Kompjuterska grafika, (ISBN 86-7746-008-X), Viša tehnička škola Uroševac, „Sven“, Niš, 2004.
3. Radosavljević, D., Tehničko crtanje Auto CAD 3D Modeling, (ISBN 978-86-86847-01-0), Viša tehnička škola Uroševac, „Sven“, Niš, 2009.
4. D. Marković, D. Cvetković: Osnovi grafičkog dizajna, Univerzitet “Singidunum”, Beograd, 2009.
5. D. Marković, D. Cvetković, Z. Kostić, A. Tasić: Osnovi grafičkog dizajna – Praktikum, Univerzitet “Singidunum”, Beograd, 2009.

Number of active teaching classes: 60	Lectures: 2x15	Practical classes: 2x15

Teaching methods: Lectures, exercises, assignments, projects, consultations.

Knowledge evaluation (maximum points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	10	Written exam	25
Practical classes - assignments	20	Oral exam	25
Colloquia	20		
Seminar papers			

Assessment methods: Students take the computer-based exam, using the following programmes: Corel DRAW, Photo Shop and AutoCAD 2D and 3D.

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Information Security Fundamentals

Teacher: Petrović M. Slobodan

Course status: Elective

Number of ECTS: 6

Prerequisites: None

Course aim: Providing students with knowledge and skills in the field of information security, and introducing them to the information security concepts.

Course outcomes: Students will be able to use the acquired knowledge successfully in any activity involving the security of computer systems and networks.

Syllabus:

Theoretical instruction:

Fundamentals of information security and protection. Concepts, services, mechanisms and control of security systems. Threats and risk factors. Malware. Protection technologies. Cryptography. Security protocols. Security and protection of operating systems. Database security. Protection of computer networks. Electronic business and Internet security. Using the Internet safely. Data protection and security risk management. Security programme management (plans, politics, security procedures). Surveilance, control, and security system revision. Incidents and unexpected situations management. Ethical hacking and analyses of penetration possibilities. Organisational, physical and legal security methods, social aspects.

Practical instruction:

Students will acquire practical knowledge required for the configuration of security sub-systems in Windows OS and for the use of complimentary tools, open source tools and other sectity-related resources.

Literature:

1. G. Grubor, M. Milosavljević, Osnove zaštite informacija – metodološko-tehnološke osnove, Univerzitet Singidunum, Beograd, 2010.
2. D. Pleskonjić, N. Maček, B. Đorđević, M. Carić, Sigurnost računarskih sistema i mreža, Mikro knjiga Beograd, 2007.
3. SRPS ISO/IEC 27001:2014, Informacione tehnologije – tehnike bezbednosti – sistemi menadžmenta bezbednošću informacija – zahtevi.

Number of active teaching classes: 90				Other classes:
Lectures: 3x15=45	Practical classes: 3x15=45	Other forms of instruction:	Research study:	

Teaching methods: 1. Oral presentation (monologue), 2. Conversation (dialogue), 3. Work with text and discussion about selected topics, 4. Examples from practice, brochures, instructions and other demonstration materials, 5. Working in computer laboratory with the access to the Internet and KOBSON database.

Knowledge evaluation (maximum number of points 100)

Pre-exam obligations	**Points: 70**	**Final exam**	**Points: 30**
Activity during lectures	10	Oral exam	Up to 30
Practical classes	10		
Colloquium	30		
paper	20		

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Information System Design

Teacher: Vidojević V. Dejan

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: The course is designed to provide students with the skills required to design, use and maintain information systems.

Course outcomes: Upon the completion of this course, students will be able to design and maintain less complex information systems.

Syllabus:

Theoretical instruction:

Introduction – system, information, business-production system, information system. Business activity labeling system. Database development tools (CASE tools). Information system development – functional modeling (functional decomposition, defining user requirements, technical requirements). Information modeling (defining detailed requirements, creating ER diagrams, creating attributes). Application modeling (defining the physical design, creating a database schema, creating applications). Implementation (introducing, testing, maintenance). Presentation of designed information systems. Occupational safety and health management information systems.

Practical instruction:

Modeling the information system entitled "Student Service Activities" – creating a model. Introduction to the BPWIN tools. Process modeling in the "Student Service Activities" information system using the BPWIN. Introducing students to the ERWIN tools. Process modeling in the "Student Service Activities" information system using the ERWIN. Creating Access applications for "Student Service Activities". Modeling the information system selected for a practical exercise – creating a model. Process modeling in the information system selected for a practical exercise using BPWIN. Process modeling in the information system selected for a practical exercise using ERWIN. Creating applications for a practical exercise using Access.

Literature:

1. Veljović A.,Projektovanje informacionih sistema, Kompjuter biblioteka, Čačak, 2003.
2. Mitrović J., Hanić H., Poslovni informacioni sistemi, Čigoja štampa, Beograd, 2005.
3. Bulat V., Gavrić Z., Proizvodni informacioni sistemi, ICIM, Beograd, 2003.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods::

Oral presentation (monologue), 2. Conversation (dialogue), 3. Work with texts, 4. Examples from practice, brochures, instructions and other demonstration materials, 5. Laboratory work.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Active participation during lectures	10	Written exam	40
Practical classes	10	Oral exam	-
Colloquia	10		
Seminar papers	30		

Different assessment methods can be used; those stated in the table above are only some of them (written exam, oral exam, project presentation, seminar paper, etc.)

Study programme: Information Technologies

Type and level of studies: Undergraduate Vocational Studies

Course title: Introduction to Object-Oriented Programming

Teacher: Milivojević S. Milovan

Course status: Compulsory

Number of ECTS: 6

Prerequisites: Exercises, colloquium, seminar paper.

Course aim: Introducing students to the object-oriented thinking. Developing models of objects, attributes, methods, events. Mastering the key algorithmic structures, programme settings and object-oriented techniques. Laying the foundation of full-scale object-oriented programming.

Course outcomes: Students will master the basic concepts and techniques in the field of object-oriented applications and programming. Laying the foundation of a full-scale object-oriented programming.

Syllabus:

Theoretical instruction:

Introduction to object-oriented concepts. Object-oriented thinking. Object-oriented programming vs. procedural programming. Objects. Attributes. Methods. Examples. Method arguments. Public and private methods. Identifier Scope. Errors and exceptions handling. Class. Abstraction. Class diagrams. Constructors and deconstructors. Object instancing. Class examples. Encapsulation. Selected examples. Understanding values and references. Using collections. Strings. Enumerations. Lists. Catalogues. Examples. Inheritance. Multiple inheritance. Selected examples. Polymorphism: operators overlapping and coercive polymorphism. Selected examples. Generic classes. Using collectors and resource management. Selected examples. Abstract classes. Selected examples.

Graphics application development/GUI. Object-oriented programming and databases (selected examples: C#-MySQL).

Practical instruction:

Lectures are followed by practical instruction, during which object-oriented programming of selected examples is performed in C# environment. Practical classes are held in the college computer laboratory. Students prepare seminar papers working in groups of three.

Literature:

1. M. Weisfeld, Objektno orjentisani način mišljenja, CET, Beograd, 2003.
2. Milo Tomašević, Algoritmi i strukture podataka, Akademska misao, Beograd, 2008.
3. Dejan Živković, Osnove dizajna i analize algoritama, Računarski fakultet i CET Beograd, 2007.
4. John Sharp, Microsoft Visual C# 2012 korak po korak, CET, Beograd, 2013.
5. Rob Miles, C# osnove programiranja, CET, 2017.
6. Laslo Kraus, Programski jezik Java 8 a rešenim zadacima, Akademska misao, Beograd, 2015.

Number of active teaching classes: 60				Other classes:
Lectures: 15*2=30	Practical exercises: 15*2=30	Other forms of instruction:	Research study:	

Teaching methods: Classic (didactic: oral presentations supported by overhead presentations, exercises and practical work, demonstration of assignments on computers using overhead projectors). Special methods (Step by Step). Types of interaction: ex cathedra, teamwork, mentoring.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Lectures	15	Practical computer-based work	30
Practical classes	20		
Colloquium	15		
Seminar paper	20		

Study programme: Information Technologies

Type and level of studies: Undergraduate Vocational Studies

Course title: Mathematical Modelling

Teacher: Nebojša V. Ivković

Course status: Compulsory

Number of ECTS: 6

Prerequisites: Mathematics 1, Mathematics 2

Course aim: Providing students with the knowledge of mathematical modeling, optimisation and prediction required by industrial engineering, as well as developing their creative and practical skills necessary for successful solving of real-world problems in industrial engineering.

Course outcomes: During the studies, students will develop general skills while solving real-world industrial problems using the mathematical apparatus, and focusing on modeling (mathematical modeling of real-world problems), optimization (achieving optimum configuration of real-world systems) and prediction (the analysis of future real-world systems).

Syllabus:

Theoretical instruction:

The concept of stochastic, deterministic and dynamic processes. Understanding experimental research. Theory of multi-factorial planning of experiments using central compositional plans. Determining number of factors. Determining intervals and factor variation range. Mathematical model forms (polynomial, exponential, rational and trigonometric). Linear regression models with one or two variables. Theory of multiple regression and correlation analysis. Analysis of variance (ANOVA). Correlation coefficient. Calculating parameters of mathematical models. Determining reliability limits of model parameters. Estimating significance of model parameters. Model adequacy checking. Determining reliability limits of mathematical models. The concept of objective function and function limits. Mathematical modeling of objective functions and function limits aimed at optimization of complex stochastic processes. Mathematical modelling of stochastic and dynamic processes using complex forms of trigonometric series.

Practical instruction:

Introducing students to working in Matlab. Practical examples of mathematical modelling of complex stochastic processes using polynomial, exponential and rational mathematical forms. The obtained results are simulated using the software developed in Matlab, together with the available software (calculating the parameters of a mathematical model, determining the reliability limits of model parameters, estimating the significance of model parameters, model adequacy checking). Practical examples of mathematical modeling of dynamic processes using trigonometric series and the software developed in Matlab. Practical examples of mathematical modelling of stochastic processes using trigonometric series and the software developed in Matlab. Practical examples of linear and non-linear programming using the software developed in Matlab, aimed at the optimization of stochastic processes.

Literature:

1. J.Stanić, Osnove matematičke teorije eksperimenata, Mašinski fakultet, Beograd, 1981.
2. N.Ivković, Izrada softvera za matematičko modeliranje složenih višefaktornih stohastičkih objekata istraživanja i njegova praktična primena, Magistarski rad, Mašinski fakultet, Beograd, 1992.
3. N. Ivković, LJ. Diković, Interpolacija racionalne funkcije sa dve nezavisne promenljive pomoću polinomijalne funkcije, Prva matematička konferencija Republike Srpske, Univerzitet u Istočnom Sarajevu, Filozofski fakultet, Pale, 2011.
4. N. Ivković, V. Urošević, LJ. Diković, Simulacija matematičkog modeliranja trofaktornog procesa pomoću polinomijalnih funkcija, XV međunarodna konferencija YUINFO 2009, Conference and Exhibition, Kopaonik, Srbija, 2009.
5. N. Ivković, LJ. Diković, Multifactorial Mathematical Modelling and Simulation in 2D and 3D Space Supported by Software, 12th Serbian Mathematical Congress, Novi Sad, Srbija, 2008.

Number of active teaching classes: 60	Other classes:

Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods:: Lectures, laboratory exercises, demonstration, illustration, presentation, consultation, conversation, seminar paper.			
Knowledge evaluation (maximum number of points: 100)			
Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	10	Written exam	
Practical classes attendance and examples of practical application	25	Oral exam	45
Colloquium			
Seminar papers	20		
Different assessment methods can be used. Those given in the table above are only some of them (written exam, oral exam, project presentation, seminar paper…)			

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Mathematics 1

Teacher: Ljubica Ž. Diković

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Providing students with mathematical knowledge in the field of linear algebra, vector algebra and analytical geometry, which will support their study of other profession-related courses.

Course outcomes: Students will be able to use the acquired general mathematical knowledge independently in other general and vocational courses, as the theoretical and/or practical basis.

Syllabus:

Theoretical instruction:

The concept of a determinant and its characteristics, the concept of a minor and algebraic cofactor. Methods for computing determinants. Systems of linear equations. Cramer's rule. Solution discussion. Special cases of systems of linear equations. Different types of use.

Scalar and vector quantities. Vector operations. The orthogonal projection of a vector onto an axis. Linear dependence of vectors. Conditions for collinearity and coplanarity of vectors. Vector decomposition. The scalar and vector products of vectors and their properties. The mixed product of three vectors and its properties. Using the mixed product to calculate the volume of a parallelepiped, tetrahedron and prism. Cartesian coordinate system. The rectangular Cartesian coordinate system. Orths. Cayley tables. The algebraic approach to the scalar, vector and mixed product. Different types of use.

Point. The distance between two points. The midpoint of a line. Dividing a line into segments in a given ratio. Plane. The equation of a plane perpendicular to a vector and passing through a point. The segmental form of a plane equation. The equation of a strand of a plane through the line of intersection of two planes. The distance from a point to a plane. The angle between two planes. Conditions for perpendicular and parallel planes. The intersection point of three planes. Straight line. General, vector, canonical and parametric forms of the equations of a straight line. The equation of a straight line passing through two points. The distance from a point to a plane. The angle between two straight lines. Conditions for perpendicular and parallel straight lines. The shortest distance between non-intersecting straight lines. Straight lines and planes. Different types of use.

Polynomials. Polynomial division. Zeros of polynomials and Vieta's formulas. Basu's theorem. The use of Basu's theorem.

Practical instruction:

Students perform the tasks relying upon the theoretical lectures; the theoretical knowledge is used to solve practical problems and tasks.

Literature:

1. Lj. Diković, Zbirka rešenih zadaaka iz MATEMATIKE 1, ISBN 978-86-6021-093-9, COBISS.SR 217969420, Naučna KMD, Beograd, 2015.
2. Lj. Diković, Praktikum iz MATEMATIKE 1, ISBN 978-86-83573-51-6, COBISS.SR 208860172, VPTŠ Užice, 2014.
3. LJ. Diković, MATEMATIKA 1, Zbirka zadataka sa elementima teorije, udžbenik broj ISBN 978-86-83573-08-0, VPTŠ Užice, 2008.
4. Marković R., Marković O., Matematika, udžbenik broj ISBN 86-80695-43-2, Učiteljski fakultet i Viša tehnička škola, Užice, 1996.
5. Nikolić O. i grupa autora, Matematika za više tehničke škole, ISBN 86-387-0610-3, Savremena administracija, Beograd 2000.

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	
Teaching methods: Ex cathedra, group work, interactive methods.				
Knowledge evaluation (maximum number of points 100)				
Pre-exam obligations	**Points**	**Final exam**	**Points**	
Class attendance	Up to 20	Oral exam	Up to 30	
Colloquia	Up to 50			

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Mathematics 2

Teacher: Ljubica Ž. Diković

Course status: Compulsory

Number of ECTS: 6

Prerequisites: Passed exam in Mathematics 1

Course aim: Mastering the mathematical knowledge in the field of differential and integral calculus, which will serve as the basis for the study of other general and profession-related courses.

Course outcomes: Developing students' ability to use the acquired higher mathematical knowledge independently in other general and vocational courses, as the theoretical and/or practical basis.

Syllabus:

Theoretical instruction:

Functions of a real variable. Review of basic functions.

Arrays. Boundary values of an array.

Boundary values of functions. Left-hand and right-hand boundary values of functions. Infinitely small and infinitely large functions. Continuity of a function at a point and over an interval. Some important limits.

Derivatives of functions. Derivative of the sum, difference, product and quotient of two functions. Geometric definition of a derivative. Kinematic definition of a dervative. Equations of the tangent and normal to a curve. Derivative of a complex function. Differential of a function. Applying a differential to approximate calculations of functions. Relationship between derivative and differential. Derivatives and higher order differentials. Roll's, Lagrange's and Cauchy's theorem. L'Hôpital's rule. Using derivatives for further study of graphs and flows of functions. Extreme values of functions. Inflection points. Convex and concave.

Indefinite integrals. Difference between differential and integral calculus. Decomposition method. Replacement method. Method of integration by parts. Recursive formulas. Integration of rational functions.Integration of trigonometric functions. Definite integrals. Newton-Leibniz formula. Methods of calculating specific integrals. Improper integrals. Using specific integrals to calculate the surface area of a flat figure and to detrmine the arc length. Examples of use in a specific field of study. First-order differential equations.

Practical instruction:

Students perform the tasks relying upon the theoretical lectures; the theoretical knowledge is used to solve practical problems and tasks.

Literature:

1. Marković R., Marković O., Matematika, udžbenik broj ISBN 86-80695-43-2, Učiteljski fakultet i Viša tehnička škola, Užice, 1996.
2. Ljaško I. i grupa autora, Zbirka zadataka iz matematičke analize, Naša knjiga, Beograd, 2007.
3. Novaković M. i grupa autora, Zbirka rešenih zadataka iz matematičke analize 1, ISBN 978-86-7892-320-3, FTS, Novi Sad, 2011

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of teaching:	Research study:	

Teaching methods: Ex cathedra, group work, interactive methods.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Class attendance	Up to 20	Oral exam	Up to 30
Colloquia	Up to 50		

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Development of Mobile Applications

Teacher: Urošević D. Vlade

Course status: Compulsory

Number of ECTS: 6

Prerequisites:

Course aim: Introducing students to fundamental and advanced programming concepts for smart mobile devices. Using different programming languages and development environments, students should develop applications for smart mobile Android and OS devices.

Course outcomes: Students acquire theoretical and practical knowledge about mobile applications, as well as about the possibilities of their practical use, by attending lectures, preparing seminar papers and doing homework.

Syllabus:

Theoretical and practical instruction:

Fundamentals of Android development environment. Basic components for development of Java-based mobile applications. Programming GUI on mobile devices. Android activity. Android Internet. Basic concepts and architecture. Storing data on mobile devices. Basic concepts and architecture of IOS applications developed using the Swift programming language.

Literature:

1. Code Complete: A Practical Handbook of Software Construction, 2nd Edition by Steve McConnell
2. Soft Skills: The Software Developer's Life Manual, 1st Edition by John Sonmez
3. Beginning Hybrid Mobile Application Development by Mahesh Panhale
4. iOS 9 Application Development in 24 Hours, Sams Teach Yourself, 7th Edition by John Ray
5. Android Application Development Cookbook- Second Edition by Rick Boyer and Kyle Mew

Number of active teaching classes: 75				Other classes:
Lectures: 2x15=30	Practical classes: 3x15=45	Other forms of instruction:	Research study:	

Teaching methods::

Lectures, practical exercises, seminar papers, homework assignments, exam.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	10	Written exam	20
Practical classes	-	Oral exam	30
Colloquia	-		
Seminar papers	40		

Study programme: Information Technologies

Type and level of studies: Undergraduate Vocational Studies

Course title: Multimedia Data Processing Software

Lecturer: Blagojević R. Dejan

Course status: Elective

Number of ECTS:6

Prerequisites: None.

Course aim: The Matlab software package is currently the most powerful and the most widely used software environment for advanced processing of all types of data. Therefore, the aim of this course is to introduce students to the basic principles, commands, functions and tools in Matlab, so that they can use these conveniences to process and implement advanced algorithms for multimedia data processing.

Course outcomes: Providing students with the qualifications required for the jobs as engineers in the field of digital and HD television.

Syllabus:

Theoretical instruction:

1. Introductory lecture. Introducing students to the working environment in Matlab; characteristics and function files.
2. Operations in Matlab, strings and matrices.
3. Relational operators, drawing graphics and areas.
4. Data analysis in Matlab, numerical analysis, statistics.
5. Implementation of basic signal transforms (DFT, DCT, DWT).
6. Working with multimedia signals, basic operations with multimedia data, presentation of multimedia data in Matlab.
7. First colloquium.
8. Audio signal filtering, spectral analysis in Matlab.
9. Working with colour images.
10. Image processing in Matlab: changing colour models, geometric transformations.
11. Frequency domain analysis.
12. Pseudo-colouring of images.
13. Implementation of data compression algorithms in Matlab.
14. Implementation of procedures for multimedia data protection.
15. Second colloquium.

Practical instruction:

Exercises, other forms of instruction, research study.

Lectures are accompanied by practical classes with students performing specific assignments.

Literature:

1. Z.Uskoković**,** LJ. Stanković, I. Đurović, Matlab for Windows, Univerzitet Crne Gore, 1998.
2. S.Stanković, I.Orović, Multimedijalni sistemi, ETF, Podgorica, 2010.

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods: Lectures, laboratory exercises, colloquia, consultations.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Activity during lectures	10	Written exam	50
Practical classes	10	Oral exam	-
Colloquia	30 (2x15)		
Seminar paper			

Different assessment methods can be used. Those given in the table above are only some of them (written exam, oral exam, project presentation, seminar papers, etc.).

Study programme: Information Technologies

Type and level of studies: Undergraduate Vocational Studies

Course title: Multimedia Technologies

Teacher: Nebojša V. Ivković

Course status: Compulsory

Number of ECTS: 6

Prerequisites: Graphic Design Tools

Course aim: Students will be able to use multimedia tools, such as Adobe Premiere, Sony Sound Forge, Cu Base, Adobe After Effects and Adobe Photo Shop, in processing, animation and non-linear editing of audio and video materials. Students will learn how to use the production-related analogue and digital audio and video equipment. Students will be introduced to the elements of proper framing, lighting and scene recording. Text and scenario writing, practical examples (videos, commercials and CD presentations).

Course outcomes:

Students will develop the skills for recording, organizing and non-linear editing of audio materials using the Sony-Sound Forge software package.

Students will be able to use a digital camera properly while recording.

Students will develop the skills for organizing and non-linear editing of audio and video material using the Adobe Premiere software package. They will master computer animation in a 2D space in video editing. They will be introduced to digital processing of images using Adobe PhotoShop programme tool. Optimizing video materials according to the type of post-production devices. Using 3D animation in non-linear video editing.

Students will be able to produce different types of multimedia products: music and commercial videos, CD presentations, business systems and multimedia CD editions for distance learning and education.

Syllabus:

Theoretical instruction:

Sony Sound Forge programme - working environment. Sound recording in different formats. Digital sound processing, sound effects, cyclic repetition of sound.

CuBase programme – working environment. Multichannel sound recording in different formats. Digital sound processing, sound effects, cyclic repetition of sound, non-linear editing of multichannel audio materials, sound mixing.

Audio equipment. Introducing students to audio equipment functions and performance. Audio equipment adjustment, connection and use.

Digital video mixer. Digital camera adjustment. Rules of recording using one or several cameras.

Discussion – the interactive professor/student involvement in the process of brainstorming ideas, writing texts and scripts for the production of commercial videos, CD presentations, multimedia CD editions for distance education and learning, as part of students' work on seminar papers.

Adobe Premiere - working environment. Advanced non-linear editing techniques. Using Virtual studio in video production.

Adobe After Effects – working environment. 2D and 3D animations and special effects for opening and closing credits, and jingles.

Exporting multimedia materials to the Internet and TV post-production.

Practical instruction:

Laboratory exercises. Practical examples digital sound processing, using sound effects, cyclic repetition of sound in Sony Sound Forge programme. Practical examples: multichannel sound recording in different formats, digital sound processing, sound effects, cyclical repetition of sound, non-linear editing of multichannel audio materials. Sound mixing using CuBase programme.

Practical examples: 2D and 3D animations and special effects for opening and closing credits and jingles using Adobe After Effects.

Practical activity: digital camera adjustment and recording in compliance with the rules of recording using one or several cameras.

Literature:

1. Adobe Premiere virtuelna škola, Bonnie Blake, Mikroknjiga, 2002.
2. Sound Forge 8, Kimpjuter biblioteka, 2005.
3. Photoshop CS Biblija, grupa autora, Beograd, 2004.
4. 3DS Max 2008, Sveobuhvatni vodič, Sham Tickoo, Kompjuter biblioteka Čačak, 2008.

Number of active teaching classes: 90				Other classes:
Lectures: 3x15=45	Practical classes: 3x15=45	Other forms of instruction:	Research study:	

Teaching methods: Lectures, laboratory exercises, demonstration, consultations, seminar papers, project work.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	10	Written exam	45
Attendance to practical classes and students' participation in the work	25	Oral exam	
Colloquium			
Seminar paper	20		

Different assessment methods can be used. Those given in the table above are only some of them (written exam, oral exam, project presentation, seminar paper…).

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Object-Oriented Programming

Teacher: Vlade D. Urošević

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Introducing students to the object-oriented concept of programming. The basic principles of OOP. Encapsulation, abstraction, inheritance and polymorphism. Derived classes and inheritance. Protected members. Derivation methods. Polymorphism. Virtual member function. Dynamic binding. Multiple inheritance.

Learning outcomes: Students will be able to take full advantage of the C++ language as the Object-Oriented Language. They will completely master the indicators and functions as the basis for dynamic memory allocation. Students will be able to recognize the interface and its realization, and they will be taught how to use the OOP logic in performing everyday tasks.

Syllabus:

Object-oriented software concepts. Elements of C++ language inherited from C language. Classes and objects. Abstraction and instances. Definition of *class*. Member functions. Access right. Static members. Friends. Structures and unions. Nested classes. Constructors and destructors. Operator overloading. C++ operators. Binary and unary operators. Special operators. Inheritance. Generalization/specialization relation. Derived classes and inheritance. Protected members. Derivation methods. Polymorphism. Virtual member functions. Dynamic binding. Multiple inheritance.

Literature:

1. Arnold, K., Gosling, D., Holmes, D., Programski jezik Java, 2. izdanje, CET, 2001.
2. Schildt H., Java: Kompletan priručnik, Mikro knjiga, Belgrade 2006.
3. Urošević V., Cplusplus, Autorizovana skripta. 2006.

Number of active teaching classes: 75				Other classes:
Lectures: 2x15=30	Practical exercises: 3x15=45	Other forms of instruction:	Research study:	

Teaching methods: Lectures and exercises are based on the interactive teaching model (teaching methods: popular presentation, discussion, practical work, workshops, enactments); active learning, meaningful verbal receptive learning, inquiry-based learning, cooperative learning, practical learning.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points**	**Final Exam**	**Points**
Activity during lectures	5		
Practical classes / exercises	5	Oral exam	30
Colloquia	50		
Seminar papers / written assignments, tasks	10		

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Operating Systems

Teacher: Petrović M. Slobodan

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: Introducing students to the structure, function and principles of operating systems in order to use them more efficiently.

Course outcomes: Students will be able to apply the acquired knowledge and skills in practice, efficiently using operating systems. Students will learn how to administer modern operating systems and optimize their performance.

Syllabus:

Theoretical instruction:

- The role and purpose of operating systems. A brief history of operating system development. Information and computer systems, definitions and concepts, data, knowledge, information. Operating systems – definition and functions, characteristics and structure of operating systems. Abstraction and complexity.
- Process management. The concepts of programme, process, thread. Operations on processes. The process state diagram. Processor queues, processor scheduling, dispatchers, processor allocation criteria and algorithms. Process distribution, cooperative processes. Process synchronization and communication. The concept of a critical section, critical section implementation, semaphores, monitors. The deadlock problem.
- Memory management. Memory hierarchy. Address mapping and binding, binding time. Static and dynamic address binding. Logical and physical address space. Memory sharing, protection, dynamic loading, overlays, library sharing, swapping. Memory allocation (continuous, discontinuous), fragmentation, partitions, pages (shared pages), segments, combined segmentation and paging. Virtual memory, loading pages as needed, interrupt signals (PF), paging in advance.
- File systems – the concept of a file, file attributes and operations, opening and locking files. Folders – the concept and definition, file sharing, file protection. File systems *Linux, Windows*, allocation methods, defragmentation, failure recovery.
- Input-output subsystems, their functions, classification of devices, hardware important for the I/O subsystem, interruptions, DMA. The uniform interface and applications, drivers. I/O operation scheduling, buffering, caching, spooling, I/O subsystem performance. User interface – its purpose, types, command languages, graphical user interface.

Practical instruction:

In the computer laboratory, students acquire the hands-on knowledge required for the use and administration of an operating system and for the optimization of its performance.

Literature:

1. B.Đorđević, D. Pleskonjić, N. Maček, Operativni sistemi: teorija, praksa i rešeni zadaci, Mikro knjiga, Beograd, 2008, ISBN: 86-7555-274-2.
2. William Stallings, Operativni sistemi – principi unutrašnje organizacije i dizajna – prevod sedmog izdanja, CET Beograd, 2013.
3. D. Simić, P. Bataveljić, Organizacija računara i operativni sistemi, FON Beograd, 2011.
4. S. Petrović, LJ. Diković, skripta Operativni sistemi Windows 7, Ubuntu 14.04 - praktikum za vežbe

Number of active teaching classes:75				Other classes:
Lectures: 15*2=30	Practical classes: 15*3=45	Other forms of instruction:	Research study:	

Teaching methods::

1 Oral presentation (monologue) – Power Point presentations, 2 Conversation (dialogue), 3 Preparation and discussion of seminar papers, 4 Examples from practice, instructions and other demonstration materials, 5 Practical activities in the computer laboratory.			
Knowledge evaluation (maximum number of points: 100)			
Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Active participation during lectures	10	Written exam	35
Practical classes	10	Oral exam	-
Colloquia	2*15=30	-	-
Seminar papers	15	-	-

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: PHP Programming

Teacher: Radosavljević D. Damnjan

Course status: Compulsory

Number of ECTS: 6

Prerequisites:

Course aim: Introducing students to modern technologies required in order to use Web applications and services. The course focuses on practical applications of PHP programming. The aim of the course is to enable students to create modern 3-tier Web applications and services.

Course outcomes: Detailed knowledge of PHP programming language. Connecting the PHP programming language to a database. Integrating PHP programming language with AJAX technology. Using Web services.

Syllabus:

Theoretical instruction:

Modern 3-tier Web applications – design and architecture. Fundamentals of PHP programming languages. Date and time. Strings. Variables. Functions. Classes and objects. Web bases. Forms. Access to databases. Files. Object-related mapper (Doctrine). Security issues and protection of developed applications. Web server and database server. Accessing a database using PHP programming language. Integrating AJAX code with PHP-enabled pages. Web service concept. Creating Web services using PHP programming language.

Literature:

1. Stefanović M., Skripta sa predavanja, PMF.
2. Gimore J., PHP 5 Beginning PHP and MySQL, from Novice to Professional, APRESS, 2007, ISBN: 978-1-59059-552-7.
3. Radosavljević, D., Mladenović, D., Web Design, ISBN: 978-86-83573-48-6), Visoka poslovno-tehnička škola Užice, Grafičar, Užice, 2014.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: Lectures, practicals, seminar papers, consultations, practical assignments (programming). Colloquia: PHP fundamentals, designing a part of a website.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Activity during lectures	10	Written exam	25
Colloquia	20	Oral exam	25
Seminar papers	20		

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Russian 1

Teacher: Terzić V. Svetlana

Course status: Elective

Number of ECTS: 6

Prerequisites: None

Course aim: Teaching students how to use specialized literature related to a specific scientific field; developing students' language skills (reading, translation, conversation); combining lexical and grammatical structures. Increasing public awareness of the importance of information technologies through specialised texts.

Course outcomes: Providing continuous foreign language education upon high school completion. Developing communication skills and ability to communicate successfully in the local and international environment.

Syllabus:

Theoretical instruction:

Airport – parts of speech that decline; Customs – nouns (three types); Phone conversation – adjectives (hard and soft declension); At the post office – the comparative degree; Commercial letters; Hotel – the superlative degree; At the restaurant – verbs of motion; International fairs and exhibitions – adverbs of manner; The theatre life of Moscow – the imperative mood; The protection of workers - taking personal protection measures and informing the workers about the signs (the implementation of the international project TEMPUS JPHES 158781)

Practical classes:

Grammar revision. Practicing conversation in unfamiliar situations.

Literature:

1. Marojević M., 1996, Ruski poslovni jezik, Beograd, Srpski leksikograf
2. Aleksić B., 2000, Ruski jezik za ekonomiste, Beograd, Ekonomski fakultet u Beogradu
3. Marojević R., 1983, Gramatika ruskog jezika, Belgrade, Yavod ya ud\benike i nastavna sredstva
4. Terzić S., 2012, Skripta odabranih tekstova

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods: Monologue and dialogue

Assessment of knowledge (maximum number of ECTS: 100)

Pre-exam obligations	**Points: 70**	**Final exam**	**Points: 30**
Active participation during lectures	10	-	-
Practical classes	-	Oral exam	30
Colloquia	60	-	-
Seminar papers	-	-	-

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Russian 2

Teacher: Terzić V. Svetlana

Course status: Elective

Number of ECTS: 6

Prerequisites: Passed examination in Russian 1.

Course aim: Teaching students how to use specialized literature related to a specific vocational area; developing students' language skills (reading, translation, conversation); combining lexical and grammatical structures. Increasing public awareness of the importance of information technologies through specialised texts.

Course outcomes: Students can use the foreign language on their own. They will develop communication skills and learn how to cooperate successfully both in the local and international environment.

Syllabus:

Theoretical instruction:

Joint ventures – present participle. Advertisements – past participle. Scientific and technological development and new industrial equipment – definite pronouns. Conversation at a Moscow bank – adverbs of reason, adverbs of purpose. What is Informatics? Using Moodle platform in Russian language instruction - active present and past participles. Business plan – passive present and past participles. PC - participles. Auction. Texts related to Business Russian.

Practical classes:

Listening exercises aimed at successful coping with unfamiliar business situations, using the specific information terminology vocabulary.

Literature:

1. Marojević M., 1996, Ruski poslovni jezik, Beograd, Srpski leksikograf
2. Aleksić B., 2000, Ruski jezik za ekonomiste, Beograd, Ekonomski fakultet u Beogradu
3. Marojević R., 1983, Gramatika ruskog jezika, Belgrade, Yavod ya ud\benike i nastavna sredstva
1. Terzić S., 2012, Skripta odabranih tekstova

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods: Monologue and dialogue.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points: 70**	**Final exam**	**Points: 30**
Activity during lectures	10		-
Practical classes	-	Oral exam	30
Colloquia	60	-	-
Seminar papers	-	-	-

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Software Tools

Teacher: Nebojša V. Ivković

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim:

- Students will acquire advanced knowledge and will be trained to use:
- Advanced text processing techniques
- Adobe Photoshop
- MS Excel
- Adobe After Effects

Course outcomes:

- Advanced text processing techniques:
  - Using sections (creating sections, working with sections, section properties)
  - Using section breaks in documents, together with headers and footers
  - Changing the orientation of certain pages of a document
  - Using different number of columns on a single page and in a document as a whole
  - Designing styles (adding and removing text styles, saving and using them…)
  - Multilevel lists
  - Creating content (automatically and manually, adjusting text using TAB key)
  - Indexing
  - Bookmarks
  - Hyperlinks
  - Electronic forms
  - Circular letters
  - Preparing documents for double-sided printed (margins, page numbers)…

- Digital image processing using Adobe Photoshop

- Automatic data processing applied to complex practical examples using nested functions in MS Excel programme. Using macros to create reports based on the processed data of different format, imported from a database of a business information system. Using templates to create reports. Using Visual Basic as an additional tool in solving more complex problems.

- Creating motion graphics, animated headlines, closing credits, jingles in 2D and 3D space with special visual effects for films, commercials and presentations using Adobe After Effects.

Syllabus:

Theoretical instruction:	**Practical instruction:**
1. Advanced text processing techniques	1. Advanced text processing techniques
2. Adobe Photoshop	2. Adobe Photoshop
3. MS Excel	3. MS Excel
4. Adobe After Effects	4. Adobe After Effects

Literature:

1. Alati grafičkog dizajna, Damnjan Radosavljević, Visoka poslovno-tehnička škola, Užice, 2014.
2. Excel 2007 Biblija, John Walkenbach, Mikro knjiga
3. Word 2016, Korak po korak, Joan Lambert, CET

4. Adobe After Effects CS4, CET				
Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction: 0	Research study:	
Teaching methods: Demonstration, illustration, presentation and conversation.				
Knowledge evaluation (maximum number of points: 100)				
Pre-exam obligations	**Points:**	**Final exam**	**Points:**	
Lectures attendance	10	Written exam	45	
Practical classes attendance and active participation	25	Project work	0	
Seminar paper	20			
Different assessment methods can be used. Those given in the table above are only some of them: written exam, oral exam, project presentation, seminar paper, etc.				

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Statistics

Teacher: Milica D. Cvetković

Course status: Compulsory

Number of ECTS: 6

Prerequisites:

Course aim: Preparing students to:

- master fundamental concepts of statistics
- use quantitative approach to problem solving
- learn how to select appropriate statistical methods, perform a statistical analysis and explain its purpose
- learn how to use the *Statistica* software package for statistical data processing.

Course outcomes: Students will:

- be able to recognise and use statistical concepts
- learn how to collect, classify, and present statistical data using tables and graphs
- be able to analyse and use mean values (measures of central tendency), measures of dispersion and measures of shape
- be able to use the *Statistica* software package for statistical data processing
- apply the acquired knowledge in particular problem-solving situations

Syllabus:

Theoretical instruction:

The concept and subject matter of statistics, statistical principles and grade statistics. Statistical recording and presentation of results. Software package supporting statistical analysis. Data analysis using methods of descriptive statistics.

Practical instruction:

Statistical research. Statistical data sets. Data collection methods. Data classification and processing. Statistical series. Statistical tables. Graphical presentation of statistical data. Processing and analyzing data and results. Central tendency measures. Variability measures. Distribution shape measures. Using the Statistica software package for statistical data processing.

Literature:

Mandatory:

1. Miodrag Lovrić, Osnovi statistike, Ekonomski fakultet, Kragujevac, 2008.
2. Nevenka Skakić, Teorija vjerovatnoće i matematička statistika, Naučna knjiga Beograd, 2001.

Additional literature:

1. Maja Biljan-August i drugi, Statistička analiza u ekonomiji, Ekonomski fakultet, Rijeka, 2009.

Number of active teaching classes: 60				Other classes:
Lectures: 2*15=30	Practical classes: 2*15=30	Other forms of instruction:	Research study:	

Teaching methods: Lectures and practicals. Preparation of seminar papers. Individual and group presentations.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points: 70**	**Final exam**	**Points: 30**
Activity during lectures	5	Written exam	30
Practical classes	5		
Colloquia	20+20=40		
Seminar paper	20		

Study programme: Information Technologies

Type and level of studies: Undergraduate vocational studies

Course title: Web Design

Teacher: Blagojević R. Dejan

Course status: Compulsory

Number of ECTS: 6

Prerequisites:

Course aim: The course is aimed at providing students with the knowledge about the most important technologies for the development of web applications. They will learn how to use these technologies to design modern websites. They will learn about the characteristics of good website design principles. They will master the Internet technologies, such as HTML, CSS, Javascript, used for designing websites.

Course outcomes: Upon the completition of the course, students will be able to:

a) design, implement and maintain websites,
b) use a range of programming techniques and languages for the development of web applications,
c) select the appropriate architecture for web applications,
d) create client-side web applications using HTML and JavaScript,
e) design and create sophisticated server-side applications using one or several proper technologies,
f) critically analyse and evaluate web applications.

Syllabus:

Theoretical instruction:

The Internet. The history of the Internet. Basic concepts. The internet and web applications (3 classes). HTML: the structure of HTML documents. Formatting text in a TextBlock. Word formatting. Enumeration elements. References to other documents or addresses. Tables. Images. Frames. Formulas.
CSS: the history of HTML styles. Creating HTML styles. Ascade styles.xternal styls in HTML. DHTML.
JavaScript language: The history of scripting languages. JavaScript fundamentals. Objects. Control structures. Operators. Functions and objects. Global functions and orders.
HTML forms and CGI script (2 classes). PHP, SQL amd Java Applets fundamentals, and overview of other technologies (AJAX; Macromedia Flash, etc).

Practical instruction:

HTML, CSS, JavaScript, PHP.

Literature:

1. Jennifer Niederst Robbins, Naučite Web dizajn, Mikro knjiga, Beograd, 2008.
2. David Flanagan, JavaScript: sveobuhvatni vodič, Mikro knjiga, Beograd, 2008.
3. Luke Welling i Laura Thomson, PHP i MySQL: razvoj aplikacija za Web, Mikro knjiga, Beograd,2009.
4. Radosavljević, D., Mladenović, D., Web design, (ISBN 978-86-83573-48-6), Visoka poslovno-tehnička škola Užice, Grafičar Užice, 2014.

Number of active teaching classes: 60				Other classes:
Lectures: 2x15=30	Practical classes: 2x15=30	Other forms of instruction:	Research study:	

Teaching methods:

Classical teaching methods are used during lectures, combined with overhead projector presentations and teacher-student interaction. During practical classes, students work with computers and apply the acquired knowledge on their own, in compliance with the subject matter presented during lectures. Their knowledge is evaluated through homework assignments and colloquia. In the final written and oral exam, students are expected to show that they have mastered basic WEB design principles and techniques (HTML + JavaScript).

Knowledge evaluation (maximum number of ECTS: 100)

Pre-exam obligations	**Points**	**Final exam**	**Points**
Active participation during lectures	10	Written exam	25
Colloquia	20	Oral exam	25
Seminar papers	20		

Study programme: Information Technology

Type and level of studies: Undergraduate Vocational Studies

Course title: Web-Based Information Systems Development

Teacher: Radosavljević D. Damnjan, Vidojevič V. Dejan

Course status: Compulsory

Number of ECTS: 6

Prerequisites: None

Course aim: The aim of the course is to teach students how to develop Web-based information systems, using the Java, .Net or Free software technologies.

Course outcomes: Students will develop the skills required to design and use Web-based information systems.

Syllabus:

Theoretical instruction:

Reference models and computer network standards. Virtual private networks. XML technologies. Principles of web-based applications development. Service-oriented architecture and web services. Business process modeling. Process-oriented software development. Modelling and presentations. Application servers. Semantic Web. Virtualization and Cloud Computing. Sensor networks. Internet of things.

Practical instruction:

HTML, CSS JavaScript, JQuery, XML DOM, AJAX, PHP, MySQL. Developing web-based applications using the AJAX, PHP, MySQL technologies. Web services. BPEL. BPML.

Literature:

1. Materijali u e-formi, sa sajta www.elab.rs
2. Internet i savremeno poslovanje, monografija editori M. Ivković i B. Radenković, Tehnički fakultet „Mihajlo Pupin“, Zrenjanin 1998.
3. Radosavljević, D., Mladenović, D., Web Design, ISBN: 978-86-83573-48-6, Visoka poslovno-tehnička škola Užice, Grafičar, Užice, 2014.

Number of active teaching classes:				Other classes:
Lectures: 3x15	Practical classes: 3x15	Other forms of instruction: 0	Research study:	

Teaching methods:

Lectures, exercises, laboratory exercises, distance learning.

Knowledge evaluation (maximum number of points: 100)

Pre-exam obligations	**Points:**	**Final exam**	**Points:**
Lectures	10	Written exam	25
Homework assignments	40	Project work	25

Different assessment methods can be used. Those given in the table above are only some of them: written exam, oral exam, project presentation, seminar paper, etc.