Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Database Administration

Teacher:Aničić M. Nenad

Course status: elective for study group Information systems

ECTS points: 6 points

Prerequisites: /

Course objective

Fundamental knowledge acquisition about functioning of database management systems and practical techniques and skills for database administration.

Learning outcomes

Student will be capable to understand architecture and components of database management system, to configure, manage and maintain database, to audit and improve database performances and to use tools for database administration.

Course structure and content

Theoretical instruction:

Introduction to database administration. Database management system architecture and functions. Physical structure of database. Database configuration. Tools for database administration. Managing database objects. Buffer and storage management. Access management and data security. Backup and database recovery. Advanced database functions. Data import and export. Connecting to database. Automating administrative tasks. Auditing and improving performances of database. Exam preparation.

Practical instruction:

Roles, components and database instances management. Management of users and privileges. Configuration and network connection. Tools for database administration. Managing database objects (tables, indexes, constraints). Auditing of job, trends, instances and environment. Buffer and storage management. Database and user security. Creating, configuring, using backup and backup optimization. Configuring and implementing database recovery. Configuring, auditing and managing of flashback. Database duplication. Automating administrative tasks. Auditing, displaying and improving database performances. Exam preparation.

Literature/Readings

1. Mullins C., *Database Administration: The Complete Guide to Practices and Procedures*, Addison-Wesley Professional, Reading 2002.
2. Fernandez I., *Beginning Oracle Database 11g Administration*, Apress, New York 2009.
3. Knight B., *Professional Microsoft SQL Server 2008 Administration*, Wiley Publishing, Indianapolis 2009.
4. Vaswani V., *MySQL Database Usage & Administration*, McGraw-Hills Company, New York, 2010.

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs: 2**	**Workshops:**	**Research study:**	

Teaching methods

Lectures (30 classes) and labs (30 classes).

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Test	30	Oral exam	30
Seminar	40		

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Business Analysis

Teacher:Babarogić S. Slađan,Vučković Đ. Milica

Course status: elective for study groups Information Systems and IS&T Management

ECTS points: 6 points

Prerequisites: -

Course objective

The aim of this course is to enable students to use modern models, methods and techniques of business analysis.

Learning outcomes

At the end of the course the student should be able to gather, document, analyze, validate and communicate all of the requirements that are used to develop a new information system, customization and implementation of the comercial software solution, or provide the basis for improving existing business processes.

Course structure and content

Theoretical instruction:

Introduction to business analysis. Basic concepts of business analysis. Defining the vision and scope of the project. The roles of the participants in the business analysis project. Requirements gathering techniques. Techniques of analysis. Categorization of requirements. Key components of the requirements. Defining the business architecture. Modeling data. Modeling business processes. Defining business rules. "AS-IS" and "TO-BE" analysis. Verification and validation of requirements. Change management of requirements.

Practical instruction:

Student projects under mentor supervision

Literature/Readings

- Basic Literature:

1. Barbara A. Carkenord: Seven Steps to Mastering Business Analysis, J. Ross Publishing, 2008.

2. Kevin Brennan: A Guide to the Business Analysis Body of Knowledge (BABOK 2.0 Guide), IIBA, 2009.

3. Howard Podeswa: UML for IT Business Analyst, 2nd ed., Course Technology PTR, 2010.

- Additional Literature:

- Howard Podeswa: The Business Analyst's Handbook, Course Technology PTR, 2008.
- James Cadle, Debra, Craig, Donald Yeates (editors): Business Analysis, 2nd ed., British Computer Society, 2010.
- James Cadle, Debra Paul, Paul Turner: Business Analysis Techniques: 72 Essential Tools for Success, British Computer Society, 2010.
- Karl Wiegers: Software Requirements, 2nd ed., Microsoft Press, 2003.
- Karl Wiegers: More About Software Requirements: Thorny Issues and Practical Advice, Microsoft Press, 2006.
- Kurt Bittner, Ian Spence: Use Case Modeling, Addison-Wesley Professional, 2002.
- Alistair Cockburn: Writing Effective Use Cases, Addison-Wesley Professional, 2000.
- Thomas Allweyer: BPMN 2.0 – Introduction to the Standard for Business Process Modeling, BoD, 2010.
- Barbara von Halle: Business Rules Applied - Building Better Systems Using the Business Rules, Wiley, 2001.
- Martin Fowler: UML Distilled - A Brief Guide to the Standard Object Modeling Language, 3rd ed., Addison-Wesley Professional, 2003.

The number of class hours per week				**Other classes:**
Lectures:	**Labs:**	**Workshops:**	**Research study:**	
2	2			

Teaching methods

Theoretical study.

After that, the students organized in small groups (typically 2-3 students per group) are working together on the selected and approved topic. Each group has a mentor (teacher or teaching assistant), that every second week, in a predetermined time period prescribed for the group (1/2 hour), controls and helps to update the results of the analysis of a specific domain.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Project development	**50**	Project presentation	**20**
		Written exam	**30**

Study program / study programs: Information Systems and Technologies

Degree level: master studies

Course:

E-commerce Applications

Teacher:Simić B. Dejan,Minović V. Miroslav

Course status: elective for study group Information technologies

ECTS points: 6 points

Prerequisites: /

Course objective The course objective is to acquire knowledge and skills required for the application of e-commerce. Learn how to develop and integrate web applications, e-commerce applications and web services.

Learning outcomes Students will gain the necessary knowledge for the development of modern e-commerce applications.

Course structure and content

Theoretical instruction: L-01: Review of information technology needed to create applications of e-commerce. L-02: Examples of necessary technologies in applications of e-commerce. L-03: Java, J2EE, JDBC, servlets. L-04: RMI, CORBA, XML. L-05: PHP, MySQL. L-06: SQL. L-07: EJB, Java Beans, DHTML. L-08: E-Commerce Applications Security L-09: Protocols for public transport and private information. L-10: SSL/TLS certificates. L-11: Digital signature and digital certificates. L-12: Electronic Payment Systems. L-13: Digital Money. L-14: Current Trends in Payment Applications. L-15: Case studies in e-commerce applications.

Practical instruction: *Exercises, Other forms of lectures, Research work*

E-01: Introduction to Development of E-Commerce Applications. E-02: The use of the ASP.NET. E-03: Security Aspect of the ASP.NET Web Applications. E-04: User Authentication in the ASP.NET Web Applications. E-05: Catalog Development using the ASP.NET technology. E-06: The Development of Shopping Cart using the ASP.NET technology. E-07: Complete E-Commerce Application using the ASP.NET technology. E-08: The Development of E-Commerce Applications using the JSP technology. E-09: Examples of the use of servlets. E-10: Catalog Development using the JSP technology. E-11: The Development of Shopping Cart using the JSP technology. E-12: Review of previous excercises. E-13: Introduction to Development of M-Commerce applications. E-14: The Development of M-Commerce Applications. E-15: Review of previous excercises and preparation for the exam.

Literature/Readings

1. Efraim Turban, Dave King, "Electronic Commerce 2012 – Managerial and Social Networks Perspectives", 7th edition, 2012
2. Kenneth C. Laudon, Carol Guercio Traver, "E-Commerce 2012 – Business, Technology, Society", 8th Edition, Pearson Education Limited, 2012.
3. Larry Ullman, "Effortless E-Commerce with PHP and MySQL", New Riders, Berkeley, 2011.
4. Sanjay Mohapatra, "E-Commerce Strategy: Text and Cases", Springer New York, 2013.
5. David Taniar, "Encyclopedia of Mobile Computing and Commerce", Information Science Reference, 2007.
6. The material in electronic form, FON, Beograd, 2013.

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs:** 2	**Workshops:**	**Research study:**	

Teaching methods

Lectures, Exercises, Practical Work, Consultation.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Participation in class	30	Written exam	30
Participation in labs	40		

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Databases 2

Teacher:Marjanović M. Zoran,Aničić M. Nenad,Babarogić S. Slađan

Course status: mandatory

ECTS points: 6 points

Prerequisites: Databases

Course objective

Students will gain knowledge about logical design, physical design on logical level and physical database design and database application development.

Learning outcomes

Students will be capable to develop logical database design, to make physical design on logical level, to design physical database structure and to develop database applications.

Course structure and content

Theoretical instruction:

Introduction. Database logical design. Physical database design on logical level. Denormalization. Physical database design. User defined data types. Database optimization. Query optimization. Application optimization. Triggers and stored procedures. Database applications development. SQL in software environments. SQL environment: schema, catalog, clients and servers. Database connection.

Practical instruction:

Project topics approval. Logical database design. Physical database design on logical level. Physical database design. User defined data types. Optimization. Triggers. Database applications development.

Literature/Readings

- Basic Literature:

1. Lazarević B., Marjanović Z., Aničić N., Babarogić S., Baze podataka, šesto izdanje, FON, 2012.
2. Databases 2, script, 2013.

- Additional Literature:

- Referenced literature at the end of each chapter of the basic literature

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs: 2**	**Workshops:**	**Research study:**	

Teaching methods

Theoretical lectures. Once lectures are finished students are independently working on selected and approved topics. Each student has its mentor (teacher and/or assistant, teaching associate) that each week, in defined period for a group (1 hour) controls and helps in implementation.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Project development	70	Project presentation	30

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Biometric Technologies

Teacher:Starčević B. Dušan,Simić B. Dejan,Minović V. Miroslav, Milovanović M. Miloš

Course status: elective for study group Information technologies

ECTS points: 6 points

Prerequisites: /

Course objective

This course introduces students to current state of the art technologies in the field of biometric systems and trains them to evaluate applications of current biometric methods.

Learning outcomes

Students will acquire necessary knowledge and skills in the area of biometric systems and their possible applications.

Course structure and content

Theoretical instruction:

P-01: Introduction to biometrics P-02: Comparing different biometric methods P-03: Fingerprint as a biometric modality P-04: Face recognition. P-05: Iris as a biometrics modality. P-06: Palmprint scanning technologies. P-07: Standardization, applications and privacy. P-08: Retina as biometric modality. P-09: Speech recognition. P-10: Other behavioristic modalities. P-11: Multimodal biometric systems P-12: Smart cards technologies. P-13: Smart cards applications. P-14: Evaluating biometrics systems performances. P-15: Biomertric systems - future development trends

Practical instruction:

Students attend labs in aforementioned lessons. Practical instruction is realized in Laboratory for multimedia communications. The work includes examining possibilities for practical application of biometric technologies in laboratory conditions. Practical application put emphasis on use of different types of biometric sensors. Student needs to finish labs and also to realize the given task in the field of biometrics applications.

Literature/Readings

1. D. Maltoni, D. Maio, A. K. Jain, S. Prabhakar, "Handbook o Fingerprint Recognition", Springer-Verlag London Limited, 2009.

2. A. K. Jain, P. Flynn, A. A. Ross, “Handbook of Biometrics”, Springer, New York, 2008.

3. J. N. Pato, and Lynette I. Millett, Editors, “Biometric Recognition Challenges and Opportunities”, The National Academy of Sciences, Washington, 2010;

4. Zeljko Obrenovic, Dusan Starcevic, Emil Jovanov, “Multimodal Presentation of Biomedical Data”, Chapter in Metin Akay (Ed.) Wiley Encyclopedia of Biomedical Engineering, Wiley, 2006.

5. Stan Z. Li, Editor, A. K. Jain, Editorial Advisor, "Encyclopedia of Biometrics", Springer, New York, 2009.

The number of class hours per week				**Other classes:**
Lectures:	**Labs:**	**Workshops:**	**Research study:**	
2	2			

Teaching methods

Lectures, labs, practical work, consultations

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Practical work, tasks	20	Written exam	50
Project	30		

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Digital media

Teacher:Minović V. Miroslav,Milovanović M. Miloš, Štavljanin B. Velimir

Course status: elective for study group Information technologies

ECTS points: 6 points

Prerequisites: /

Course objective

Broadening earlier acquired knowledge and skills in the field of digital media. Enabling students to evaluate current approaches, techniques and technologies in digital media research field.

Learning outcomes

Understanding the operation and usage of digital media in application development. Acquiring knowledge and skills necessary for use and development of advanced multimedia systems.

Course structure and content

Theoretical instruction:

P-01: Introduction to digital media. P-02: Digital data. P-03: Computer hardware. P-04: Computer software. P-05: Text. Hypertext. P-06: Vector image. P-07: Raster image. P-08: Sound. P-09: 2D animation. P-10: 3D animation. P-11: Video. P-12: Multimedia content development. P-13: Unstructured data search and management. P-14: Digital media standards. P-15: Technologies for digital multimedia data transfer.

Practical instruction:

Students attend labs in aforementioned lessons. Practical instruction is realized in Laboratory for multimedia communications. The work includes examining possibilities for practical application of digital media technologies in laboratory conditions. The emphasis is on mastering actual technologies and digital media formats. Student needs to finish labs and also to realize the given task in the field of multimedia communications.

Literature/Readings

1. *Terry Michael Savage, Karla E. Vogel, An Introduction to Digital Multimedia, Jones & Bartlett Learning, 2009*
2. *Starčević, D., Štavljanin, V., „Multimediji“, FON, Beograd, 2013*
3. *Paul Messaris , Lee Humphreys, Digital Media: Transformations in Human Communication., Peter Lang International Academic Publishers, 2006*

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs:** 2	**Workshops:**	**Research study:**	
Teaching methods Lectures, labs, practical work, consultations				
Evaluation/Grading (maximum 100 points)				
Pre-exam requirements	**Points**	**Final exam**	**Points**	
Practical work, tasks	20	Written exam	50	
Project	30			

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Advanced Topics in Information Systems

Teacher: Marjanović M. Zoran, Nešković N. Siniša,Vučković Đ. Milica, Aničić M. Nenad, Babarogić S. Slađan, Pantelić S. Ognjen

Course status: elective for study group Information Systems

ECTS points: 6 points

Prerequisites: /

Course objective

The goal of this course is to train students to independently research theoretical aspects of selected topic and to apply gained knowledge in practice.

Learning outcomes

Students will gain detailed insight in achievements in subject area of selected topics. Also, student will learn methodology and evolve necessary skills which help him in easy gaining knowledge in any other scope inside information systems area.

Course structure and content

Practical instruction: Student projects under mentor supervision

Seminar topics approval 1. Seminar topics approval 2. Project consultation 1. Achieved results analysis 1. Project consultation 2. Achieved results analysis 2. Project consultation 3. Final achievements analysis.

Literature/Readings

1. Hoffer J., George J., Valacich J., Modern Systems Analysis and Design, 4th Edition Prentice Hall, UpperSaddle River, Nj. 2005.
2. Literature available online

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs: 2**	**Workshops:**	**Research study:**	

Teaching methods

Students are individually working on selected and approved topics. Each student has its mentor (teacher and/or assistant, teaching associate) that each week, in defined period for a group (1 hour) controls and helps in seminar realization.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Seminar	70	Seminar presentation	30

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Integrated Software Solutions

Teacher:Marjanović M. Zoran

Course status: elective for study groups: Information Systems and IS&T Management

ECTS points: 6 points

Prerequisites: /

Course objective

This course will give an overview of integrated software systems characteristics, selection principles and specific problems that may occur in their implementation.

Learning outcomes

Students will learn all characteristics and types of available software solutions, their specificities and suitability for certain enterprise types.

Course structure and content

Theoretical instruction:

Introduction: History. Developing or buying software solution. EAS, ERP and CRM systems. Software systems for enterprise resource planning: from passive control and supplies management over integrated systems for production management to integrated systems for enterprise resource management. Typical logical architecture. Functional domains and program systems (modules). Development environment. Overview of characteristics of the most important solutions: SAP, Navision, Oracle Financial and others. Defining selection criteria. Local and world solutions. Evaluation process. ERP system implementation: critical factors of ERP system implementation. Localization (language and national laws problems). Adjustment according to internal standards and enterprise business rules. Integrated software solutions for SME.

Practical instruction:

Introduction: History. Developing or buying software solution. EAS, ERP and CRM systems. Defining seminar topics. Typical logical architecture. Functional domains and program systems (modules). Development environment. The most important solutions: SAP, Navision, Oracle Financial and others. Examples. Seminars. Overview of main characteristics of domestic solutions. Domestic solutions. Examples. Seminars. Integrated software solutions for SME. Seminars.

Literature/Readings

- Basic Literature:

1. E-presentations
2. Bret J.W., Ellen M., Concepts in Enterprise Resource Planning, Course Technology 2008.

- Additional Literature:

- Integrated software solutions documentation

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs: 2**	**Workshops:**	**Research study:**	

Teaching methods

Lectures. Labs. Seminar development.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Seminar	60	Written exam	30
		Oral exam	10

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Human-Computer Interaction

Teacher:Starčević B. Dušan,Minović V. Miroslav,Milovanović M. Miloš

Course status: elective for study group Information technologies

ECTS points: 6 points

Prerequisites: /

Course objective

Training students to define user requirements in domain of human-computer interaction, perform analysis, project, implement and evaluate elements of user interface. All steps are done in accordance with well known and generally accepted development methodologies.

Learning outcomes

Students will acquire necessary knowledge in domain of human-computer interaction, learn to perform analysis, project, implement and evaluate elements of user interface.

Course structure and content

Theoretical instruction:

P-01: Human-computer interaction basics. P-02: Paradigms and principles. P-03: Development process. User models in development process. P-04: Defining user requirements. Social-Technical Models. P-05: Soft systems methodology. Participative development. P-06: Cognitive models. Linguistic models. P-07: Physical and device models. P-08: Assignement analysis. Digital notation and development. P-09: System models: Implementation support. P-10: Evaluation techniques. P-11: Areas of application. Groupware. CSCW. P-12: Multimodal communucation. Speech. Natural user interfaces. P-13: Handwriting recogniton. Computer vision. P-14: Comprehensive computing. Virtual reality. Hypertext. P-15: Multimedia. WWW. Animations. Digital Video. Computer supported learning .

Practical instruction:

V-01: Human-computer interaction basics. V-02: Devices for human-computer interaction. V-03: Principles of user interface. WIMP paradigm examples. V-04: User interface development methodology. V-05: Examples and assigments. V-06: Cognitive systems architecture. V-07: Help systems development. V-08: Decomposition examples (HTA). V-09: Knowledge based analysis example (TAKD). V-10: Analysis based on entity-relationship model (ATOM). V-11: Dialog development examples. V-12: Multimoda communication examples. V-13: Natural user interfaces examples. V-14: Virtual reality examples. V-15: Development of a WWW application with focus on user interface

Literature/Readings

Human-Computer Interaction, Third Edition, Dix, Finlay, Abowd, Beale, Prentice Hall, 2004

Usability Engineering, Jakob Nielsen, Morgan Kaufmann, 1993 Designing the User Interface, Shneiderman, Plaisant, Addison Welsey, 2005				
The number of class hours per week				**Other classes:**
Lectures: 2	**Labs:** 2	**Workshops:**	**Research study:**	
Teaching methods Lectures, labs, practical work, consultations				
Evaluation/Grading (maximum 100 points)				
Pre-exam require*m*ents		**Points**	**Final exam**	**Points**
Project		60	Written exam	40

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Knowledge management information systems

Teacher:Delibašić V. Boris,Suknović M. Milija

Course status: elective for study group IS&T Management

ECTS points: 6 points

Prerequisites: /

Course objective

To understand the role of knowledge management during information systems development, as well as using methods for improving the business process

Learning outcomes

Acquiring knowledge about needs and rules of knowledge management IS, and about concepts of their development. Understanding various concepts of knowledge management IS, standalone software systems and their implementation.

Course structure and content

Theoretical instruction:

Introduction: Knowledge management (KM) definition. Knowledge management process as a business activity. KM role. History of KM. KM as a scientific discipline. Cognitive science. Expert systems, artificial intelligence and main concepts of knowledge management systems. Computer supported collaborative work, libraries and information science, document management. Simulations, Semantic nets etc. Categorization of KM approaches. Information management. Categorization of KM IS: mechanistic approach, cultural/ behavioural and system approach. The need for KM. KM rules. Knowledge management software packages.

Practical instruction:

Workshop: Using a KM software tool; Case study– analysis of a KM IS; Exploration of new methods for developing KM IS.

Literature/Readings

Tiwana,A. „Knowledge Management Toolkit, The: Practical Techniques for Building a Knowledge Management System“, Prentice Hall, 2002.

Holsapple, Clyde W. „ Handbook on Knowledge Management“ , Springer, 2004. ISBN: 978-3-540-20019-2

The number of class hours per week				Other classes:
Lectures: 2	**Labs:** 2	**Workshops:**	**Research study:**	
Teaching methods				
Evaluation/Grading (maximum 100 points)				
Pre-exam requirements		**Points**	**Final exam**	**Points**
Participation in class		40	Oral exam	60

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Business Systems Efficiency Measurement

Teacher:Martić M. Milan,Savić I. Gordana

Course status: elective for study group Business Intelligence

ECTS points: 6 points

Prerequisites: /

Course objective

Introduction of performance measures and tools for their evaluations. Students will learn advanced concepts of mathematical programming methods – Data Envelopment Analyses (DEA). The method is used for comparative analyses of business systems performances, determine best practices and defining operating and strategic objectives and monitoring their implementation.

Learning outcomes

Students will be able to independently apply data envelopment analysis and specialized DEA software packages as the basis of business intelligence and decision making.

Course structure and content

Theoretical instruction:

Measuring the performance of business systems. Processes and systems to measure and improve performance (eg traditional ratio analysis or Balanced Score Card - BSC) Determination performance measures (key performance indicators). Comparative performance analysis. Quantitative methods for measuring performance. Data envelopment analysis (DEA). Basic and advanced DEA models. Modifications DEA models: models for ranking, Non-radial measures and models with non-convex efficiency frontier, Resource allocation models. Comparison of DEA methods and the multi-criteria analysis. Nonparametric analysis of efficiency. Stochastic frontier efficiency analysis (SFA). Statistical method for efficiency index correction. Implementation of the method and the data quantitative analysis. Software for DEA and SFA to support business intelligence. Models for the following of dynamics. Of the system performance. Comparison of different systems in order to define strategic plan and its adjustments.

Practical instruction:

Measurement and measures of the performance of business systems. The key performance indicators. Data analysis and selection of performance indicators - case study. Comparative analysis of the performance of a specific example. Quantitative models for performance measurement system. Input and output -oriented DEA models. Limiting of the weights. Target inputs and outputs. Andersen - Petersen, additive and FDH models. Profit-oriented DEA models for resource allocation. DEA and multi-criteria analysis. SFA analysis. Modelling and solving problems in MS Excel and specialized software. Business

Game: Determining the best practices and business and adjusting plan.

Literature/Readings

Cooper W, Seiford L, Tone K, "Introduction to Data Envelopment Analysis and its Applications, With DEA-Solver Software", Springer, 2006,

Zue J, " Quantitative Models for Performance Evaluation and Benchmarking: Data Envelopment Analysis with Spreadsheets - Applications and implementations issues ", Springer, 2009.

Bogetoft P, "Performance Benchmarking - Measuring and Managing Performance", Springer, 2012.

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs: 2**	**Workshops:**	**Research study:**	

Teaching methods

Lectures are followed by the corresponding presentations; all models will be illustrated in the hypothetical example. Students will, through case studies and business games using appropriate software, analyze the input and output factors, define plans and target valuable asset for improving the performance of business systems.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Participation in class	10	Written exam	80
Participation in labs	10		

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Method and Tools for Automatization of Information Systems Development

Teacher:Nešković N. Siniša

Course status: elective for study group Information Systems

ECTS points: 6 points

Prerequisites: /

Course objective

To attain practical knowledge and skills in the area of automatization of information systems development

Learning outcomes

Students will be enabled to analyze, select and successfully apply methods and tools which suitable for Automatization of IS development in an organization or a project.

Course structure and content

Theoretical instruction:

The concepts and goals of automatization of information systems development. Categories of CASE software: tools, workbenches and integrated development environments. Basic elements of IS development methodology. Life cycle of IS development. Methods and languages for IS modeling. Model driven development. OMG MDA standard architecture. Domain specific languages. Model transformations. Software production lines. Integrated software environment for automatization of IS development.

Practical instruction:

Laboratory exercises and homework independently made using available CASE tools and Eclipse EMF development environment.

Literature/Readings

1. E-presentations
2. A. Kleppe, J. Warmer, W. Bast, MDA Explained: The Model Driven Architecture, Addison Wesley 2003, ISBN 0-321-19442-X
3. K.Pohl , G. Böckle, F. Linden, Software Product Line Engineering: Foundations, Principles and Techniques, Springer, 2005, ISBN 978-3-540-28901-2

The number of class hours per week				**Other classes:**
Lectures:	**Labs:**	**Workshops:**	**Research study:**	

2	2			
Teaching methods				
Evaluation/Grading (maximum 100 points)				
Pre-exam requirements		**Points**	**Final exam**	**Points**
Project		50	Oral exam	50

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Multimedia databases

Teacher:Starčević B. Dušan,Minović V. Miroslav,Milovanović M. Miloš

Course status: elective for study group Information technologies

ECTS points: 6 points

Prerequisites: /

Course objective

Course serves as an introduction into multimedia databases and provides understanding of multimedia data. Students will acquire knowledge and skills needed to successfully develop and implement different multimedia information systems. Special focus is given on multimedia data storage and search on the Internet.

Learning outcomes

Students will acquire necessary knowledge in domain of multimedia databases development and implementation.

Course structure and content

Theoretical instruction:

P-01: Multimedia databases(basic concepts, characteristics extraction,data search) P-02: Multimedia data P-03: Perceptive mechanims and multimedia P-04: SQL and multimedia. P-05: Work with multimedia P-06: Multimedia databases development P-07: Multimedia metadata P-08: Multimedia databases architectures and performances P-09: Multimedia and Internet P-10: Textual databases P-11: Image databases P-12: Image classification P-13: Case study: Audio and video records, analysis and segmentation P-14: Case study: Audio and video data - metadata P-15: Case study: Audio and video data – manipulation and search

Practical instruction:

V-01: Introduction to multimedia (multimedia types, data formats, standards) V-02: Creating multimedia records V-03: Perceptive media assigments V-04: SQL and Blob objects V-05: Data processing and extraction examples V-06: Using UML for multimedia data modelling V-07: Metadata. Classification examples. Characteristics extraction. Standards. V-08: Multimedia databases architerctures examples. Performance optimization. V-09: NET technologies (.NET Framework, .NET XML Web services, multimedia support) V-10: .NET workshop (developing video streaming server and client) V-11: Using RTP, RTCP and SIP protocols V-12: Using textual databases V-13: Mobile devices and multimedia + Workshop (Services for multimedia data transfer V-14: Oracle Multimedia V-15: Workshop (Application development with Oracle Multimedia + Java ORD library)

Literature/Readings

1. L. Dunckley, „Multimedia Databases – An Object-Realtional Approach“,Addison Wesley, 2003

2. Harald Kosch, Distributed Multimedia Database Technologies Supported by MPEG-7 and MPEG-21, CRC Press, 2003

3. Starčević, D., Štavljanin, V., (2013), „Multimediji“, FON, Beograd

4. R. Steinmetz, K. Nahrstedt, "Media Coding and Content Processing", Springer Verlag, 2002.

5. Havaldar, P., Medioni, G. (2010), Multimedia Systems: Algorithms, Standards, and Industry Practices, Boston, MA: Course Technology, Cengage Learning

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs:** 2	**Workshops:**	**Research study:**	

Teaching methods

Lectures, labs, practical work, consultations

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Project	60	Written exam	40

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Multimedia communications

Teacher:Starčević B. Dušan,Štavljanin B. Velimir,Minović V. Miroslav

Course status: elective for study group Information Technologies

ECTS points: 6 points

Prerequisites: /

Course objective

Expanding previous acquired knowledge and skills in the area of multimedia communications. Students will learn to evaluate current multimedia communication methodologies, techniques and technologies.

Learning outcomes

Understanding mechanics and practucal use of multimedia communication in modern business. Acquiring knowledge and skills needed for advanced communication systems use.

Course structure and content

Theoretical instruction:

P-01: Digital economy and multimedia communication. P-02: Multimedia phenomenon, as a dominant way of storage, presentation, transfer and information perception P-03: Human-computer interaction. Multimodal Communication. P-04: Multimedia data classification: Text and hypertext. Graphic. Animation. P-05: Sound. Video. P-06: Multimedia data storage and transfer standards P-07: Multimedia technologies. P-08: Internet and mobile technologies P-09: User interface. P-10: Web 2.0 Tools. P-11: Application examples: Areas of use. Web 2.0. P-12: CSCW. P-13: Social Networks. P-14: Use of Cloud Technologies. P-15: Digitak Video. Computer Aided Learning (CAL).

Practical instruction:

Students attend labs in aforementioned lessons. Practical instruction is realized in Laboratory for multimedia communications. The work includes examining possibilities for practical application of multimedia communications in laboratory conditions. The emphasis is on mastering Web 2.0 technologies. Student needs to finish labs and also to realize the given task in the field of multimedia communications.

Literature/Readings

1. Starčević, D., Štavljanin, V., (2013), „Multimediji“, FON, Beograd

<table>
<tr><td colspan="5">2. F. Hallsall, "Multimedia Communications", Addison Wesley, 2001.

3. V. Pantović, S. Dinić, D. Starčević,"Savremeno poslovanje i Internet tehnologije", InGraf, 2002.</td></tr>
<tr><td colspan="4">The number of class hours per week</td><td>Other classes:</td></tr>
<tr><td>Lectures:

2</td><td>Labs:

2</td><td>Workshops:</td><td colspan="2">Research study:</td></tr>
<tr><td colspan="5">Teaching methods

Lectures, labs, practical work, consultations</td></tr>
<tr><td colspan="5">Evaluation/Grading (maximum 100 points)</td></tr>
<tr><td colspan="2">Pre-exam requirements</td><td>Points</td><td>Final exam</td><td>Points</td></tr>
<tr><td colspan="2">Practical work, tasks</td><td>30</td><td>Written exam</td><td>50</td></tr>
<tr><td colspan="2">Seminars</td><td>20</td><td></td><td></td></tr>
</table>

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Advance computer networks

Teacher:Starčević B. Dušan,Minović V. Miroslav,Milovanović M. Miloš

Course status: mandatory for study group Information Technologies

ECTS points: 6 points

Prerequisites: /

Course objective

Familiarizing students with advance computer networks and telecommunication systems that relate to fields of wire and wireless communication. Exploring user multimedia services, protocols that are used for data transfer, protection systems and network management. Acquiring knowledge and skills needed for designing, usage and maintenance of advanced communication systems.

Learning outcomes

Students will acquire necessary knowledge needed in the domain of design, usage and maintenance of advanced communication systems.

Course structure and content

Theoretical instruction:

P-01 : Wireless telecommunication systems . GSM mobile telephony . 3G. GPRS and EDGE services . P- 02: DECT. TETRA , UMTS and IMT-2000. P- 03: Satellite systems . Broadcasting systems . P- 04: Wireless and mobile networks . CDMA. P- 05: Wi-Fi wireless local area network . Bluetooth . HyperLAN2 . P- 06: Mobile IP . Mobile ad hoc networks . Mobile transport layer . P- 07: Multimedia. Multimedia network applications . P- 08: Streaming of stored audio and video. P- 09: Voice communication over the Internet . P- 10: Protocols for interactive real-time applications : RTP , RTPC , SIP , H323 . P -11: Security in computer networks . Safety issues . Cryptography . P- 12: Authentication . Integrity . Key distribution and certification . P -13: Access Control : Firewalls . Threats and countermeasures . P-14 : Security protocols : SSL , TSL , IPSec . P-15 : Network Management. Infrastructure network management. Standard environment of Internet network management.

Practical instruction:

V- 01: Mobile services . Problems connecting mobile telephony system with wired systems. V- 02: Solving Tasks (GSM. 3G. GPRS EDGE and DECT. TETRA , UMTS and IMT -2000) . V- 03: DAB and DVB technologies . V- 04: Introduction to Etheral. Wi-Fi networks. V- 05: Bluetooth . HyperLAN2 . V- 06: Mobile IP performance analysis. Ad hoc networks . V- 07: Working with tools for multimedia. V- 08: Working with tools for streaming . V- 09 : Exercises with applications for voice communication . V- 10: Exercises - using RTP , RTPC and SIP protocols . V-11 : Working with cryptographic algorithms . V-12 : Exercises with the systems of data protection and access to resources . V-13 : Exercises with the firewall . V-14 : The use of security protocols

. V-15 : Working with a network management system.

Literature/Readings

1. J. F. Kurose, K. W. Ross, "Umrežavanje računara", CET, 2009
2. D. Comer, »Computers Networks and Internets«, Prentice Hall, 2004
3. A. S. Tanenbaum, "Computer Networks", Prentice Hall, 2003
4. J. Schiller, “Mobile Communications”, Addison Wesley, 2003

The *number of class hours* per *week*				**Other classes:**
Lectures:	**Labs:**	**Workshops:**	**Research study:**	
2	2			

Teaching methods

Lectures, labs, practical work, consultations

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Tasks	20	Written exam	50
Seminar, project	30		

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Advanced Mobile Computing

Teacher:Starčević B. Dušan,Minović V. Miroslav,Milovanović M. Miloš

Course status: elective for study group Information Technologies

ECTS points: 6 points

Prerequisites: /

Course objective

Students will acquire skills and knowledge to write applications for mobile devices. Various platforms, with limited system resources are studied. Also, students will learn to connect mobile devices into computer network infrastructure.

Learning outcomes

Students will acquire skills and knowledge to write applications for mobile devices.

Course structure and content

Theoretical instruction:

P-01: Introduction to mobile computing. Industrial trends. P-02: Wireless communication P-03: Wireless network standards (Wi-Fi. IEEE 802.11. MAC protocol. Mobility inside subnet. Bluetooth. IEEE 802.15, IEEE 802.16, IEEE 802.20). P-04: Advanced celular networks: standards and technologies. P-05: Mobile internet protocol. P-06: Mobile operating systems. P-06: Mobile sensor technologies. P-07: Geolocation systems. P-08: Managing data in mobile environment. P-09: Mobile Applications. P-10: Data exchange services . P-11: User interfaces in mobile computing P-12: Content adaptation. P-13: Usability aspects in mobile computing. P-14: Mobile systems security. P-15: Future technologies in mobile computing.

Practical instruction:

V-01: Mobile computing technologies examples. V-02: Use of usual mobile devices and platforms V-03: Wi-Fi network development and realization examples. V-04: Bluetooth V-05: Using new generation of celular networks V-06: Using mobile IP protocol. V-07: Android OS characteristics and work with according development environment. V-08: iOS characteristics and work with according development V-09: Windows Mobile characteristics and work with according development. V-10:AndroidOS application example. V-11: iOS application example. V-12: Windows Mobile OS application example. V-13: Developing network applications with mobile services. V-14: Developing applications based on sensor technologies. V-15: Adaptive applications development

Literatura :

<table>
<tr><td colspan="5">1. J. McWherter, S. Gowell, Professional Mobile Application Development, Wrox, 2012

2. A.F. Molisch, Wireless Communications, Wiley, 2010

3. Kurose, Ros, Computer Networking, Addison-Wesley, 2009.</td></tr>
<tr><td colspan="4">The number of class hours per week</td><td>Other classes:</td></tr>
<tr><td>Lectures:

2</td><td>Labs:

2</td><td>Workshops:</td><td colspan="2">Research study:</td></tr>
<tr><td colspan="5">Teaching methods

Lectures, labs, practical work, consultations</td></tr>
<tr><td colspan="5">Evaluation/Grading (maximum 100 points)</td></tr>
<tr><td colspan="2">Pre-exam requirements</td><td>Points</td><td>Final exam</td><td>Points</td></tr>
<tr><td colspan="2">Practical work, tasks</td><td>20</td><td>Written exam</td><td>50</td></tr>
<tr><td colspan="2">Project</td><td>30</td><td></td><td></td></tr>
</table>

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Organization of IS&T function and change management

Teacher:Čudanov J. Mladen,Marković D. Vidan

Course status: elective for study group IS&T Management

ECTS points: 6 points

Prerequisites: /

Course objective

Course objective is to introduce students to different models of organizing IS&T function, organizational change and change in a way of business process work, which start as a consequence of implementation of information systems, as well as to get necessary knowledge and skills of change management for IS&T function itself, which are caused by technology development and evolution in approach of information function support.

Learning outcomes

To get skills and knowledge and master techniques necessary for successful change management in the information system life cycle and solving the change resistance. Knowing particular changes in information systems life cycle, as well as knowledge on needed actions to optimize gains and minimize problems which emerge in organization during life cycle of information systems.

Course structure and content

Theoretical instruction:

Place and role of information systems nd technology in organization. Authority and accountability of manager of information systems and technologies function. Definition of organizational change. Typology of organizational change. Organizational transformation. Reengineering of business process. Adizes method of organizational transformation. Lewin's method of organizational change. Koter's approach to leading change. Organizational change resistance. Phases of implenetation of information system. Particularities of ERP implementation. Changes in organization during information systems application.

Practical instruction:

Strategic stance of top management toward the function of information systems and technologies. Position of manager of information systems and technologies function in top management. Recognition and classification of organizational change. Influence of integrated information systems on business process change. Changes in organizational coordination during information systems implementation. Changes in organizational specialization during information systems implementation. Changes in organizational centralization during information systems implementation. Alignment of business process and information systems. Methods of re-engineering implementation.

Literature/Readings

1. Spagnoletti, P: *Organizational Change and Information Systems*. Springer, 2013
2. Čudanov, M (2011) *Organizaciona i strateška primena IKTa*, Beograd, Srbija: Zadužbina Andrejević.
3. Koter, DŽ: *Vođenje promene*. Beograd, Srbija: Želnid, 2000
4. Dulanović, Ž., Jaško, O: *Organizaciona struktura i promene*, Beograd, Srbija: Fakultet organizacionih nauka, 2007
5. Wallace, Thomas F., and Michael H. Kremzar. *ERP: making it happen: the implementers' guide to success with enterprise resource planning*. Wiley, 2002.
6. Keen, P. G. *Information systems and organizational change. Communications of the ACM*, 24(1), 24-33, 1981.

The number of class hours per week				**Other classes:**
Lectures:	**Labs:**	**Workshops:**	**Research study:**	
2	2			

Teaching methods

Monological method, demonstrative method, case study, learning through mutual work on practical problem solution, independent research and problem solving on the background of given problems.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Participation in class	5	Written exam	20
Mid-term paper	65	Project presentation	10

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Data mining

Teacher:Suknović M. Milija,Delibašić V. Boris

Course status: elective for study group Business Intelligence

ECTS points: 6 points

Prerequisites: /

Course objective

Introduction to the important business problems for which data mining can be applied, and gaining skills for using selected data analysis tools.

Learning outcomes

Students have acquired skills to recognize cases where data mining can be used, and how to apply data mining tools for analsis.

Course structure and content

Theoretical instruction:

L-01: Introduction to data mining. L-02: Market basket analysis with case study. L-03: Credit scoring with case study. L-04: Churn prediction with case study. L-05: Electricity load prediction with case study. L-06: Market segmentation with case study. L-07: Gene expression clustering with case study. L-08: Student success prediction with case study. L-09: Collaborative filtering for recommendation systems with case study. L-10: Spam detection with case study. L-11: User comment analysis with case study. L-12: Attribute selection with medical application. L-13: Image analysis with case study. L-14: Anomaly detection in data. L-15: Preparation for the final exam.

Practical instruction:

E-01: Introduction to software tools. E-02: Market basket analysis using software. E-03: Credit scoring using software. E-04: Churn prediction using software. E-05: Electricity load prediction using software. E-06: Market segmentation using software. E-07: Gene expression clustering using software. E-08: Student success prediction using software. E-09: Collaborative filtering for recommendation systems using software. E-10: Spam detection using software. E-11: User comment analysis using software. E-12: Attribute selection with medical application. E-13: Image analysis using software. E-14: Anomaly detection in data. E-15: Preparation for the final exam.

Literature/Readings

1. RapidMiner: Data Mining Use Cases and Business Analytics Applications Edited by Ralf Klinkenberg, Chapman and Hall/CRC 2013, Print ISBN: 978-1-4822-0549-7, eBook ISBN: 978-1-4822-0550-3

The number of class hours per week	**Other classes:**

Lectures: 2	Labs: 2	Workshops:	Research study:	
Teaching methods Classic lecture, lab exercises.				
Evaluation/Grading (maximum 100 points)				
Pre-exam requirements		**Points**	**Final exam**	**Points**
Participation in class			Project work	80
Participation in labs			Written exam	20

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Planning of IS Development

Teacher:Nešković N. Siniša,Marjanović M. Zoran

Course status: elective for study group Information Systems

ECTS points: 6 points

Prerequisites: /

Course objective

To attain theoretical and practical knowledge needed for the process of information system planning

Learning outcomes

Students will be enabled to participate in activities of information system planning, i.e. enabled to create particular elements of IS development plan.

Course structure and content

Theoretical instruction:

Role of ICT in business organizations. Relationship between business strategy and strategy of IS development. Elements of IS development plan. Methods for IS development planning. Enterprise architecture. Business architecture, Logical IS architecture. Technological IS architecture. Analysis and assessment of existing IS. Vision of future IS development. Organization of IS development. Resource plan and temporal plan for IS development.

Practical instruction:

Practical exercises with aim to illustrate particular activities of IS planning and creation of IS plan elements.

Literature/Readings

- E-presentations
- J. Ward, J. Peppard: Strategic Planning for Information Systems, Third Edition, John Wiley & Sons Ltd, 2002. ISBN 0-470-84147-8

The number of class hours per week				**Other classes:**
Lectures:	**Labs:**	**Workshops:**	**Research study:**	0
2	2	0	0	

Teaching methods Conventional lecturing and exercises. Case studies. Seminar homework in small groups.			
Evaluation/Grading (maximum 100 points)			
Pre-exam requirements	**Points**	**Final exam**	**Points**
Project	50	Oral exam	50

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Business analytics and optimization

Teacher:Vujošević B. Mirko,Čangalović M. Mirjana,Martić M. Milan,Stanojević J. Milan,Kuzmanović S. Marija,Savić I. Gordana,Makajić-Nikolić D. Dragana

Course status: elective in study group Business Intelligence

ECTS points: 6 points

Prerequisites: /

Course objective

To provide the students with basic knowledge in business analytics and optimization and to enable them to apply optimization methods in the process of decision making.

Learning outcomes

Students will examine the importance of optimization in business analytics and decision-making. They will be able to recognize situations in which it is possible to successfully apply the methods and techniques of optimization, and to develop decision support systems based on optimization.

Course structure and content

Theoretical instruction:

Introduction to business analytics. Development and trends of business analytics. Business analytics and business decisions. Business intelligence as a part of business analytics. Operations research methods in business analytics. Mathematical modelling of business systems. The architecture of decision support system based on optimization. Algebraic programming languages and their use in developing optimization models. The use of databases Optimization in business analytics – case studies. Postoptimal and sensitivity analyses. Optimization under uncertainty.

Practical instruction:

Work on case studies using available software.

Literature/Readings

1. S. Krčevinac i dr, Operaciona istraživanja 1, FON, Beograd, 2013.

2. S. Krčevinac i dr, Operaciona istraživanja 2, FON, Beograd, 2013.

3. M. Vujošević, Metode optimizacije u inženjerskom menadžmentu, FON, Beograd, 2012.

4. M. Vujošević, Linearno programiranje, FON, Beograd, 2013.

5. J.A. Lawrence, B.A. Pasternack, Applied Management Science, John Wiley & Sons Inc. 2002.

6. R. Fourer, D.M. Gay, B.W. Kernighan, AMPL: A Modeling Language for Mathematical Programming, Duxbury Press / Brooks /Cole Publishing Company, 2002.

7. A. Makhorin, Modeling Language GNU MathProg Language Reference, Free Software Foundation, 2013.

8. R. Saxena, A. Srinivasan, Business Analytics: A Practitioner's Guide, Springer, 2013

9. J. R. Evans, Business Analytics: Methods, Models and Decisions, Pearson, 2013

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs:1**	**Workshops:1**	**Research study:**	

Teaching methods: Classical lessons, work in computer laboratory; workshops.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Participation in class	5	Written exam - project	50
Participation in labs	5	Oral exam	40

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Approaches and tools for developing domain-specific languages

Teacher:Vučković Đ. Milica

Course status: elective for study group Information Systems

ECTS points: 6 points

Prerequisites: /

Course objective The aim of this course is to provide students with the necessary theoretical and practical knowledge of the fundamental concepts of domain-specific languages, the different approaches to their development and the tools and platforms for their implementation.

Learning outcomes The acquired knowledge of the concepts of domain-specific languages as well as the approaches and tools for their design and implementation will enable students to select and use the appropriate approach when developing a domain-specific language for a given domain.

Course structure and content

Theoretical instruction: The course covers four main topics:

First, the fundamental concepts of domain-specific languages (DSL) will be examined: abstract and concrete syntax and semantics (static and dynamic).

Secondly, an overview and analysis of the two main approaches to DLS development will be given, namely the explicit and implicit approach. Different options for the specification of a language model of a domain-specific language in the explicit approach will be studied: metamodels, XML schemas and context-free grammars.

The third topic will cover the implementation of explicit and implicit language models using appropriate software tools such as: parser generator tools, advanced platforms which support explicit language models based on metamodels and dynamic languages for the implementation of implicit languages models.

Finally, the application of the introduced approaches for the design and implementation of domain-specific languages will be illustrated in the context of selected specific domains, through several practical examples.

Practical instruction: Mentoring for student projects.

Literature/Readings

- M. Fowler, *Domain-Specific Languages*. Pearson Education, 2010.
- S. Kelly and J. P. Tolvanen, *Domain-Specific Modeling: Enabling Full Code Generation*, Wiley, 2008.
- T. Clark, P. Sammut and J. Willans, *Applied metamodelling: a foundation for language driven development*. Sheffield: Ceteva, 2008.
- S. Cook, G. Jones, S. Kent and A.C. Wills, *Domain Specific Development with Visual Studio DSL Tools*, Addison-Wesley, 2007.
- R.C. Gronback, *Eclipse Modeling Project: A Domain-Specific Language (DSL) Toolkit*, Addison-Wesley Professional, 2009.

The number of class hours per week	Other classes:

Lectures: 2	Labs: 2	Workshops:	Research study:	
Teaching methods: Lectures. Subsequently, students will individually work on selected and approved topics. Each student will be assigned a mentor (professor and/or teaching assistant) who will, on a weekly basis in a dedicated term (1 hour), review and aid the students in the development of their projects.				
Evaluation/Grading (maximum 100 points)				
Pre-exam requirements		**Points**	**Final exam**	**Points**
Project implementation		70	Project presentation	30

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Machine learning algorithm development

Teacher:Suknović M. Milija,Delibašić V. Boris

Course status: elective for study group Business Intelligence

ECTS points: 6 points

Prerequisites: /

Course objective: Acquiring knowledge for implementation of algorithms of parts of algorithms for machine learning in the selected open-source software environment.

Learning outcomes: Students have gained skills for analysis, implementation, application and evaluation of machine learning algorithms, using selected open-source software.

Course structure and content

Theoretical instruction:

1. Overview of machine learning (ML) algorithms; 2. Overview of open-source software for ML; 3. Structured analysis of ML algorithms; 4. Component-based algorithms – Decision trees; 5. Component-based algorithms – Clustering; 6. Algorithm testing – dataset properties; 7. Algorithm testing – evaluation measures; 8. Advanced ML algorithms – neural networks; 9. Advanced ML algorithms – Support vector machines; 10. Advanced ML algorithms – Ensembles; 11. Meta-learning systems for classification algorithms; 12. Meta-learning systems for clustering.

Practical instruction:

1. Application of ML algorithms in open-source software – classification and regression; 2. Application of ML algorithms in open-source software – clustering and association; 3. Application and development of component-based algorithms in WhiBo enviroment; 4. Project work specification; 5. Selection of available algorithms (in literature and software); 6. Analysis of selected algorithms; 7. Identification of potential improvements of algorithms; 8. Collection of representative datasets for testing; 9. Testing environment definition; 10. New algorithm design; 11. Implementation; 12. Testing; 13. Implementation and testing.

Literature/Readings

1. Radovanovic S., Vukićević M., Jovanović M., Delibašić B., Suknović M., Meta-learning system for clustering gene expression microarray data In proc. of the 4th RapidMiner Community Meeting and Conference, August 27- August 29, Porto, Portugal, www.rcomm2013.org
2. Jovanovic M., Vukicevic M., Isljamovic S., Suknovic M., (2012) Automatic evolutionary design of decision tree algorithm for prediction of university student success, Stochastic Modeling Techniques and Data Analysis International Conference (SMTDA 2012, http://www.smtda.net), 5-8 June, 2012 Chania, Crete, Greece.
3. Vukicevic, M., Delibasic, B., Obradovic, Z., Jovanovic, M., Suknovic, M. (2012) " A Method for Design of Data-tailored Partitioning Algorithms for Optimizing the Number of Clusters in Microarray Analysis," Proc. 2012 IEEE Symposium on Computational Intelligence in Bioinformatics and Computational Biology, San Diego, CA, May 2012.

4. Jovanović M., Delibašić B., Vukićević M., Suknović M. (2011) Optimizing performance of decision tree component-based algorithms using evolutionary algorithm in RapidMiner, In proc. of the 2nd RapidMiner Community Meeting and Conference, June 7-10, Dublin, Ireland, www.rcomm2011.org, 135-149, ISBN 978-3-8440-0093-1
5. Vukićević M., Jovanović M., Delibašić B., Suknović M. (2010) WhiBo - RapidMiner plug-in for component based data mining algorithm design, In proc. of the 1st RapidMiner Community Meeting and Conference, September 13-16, Dortmund, Germany, www.rcomm2010.org, p. 30-35.
6. *M. Jovanovic, B. Delibasic, M. Vukicevic, M. Suknovic, M. Martic (2014), Evolutionary approach for automated component-based decision tree algorithm design, Intelligent Data Analyses, in press*
7. Delibasic B, Jovanovic M, Vukicevic M, Suknovic M, Obradovic Z (2011) Component-based decision trees for classification, Intelligent Data Analysis 15(5), 671-693, http://dx.doi.org/10.3233/IDA-2011-0489, ISSN: 1088-467X
8. Suknovic M, Delibasic B, Jovanovic M, Vukicevic M, Becejski-Vujaklija D, Obradovic Z (2011) Reusable Components in Decision Tree Induction Algorithms, Computational Statistics. DOI: http://dx.doi.org/10.1007/s00180-011-0242-8, ISSN: 1613-9658
9. B. Delibasic, M. Vukicevic, M. Jovanovic, K. Kirchner, J. Ruhland, M. Suknovic, An architecture for component-based design of representative-based clustering algorithms, Data & Knowledge Engineering (2012). doi: http://dx.doi.org/10.1016/j.datak.2012.03.005
10. Delibasic B, Kirchner K, Ruhland J, Jovanovic M, Vukicevic M (2009) Reusable components for partitioning clustering algorithms, Artificial Intelligence Review 32 (1), 59-75. http://dx.doi.org/10.1007/s10462-009-9133-6.

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs: 2**	**Workshops:**	**Research study:**	

Teaching methods

In addition to classic lecture, lab exercises will introduce students with needed tools and environments for development of machine learning algorithms.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Participation in class		Project work	100
Participation in labs			

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Service-oriented architecture

Teacher:Marjanović M. Zoran,Vučković Đ. Milica

Course status: elective for study group Information Systems

ECTS points: 6 points

Prerequisites: /

Course objective

The aim of this course is to enable students to use object-oriented models and SOA-specific methods to design SOA-based information systems and to implement them using object-oriented development environments.

Learning outcomes

At the end of the course the student should be able to specify services identified within the design phase of SOA-based information system, describe the web services using appropriate XML-based standards and realize the implementation of service-oriented information system using different types of web services and various web services development approaches, through work on the project under mentor supervision.

Course structure and content

Theoretical instruction:

Introduction to SOA. Model-driven development (MDD) and Service-oriented architecture (SOA). Modeling SOA: Service identification and specification. Modeling SOA: Service realization and composition. SOA modeling patterns. SOA modeling frameworks. Introduction to web services. Main XML standards that support SOAP-based web services. Other XML standards that support SOAP-based web services. RESTful web services. Web services choreography and orchestration. Event-driven architecture (EDA) and Service-oriented architecture (SOA). Service-component architecture (SCA). Interoperability and i Service-oriented architecture (SOA). Preparing for the exam.

Practical instruction:

Modeling SOA: Service identification. Modeling SOA: Service specification. Consultation for the first phase of the student project. Modeling SOA: Service realization. Modeling SOA: Service composition. Consultation for the second phase of the student project. XML standards that support SOAP-based web services. SOAP-based web services development – Basic concepts. SOAP-based web services development – Advanced concepts. Developing clients for the SOAP-based web services. Consultation for the third phase of the student project. RESTful web services development – Basic concepts. RESTful web services development – Advanced concepts. Developing clients for the RESTful web services.

Consultation for the fourth phase of the student project.

Literature/Readings

1. Erl T., *SOA: Principles of Service Design*, Vol. 1. Upper Saddle River: Prentice Hall, 2008.
2. Hansen M., *SOA using Java Web Services*, Pearson Education, 2007.
3. Rosen M., *Applied SOA: Service-Oriented Architecture and Design Strategies*, John Wiley & Sons, 2008.

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs:** 2	**Workshops:**	**Research study:**	

Teaching methods

Theoretical study (30 class hours), practical study (22 class hours), consultation-based project supervision by the assigned mentor (8 class hours)

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Student project	70	Written exam	30

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Approximate Systems

Teacher:Mihić R. Olivera

Course status: elective for study group Business Intelligence

ECTS points: 6 points

Prerequisites: /

Course objective:

Argumentation methods for correct, approximate and incorrect inference.

Learning outcomes

Students will learn the techniques of proving (and refuting) based on many-valued, modal, relevant, fuzzy and probabilistic logics..

Course structure and content

Theoretical instruction:

1-3. Many-valued logic as an alternative to classical two-valued logic. Matrix semantics of a finite-valued logic. Hilbert formulation of logical system. Soundness and completeness.

4-7. Infinite-valued logic. Intuitionistic logic as an constructive alternative of mathematics foundations. Kripke possible world semantics. Soundness and completeness.

8-11. Propositional language expansion by modal operators. Normal modal logics, material implication and the possible world semantics.

12-15. Correct, approximate and incorrect inference processes. Statistical syllogism, many-valued, probabilistic and fuzzy logics as a base of founding of the approximate inference definition.

Practical instruction:

Practical classes, other forms of lectures, research work

The topics covered by practical instructions and exercises match the theoretical topics given above

Literature/Readings

1. B. F. Chellas, Modal Logic: An Introduction, Cambridge University Press, Cambridge, 1995.
2. D. van Dalen, Logic and Structure, Springer, Berlin, 1980. (Fifth edition 2013)
3. D. Mundici, Advanced Lukasiewicz Calculus and MV-algebras, Springer, Heidelberg, 2011.
4. Z. Ognjanović, M. Rašković, Z. Marković, *Probability logics*, in Z. Ognjanović (editor), Logic in Computer Science, Zbornik radova 12 (20), Mathematical Institute SANU, Belgrade, 2009, pp. 35-111.
5. G. Priest, An Introduction to Non-Classical Logic, Cambridge University Press, Cambridge, 2008.

The number of class hours per week				**Other classes:**
Lectures: 2	Labs: 2	Other type of classes	Research study:	:
Teaching methods Mentoring or classic teaching				
Evaluation/Grading (maximum 100 points)				
Pre-exam requirements		**Points**	**Final exam**	**Points**
Participation in class		10	Written exam	20
Participation in labs		40	Oral exam	30

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Business intelligence systems

Teacher:Suknović M. Milija,Delibašić V. Boris

Course status: mandatory for study group Business Intelligence

ECTS points: 6 points

Prerequisites: /

Course objective

Students should be introduced with concepts of Business intelligence. Additionally students should be familiar with Business intelligence tools and techniques in order to get practical knowledge and skills that should enable them efective usage of data with the goal of quality decision making.

Learning outcomes

At the end of the course students should be able for timely decision making in the situationce when there is the need for big data analysis and when decision making time is limited for making right decisions.

Course structure and content

Theoretical instruction

01: Decision support systems and Business intelligence. 02: Decision making modeling and decision support. 03: Basics of Business intelligence. 04: Data Warehousing. 05: Business analytics and data visualization. 06: Data, text and web mining. 07: Neural networks in data mining. 08: Enterprise performance management. 09: Group and collaborative decision support systems. 10:Knowledge management. 11: Expert systems. 12: Intelligent systems for decision support. 13: Integration and the future of the decision support.14: Business intelligence system - case study 1. 15: Business intelligence system - case study 2.

Practical instruction

01: Decision support systems. 02: Decision support. 03: Introduction to Business intelligence. 04: OLAP cubes. 05: Analytics and visualization. 06: Data mining. 07: Neural networks. 08: Key performance indicators. 09: Group decision support systems. 10: knowledge management. 11: Expert systems. 12: Intelligent decision support systems. 13: Hybrid systems.14: Case study 1. 15: Case study 2.

Literature/readings

1. Turban, E., Aronson, EJ., Liang, TP. & Sharda, R. (2007) Decision Support and Business Intelligence Systems (8th Edition).
2. Suknović M, Delibašić V (2010) Business intelligence and decision support systems, Faculty of Organizational sciences, Belgrade, Serbia.

The number of class hours per week	Other classes:

Lectures: 2	Labs: 2	Workshops:	Research studies:	

Teaching methods

Classical teaching and exercises. Case studies. Work on projects in small groups. Presentation of project results

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	Final Exam	**Points**
Homework project	50	Project proposal	30
		Oral exam	20

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Data warehousing

Teacher:Suknović M. Milija,Delibašić V. Boris

Course status: elective for study group Business Intelligence

ECTS points: 6 points

Prerequisites: /

Course objective

Development of business reporting systems through following steps: aquisition of customers requirements, data warehouse structure design, data cleansing, integration and loading data and implementation of reporting systems in web environment.

Learning outcomes

Students should be capable for acquisition of customers requirements, data warehouse design and implementation as well as implementing reporting system in Microsoft technologies (Integration and Reporting services).

Course structure and content

Theoretical instruction

1. Data warehouse as a part of Business intelligence systems 2. Understanding and acquisition of customers requirements 3. Relational and multidimensional data models 4. Multidimensional data models - Case studies 5. Data warehouse properties - Granularity, integrality 6. Data warehouse properties - time dimension, slowly changing dimensions. 7. ETL - data cleansing 8. ETL - integration 9. OLAP systems and technologies 11.OLAP reporting - case studies. 12. New trends: master data management 13. New trends: Real-time reporting

Practical instruction

1. Pivot report design 2. Design of simple OLAP model 3. Subject selection for project work and definition of business reports. 4. Data warehouse design - multidimensional model definition 5. Data warehouse desogn - definition of granularity levels, slowly changing dimensions and aggregations 6. Introducing to Microsoft integration services 7. ETL - identification of inconsistencies and errors in data. 8. ETL - data cleansing 9. ETL - data integration 10. Data aggregation and OLAP cube design 11. Design of OLAP cube reports in Microsoft Power Pivot technology 12. Introduction to Reporting services 13. Design of reporting system in web environment

Literature/readings

1. Suknović M, Delibašić V (2010) Business intelligence and decision support systems, Faculty of Organizational sciences, Belgrade, Serbia.
2. Kimball, R., & Caserta, J. (2006). The data warehouse ETL toolkit, Wiley Publishing, Inc.
3. Inmon, W. H. (1996). Building the data warehouse, Wiley Publishing, Inc.

<table>
<tr><td colspan="5">4. Mundy, J., & Thornthwaite, W. (2008). The MicrosoftData Warehouse Toolkit: With SQL Server2005 and the MicrosoftBusiness Intelligence Toolset. Wiley Publishing, Inc.</td></tr>
<tr><td colspan="4">The number of class hours per week</td><td>Other classes:</td></tr>
<tr><td>Lectures: 2</td><td>Labs: 2</td><td>Workshops:</td><td>Research studies:</td><td></td></tr>
<tr><td colspan="5">Teaching methods

Classical teaching, Lab exercises</td></tr>
<tr><td colspan="5">Evaluation/Grading (maximum 100 points)</td></tr>
<tr><td colspan="2">Pre-exam requirements</td><td>Points</td><td>Final Exam</td><td>Points</td></tr>
<tr><td colspan="2"></td><td></td><td>Project proposal</td><td>80</td></tr>
<tr><td colspan="2"></td><td></td><td>Oral exam</td><td>20</td></tr>
</table>

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Standardization in information systems and technologies

Teacher:Filipović V. Jovan,Mijatović S. Ivana,Marjanović M. Zoran

Course status: elective for study group IS&T Management

ECTS points: 6 points

Prerequisites: /

Course objective

Acquiring of knowledge about standardization in information systems and technologies on the levels of understanding, application of the acquired knowledge.

Learning outcomes

Active participant will be able to: understand importance, purposes and benefits of ICT standardization; understand roles and complex relationships among organizations for standardization in ICT sector; understand and contribute to researches related to broad aspects of ICT standardization.

Course structure and content

Theoretical instruction:

Standardization and standards - basics. Development and importance of ICT standardization on global market; Classification of ICT standards and standardization. Formal ICT standardization. Consortia based ICT standardization. Sectoral ICT standardization. Organizations for standardization in ICT sector (ITU, ISO, IEC, CEN, CENELEC, ETSI, TIA, TTC, W3C, WWRF, IEEE, OASIS, OMG, IETF, OSI...) and cooperation among them. Relationships between standards and markets. Competing standards and standards battles in area of ICT. Dynamics and quality of standards in ICT. Specific principles of ICT standardization. Paradox of RAND/FRAND principles. Interoperability and compatibility and ICT standards. Standards related to ITC services. ITIL concept. Relationships between ITIL concept and QMS in accordance to ISO 9001. Family of standards ISO/IEC 20000. ISO/IEC 20000 Certification. Relationships between ITIL concept and ISO/IEC 20000. Capability Maturity Model Integration (CMMI). IT Mark

Practical instruction:

Case study: Development of ICT standardization. Standardization Workshop: Classifications of standards. Case Study: ICT standards and market. Standardization workshop: Standards development, Case study:

Standards battle. Case study: Consortia based standardization. Standard development in formal organizations for standardization. Ad hoc de facto standardization. Work shop: ITIL concept, Workshop: ISO /IEC 20000. Workshop: CMMI. Workshop: IT mark.

Literature/Readings:

1. Filipović J., Jovanović B., *Kvalitet i informacione tehnologije - Priručnik za vežbe*, Fakultet organizacionih nauka, Beograd, 2014.
2. Mijatović I., *Standardizacija*, Fakultet organizacionih nauka, 2014.
3. Jakobs K., *Information Communication Technology Standardization for Business Sectors: Integrating Supply and Demand Factors*, IGI Global, 2009.
4. Ahern, Dennis; Jim Armstrong, Aaron Clouse, Jack Ferguson, Will Hayes, Kenneth Nidiffer, *CMMI SCAMPI Distilled: Appraisals for Process Improvement*. Addison-Wesley Professional, 2005.

The number of class hours per week				**Other classes:**
Lectures:	**Labs:**	**Workshops:**	**Research study:**	
2	2			

Teaching methods

Interactive lectures, workshops and case studies

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Participation in class	5	Written exam	20
Seminar papers	20	Verbal exam	35
Midterm exams	20		

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Game Theory and Business Strategy

Teacher:Kuzmanović S. Marija,Martić M. Milan

Course status: elective for study group Business Intelligence

ECTS points: 6 points

Prerequisites: /

Course objective

The course is designed to introduce students to the basic concepts, principles and models of game theory with the goal of providing the student with the tools and the ability to enhance their abilities for strategic and analytical thinking as well as for modeling and analyzing strategic interaction in the complex and interactive business environment.

Learning outcomes

Students will be provided with the tools and the ability to enhance their abilities for strategic and analytical thinking and application of game theory concepts in modeling and solving real world problems.

Course structure and content

Theoretical instruction: P01: Introduction and basic principles: Course objectives. Terminology. Strategic Thinking. Understanding the rules. Rationality and Common Knowledge. Equilibrium. P02-P03. General classes of games and strategies: Cooperative and Non-cooperative games. Simultaneous Games. Sequential Games. Mixed games. Repeated games. P04. Typical games: Prisoner's Dilemma – solving and application. P05-P06. Games with strategic moves: Strategic use of information. Commitment and credibility. Strategic substitutes and complements. Games with asymmetric information. Bayesian games. Signaling games. P07. Cooperative games: Coalitions. The core. The Shapley value. P08-P11. Oligopoly models: Cournot, Bertrand and Stackelberg competition. P12-P15. Applications: Economics. Business. Marketing. Finance. Computer scence. Other applications.

Practical instruction: Modeling strategic interaction. Typical games: Prisoner's dilemma, Coordination, Battle of the sexes, Chicken game, Hawk and Dove. Analogy of the typical games with real situations through examples. Methods and techniques for solving the strategic equilibrium in static and dynamic games. Solving equilibrium in duopoly models. The interpretation of the strategic equilibrium. Software for solving games and simulation. Case Studies: Price war, Market entry, Strategic investment, Negotiation, Auctions.

Literature/Readings

1. Krčevinac, S. et al., Operaciona istraživanja 1, FON, Beograd, 2006.

2. Stojanović, B., Teorija igara - elementi i primena, Službeni glasnik, 2005.

3. Dixit A., and Skeath S., Games of Strategy, 2nd edition, Norton, New York, 2004.

4. Hillas, J., Schiff, A., Game theory and Economic Applications, Lecture notes, 2002.

5. www.gametheory.net

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs:** 2	**Workshops:**	**Research study:**	

Teaching methods

Lectures accompanied by appropriate presentations and multimedia content. Exercises based on realistic and illustrative examples. Creative workshops based on interactive work with students through analysis of case studies, experimental games and simulations.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Class Participation	10	Written exam	30
Practical lectures	30		
Seminar work	30		

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Security Techniques in Computer Networks

Teacher:Simić B. Dejan,Starčević B. Dušan

Course status: elective for study group Information Technologies

ECTS points: 6 points

Prerequisites: /

Course objective The course objective is to transfer knowledge to students about possible threats, attacks, and safeguards that are relevant to Internet environment, and Web services, the basic principles of protection techniques and mechanisms for the protection of information systems and computer networks, various methodological approaches to the design and implementation of protection.

Learning outcomes Students will gain the necessary knowledge in the field of computer networks security on concrete examples.

Course structure and content

Theoretical instruction:

L-01: Introduction to Network Security. L-02: Basic Concepts of Network Security. L-03: Security Models. L-04: Access Control Mechanisms. L-05: Introduction to Cryptography. L-06: Applied Cryptography. L-07: Digital Signature. L-08: Digital Certificates. L-09: SSL/TLS protocol. L-10: IPsec. L-11: Intrusion Detection and Prevention Systems. L-12: Network Security and Wireless Security. L-13: Protecting Applications in Computer Networks. L-14: Electronic Payment Systems Security. L-15: Review of previous lectures and preparing for the exam.

Practical instruction: *Exercises, Other forms of lectures, Research work:*

E-01: Basic Terms in Network Security. E-02: Risk Management Methods. Social Engineering Methods. E-03: Protocols for Network Security. E-04: Nessus E-05: Examples of malicious software (malware) in computer networks. E-06: Linux operating system protection. E-07: Windows operating system protection. E-08: Kerberos. E-09: Examples of Applied Cryptography in Computer Networks. E-10: Steganography. Web Security. E-11: Authentication Methods. E-12: Appying Smart Cards in Computer Networks. E-13: Appying PKI. E-14: Applying Firewalls. E-15: Review of previous excercises and preparation for the exam.

Literature/Readings

1. Lectures in e-form, FOS, 2013.

2. Jim Curose, Keith Ross, *Computer Networking: A Top Down Approach*, 6th edition, Addison-Wesley, 2012.

3. Stallings W., *Network Security Essentials: Applications and Standards*, Pearson Education Limited, 2013.

4. Randy Weaver, *Guide To Network Defense and Countermeasures*, 3rd edition, 2013.
5. Emmett Dulaney, *ComTIA Security+ Deluxe Study Guide*, Sybex, 2009.

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs:** 2	**Workshops:**	**Research study:**	

Teaching methods

Lectures, Exercises, Practical Work, Consultation.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Participation in class	30	Written exam	30
Participation in labs	40		

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Introduction to advanced information system architectures

Teacher:Nešković N. Siniša

Course status: elective for study group Information Systems

ECTS points: 6 points

Prerequisites: /

Course objective

To attain theoretical and practical knowledge in the area of advanced information system architectures

Learning outcomes

Students will be enabled to critically analyze different advanced IS architectures and select one (or combination of more) as the most suitable for an IS in the given organization.

Course structure and content

Theoretical instruction:

The concept of IS architecture. Relationship between IS architecture, development process and models. Zahman's framework. TOGAF standard. Federal Enterprise Architecture standard. Business architecture. Logical IS architecture. Technological IS architecture. Survey of software technological platforms. Model driven architecture. Service oriented architecture. Event driven architecture.

Practical instruction:

In practical exercises particular IS architectures will be illustrated with examples, and within seminar works students will analyze and model architecture of some concrete IS.

Literature/Readings

1. E-Presentations
2. C.Perks, T. Beveridge: Guide to Enterprise IT Architecture, Springer, 2003, ISBN 0-387-95132-6
3. A. Kleppe, J. Warmer, W. Bast, MDA Explained: The Model Driven Architecture, Addison Wesley 2003, ISBN 0-321-19442-X

The number of class hours per week				**Other classes:**
Lectures:	**Labs:**	**Workshops:**	**Research study:**	
2	2			

Teaching methods Conventional lecturing and exercises. Case studies. Seminar homework in small groups.			
Evaluation/Grading (maximum 100 points)			
Pre-exam requirements	**Points**	**Final exam**	**Points**
Project	50	Oral exam	50

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

IS&T Project Management

Teacher:Marković D. Vidan

Course status: elective for study groups Information Systems and IS&T Management

ECTS points: 6 points

Prerequisites: /

Course objective

Implementation and upgrade of basic knowledge about project management in the domain of IS&T projects, analysis of specific aspects of planning and development of IS&T projects, define the expected quality of IS&T solutions (KPI metrics), understanding the impact of implementation of IS&T projects on processes and the way company is organized.

Learning outcomes

Students will be able to analyze all the needs of the IS&T project, define the expected value that the project will bring (KPI metrics), to guide the project through all phases of project management (based on the methodology applied), to assess the impact of implementation of the project on the organizational model and processes inside the company (if any).

Course structure and content

Theoretical instruction:

Introduction to IS&T project management. Modern project management methodology. Definition of the IS&T projects (why, who and how). Managing user requirements (demand management). The preparatory phase of IS&T project. Planning the IS&T project. The implementation of the IS&T project. Monitoring of the IS&T project. Closing the IS&T project.

Practical instruction:

Accepting topic of IS&T project. Preparation of the IS&T Project. Planning the IS&T project. The implementation of the PIS&T project. Monitoring of the IS&T project. Closing the IS&T project.

Literature/Readings

- Basic Literature:

1. Marković B., (review B. Lazarević), *Informatičko sazrevanje kompanije*, Budućnost, Novi Sad, 2005.

- Additional Literature:

- *PMI, PMBOK* verzija 4, PMI, Pensilvanija, 2008.
- Galegios F. i autori, *IT Kontrola i Audit*, second edition, CRC Press LLC, 2004.
- Draft R., *Teorija organizacije i dizajn*, tenth edition, Cengage Lerning, 2008

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs:** 2	**Workshops:**	**Research study:**	

Teaching methods

Theoretical instruction. After theoretical instructions, students are individually working on selected and approved topic. Each student has its mentor (teacher, assistant or teaching associate) that each week, in defined period for a group (1 hour) controls and helps in implementation.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Project development	70	Project presentation	30

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Management of IS Development

Teacher:Pantelić S. Ognjen,Marjanović M. Zoran,Čudanov J. Mladen

Course status: mandatory for study group IS&T Management, elective for study group Information Systems

ECTS points: 6 points

Prerequisites: /

Course objective

The course is designed to introduce students to the specific concepts of managing IT projects and provide necessary knowledge and skills for managing and evaluating system performance.

Learning outcomes

Students have sufficient knowledge and skills for managing IT projects. The student leaves the course with an understanding of different concepts of software systems and the risks of their implementation. The student has knowledge of standards in the field of information systems and technologies.

Course structure and content

Theoretical instruction:

Project management of IS development, IS development models, Analysis of different IS development methodologies, IT service management, Standards in the field of software development processes and system documentation, Software metrics: Different models of software metrics, The role and characteristics of ERP systems, Overview of ERP solutions from different vendors, IT economy, The role of IS in the supply chain management, IS security and business ethics, Content management: Overview of content management IS, Cloud computing and virtualization characteristics, Green IT, The role of business analytics in the development of IS, Big data management, New trends in development of IS.

Practical instruction:

Workshop- Select the best providers offer for information system based on implemented standards, Case study- Analysis of business information systems and simulation of decision making process regarding IS development, Research of new methods in IS development, Examples of ERP system implementation,

Implementation of ITIL framework in the practice.

Literature/Readings

1. Paul, B. Davies, *Business Information Systems*, Palgrave Macmilan, 2009
2. Whitten Bentley Dittman, *Systems analysis and design methods*, McGraw-Hill, 2005
3. Laudon & Laudon, *Management Information systems*, Prentice Hall, 2004
4. Applegate,Austin, McFarlan, *Corporate Information Strategy and Management,* Mc Grow Hil,2003
5. Electronic presentations of lecture, poslis.fon.rs, 2013

The number of class hours per week				**Other classes:**
Lectures:	**Labs:**	**Workshops:**	**Research study:**	
2	2			

Teaching methods

Formal lectures, Workshops, Writing individual student papers

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Student paper	60	Oral exam	40

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Physical Design of IS in Selected Software Environment (project)

Teacher:Aničić M. Nenad,Babarogić S. Slađan

Course status: mandatory for study group Information Systems, elective for study group Business Intelligence

ECTS points: 6 points

Prerequisites: /

Course objective

The goal of this course is to train students to develop and implement real IS in selected modern software environment in accordance with object-oriented specification of IS.

Learning outcomes

Students will extend their knowledge by implementing an information system in an emerging systems environment, using components and patterns through work in project group on certain parts of real systems.

Course structure and content

Theoretical instruction:

Introduction. Explanation of software architecture elements that needs to be implemented. Overview of J2EE development environment. Advanced J2EE development environment technologies. Overview of .NET development environment. Advanced .NET development environment technologies.

Practical instruction: Student projects under mentor supervision

Determining visibility, creating detailed class diagrams. Organizing UML packages of project and implementation models. Persistent framework design using patterns. Mapping model elements into program code. Defining class definition which bases on detailed class diagrams. Defining methods based on interaction diagram and statechart diagram. Implementation in J2EE or .NET environment. Implementation.

Literature/Readings

- Basic Literature:

1. Materials and scripts from lectures and labs, Laboratory for Information systems, FOS

2. e-Presentations on course site pisbp.fon.bg.ac.rs

- Additional Literature:

Larman C., *Applying UML and Patterns-An Introduction to Object-Oriented Analysis and Design and Iterative Development*, 3rd ed., Prentice Hall, 2004.

The number of class hours per week				**Other classes:**
Lectures: 2	**Labs: 2**	**Workshops:**	**Research study:**	

Teaching methods

Theoretical instruction. After theoretical instructions, students are organized into small groups (usually 4 students per group) and are working on selected and approved topic. Each group has its mentor (assistant or teaching associate) that each week, in defined period for a group (1 hour) controls and helps in implementation.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**
Project development	70	Project presentation	30

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Practice Specification

Teacher: All teachers involved in the study program

Course status: Mandatory

ECTS points: 4

Prerequisites: /

Course objective

Training students to do independent research and professional work in identifying and solving specific tasks in the program of study, in real conditions of practice and / or research laboratories and centers.

Learning outcomes

Gaining experience and mastery of skills in the use of deepening and enriching the acquired theoretical and practical knowledge for the purpose of identifying and resolving specific issues and tasks that occur in the real system.

Course structure and content

Elements of the project task; Defining the objectives and tasks of the research; Identification and description of the basic problems through the development of key thesis; The basic methods, techniques and tools for the project professional practice - selection of appropriate methods TOR and predicted empirical research; Basic elements of the presentation of research results - the principles of successful presentations and various forms and characteristics of individual forms, such as the content of written documents, oral, electronic presentations; Defining a specific project task of professional practice for each student - goals and tasks, duties and responsibilities of the student organization (if it is implemented in a particular organization), mode, form and content of the final report, and etc.

Literature/Readings

The *number of class hours* per *week*				
Lectures:	**Labs:**	**Workshops:**	**Research study:** 20	**Other classes:**

Teaching methods

The application of different methods of research, consultations (individual and group). The use of different teaching methods with practical work.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	**Points**	**Final exam**	**Points**

Seminar	50	Written exam	50

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Research proposal

Teacher: All teachers involved in the study program

Course status: Mandatory

ECTS points: 8

Prerequisites: /

Course objective

The main objective is to prepare students for Degree - Master of work, so he is the first phase of development of master work. With the help of mentors, students will be prepared that, with the conquest of the necessary methods and with the use of basic acquired during their studies, scientific-technical and professional application of knowledge, solve a specific problem within the selected areas. As part of these preparations student studying the broader context of the problem, its structure and complexity.

Based on literature student meets with the existing approaches to solving similar tasks and good practice. Based on the conducted comparative analysis of available solutions student brings a proposal of its own approach to solving the complex problems. The aim of the activities of students in this part of the research is to gain the necessary experience through solving complex problems and tasks and identifying opportunities for the application of previously acquired knowledge into practice.

Learning outcomes

Engineer should improve their previous titles acquired those skills and knowledge which enables him to solve the most complex problems. In addition to the knowledge and skills acquired in undergraduate studies, students are trained for research work. Acquire the necessary knowledge in specific scientific fields, methods of scientific research and skills (oral presentation, group communication, etc.). Because creative approach to the interpretation of other people's knowledge and experience can exercise and less scientific contributions. In this way gain a better performance on the market work, and acquired competencies enable them to find employment in research and development centers and institutes, or in companies that are committed to improving their own work and open to new approaches and solutions in the areas of organization and management. In the access student work defines the topic, purpose, research methods, literature you will use.

Course structure and content

The content of the work depends on the particular rešavanog problems and is aligned with the objectives of the case. The work includes the object and purpose of the research, initial hypotheses, research methods, the contribution of access and conclusions.

Literature/Readings

The *number of class hours* per *week*	**Other**

Lectures:	Labs:	Workshops:	Research study:	classes:
			20	

Teaching methods

After discussions with the supervisor about topics of the future specialist labor, student, with the approval of the selected mentors and task-specific, starts making the access operation. During the preparation of this paper, mentor conduct regular consultations to learn about the progress of the student, critically evaluate current work and provides additional guidance in the form of student guidance or reference to a particular literature.

Evaluation/Grading (maximum 100 points)

Pre-exam requirements	Points	Final exam	Points
Creation paper specification	50	Defense graduate paper specification	50

Study program / study programs:Information Systems and Technologies

Degree level: master studies

Course:

Graduate paper specification

Teacher: All teachers involved in the study program

Course status: Mandatory

ECTS points: 18

Prerequisites: /

Course objective

Engineer of organizational sciences should demonstrate an increased ability to research in the case of new or unfamiliar problems in this area, linking the acquired knowledge and skills in solving complex problems, and the ability to follow and adopt papers and research results.

Learning outcomes

Graduate engineers - masters improve their previous knowledge acquired those skills and knowledge that they provide better performance on the market work, and acquired competencies enable them to find employment in research and development centers and institutes, enterprises or their own organizations. Students gain specialization in the above sub-group can independently or in a team to solve the most complex problems, because they deepen previously acquired academic skills and knowledge, understanding and skills. Are trained to solve complex problems. They independently investigate, process the data obtained in the research, draw conclusions, write and defend the results.

Course structure and content

By creating and defending the master's thesis students are usavšavaju in the scientific field that is the subject of their master academic studies and acquire a graduate engineer in the field of master academic studies. Engineer - master has deepened academic theoretical and practical knowledge and skills in the chosen specific scientific field, knows in academia and beyond the accepted methodology for solving complex problems and is able to be independent and creative application in solving the problems that will occur in practice.

Literature/Readings

The *number of class hours* per *week*				**Other classes:**
Lectures:	**Labs:**	**Workshops:**	**Research study:**	

Teaching methods

After accepting the diploma master work of a candidate under the supervision of a mentor approach to designing work. Creating work should be carried out in accordance and in the implementation plan exposed in the application work. Candidate in the laboratory and / or field work independently on the practical aspects of the problems solved. In consultation with the supervisor if necessary checks the work plan, in terms of the elements it contains, or the dynamics of additional sources.

Evaluation/Grading (maximum 100 points)			
Pre-exam requirements	**Points**	**Final exam**	**Points**
Creation graduate paper specification	50	Defense graduate paper specification	50