Program Overview - Computer Engineering

Year I							
Semester I			Hours/week				
No.	M/E	Courses	L	NE	Lab	ECTS	Teacher
1.	M	Advanced Algorithms	2	2	0	6	Agni Dika
2.	M	Programming Paradigms	2	2	0	6	Idriz Ismajli
3.	M	Advanced Computer Logic Design	2	2	0	6	Astrit Ademaj
4.	M	Information Security	2	2	0	6	Blerim Rexha
5.	M	Artificial Intelligence	2	2	0	6	Nysret Musliu
Semester II							
1.	M	Semantic Web	2	2	0	6	Lule Ahmedi
2.	M	Distributed Programming	2	2	0	6	Isak Shabani
3.	M	Systems Programming	2	2	0	6	Idriz Ismajli
4.	M	Legal, Ethical and Social Issues in ICT	2	2	0	6	Blerim Rexha
5.	E	Elective Courses: 1. Methodology of scientific research 2. Computer Vision (Image Understanding)	2 2	2 2	0 0	6 6	1. Lule Ahmedi 2. Yll Haxhimusa

In the II[nd] year of studies, students can choose from two group of courses in the area of Databases or Network Security

Databases and artificial intelligence							
Year II							
Semester III			Hours/week				
No.	M/E	Courses	L	NE	Lab	ECTS	Teacher
1.	M	Web Services	2	1	0	5	Isak Shabani
2.	M	e-Governance	2	1	0	5	Blerim Rexha
3.	M	Nature Inspired Algorithms	2	1	0	5	Agn i Dika
4	M	Seminar in information systems	2	1	0	5	Lule Ahmedi
5	M	Strategic Management	2	1	0	5	Bernard Nikaj
6	E	Elective courses: 1. Patter Recognition and	2	1	0	5	1. Yll Haxhimusa

	Machine Learning					
2.	Parallel Programming	2	1	0	5	2. Blerim Rexha
3.	Hardware Programming	2	0	1	5	3. Agni Dika
4.	Cloud computing	2	1	0	5	4. Astrit Ademaj

Computer Network Security

Semester III			**Hours/week**				
No.	M/E	Courses	L	NE	Lab	ECTS	Teacher
1	M	Patter Recognition and Machine Learning	2	1	0	5	Yll Haxhimusa
2	M	Parallel Programming	2	1	0	5	Blerim Rexha
3	M	Hardware Programming	2	1	0	5	Agni Dika
4	M	Cloud computing	2	1	0	5	Astrit Ademaj
5	M	Strategic Management	2	1	0	5	Bernard Nikaj
6	E	Elective courses:					
		1. Web Services	2	1	0	5	1. Isak Shabani
		2. e-Governance	2	1	0	5	2. Blerim Rexha
		3. Nature Inspired Algorithms	2	1	0	5	3. Agni Dika
		4. Seminar in information systems	2	1	0	5	4. Lule Ahmedi

Semester IV

Master thesis	30

1.1.1. Course Descriptions

Course title: Advanced Algorithms (Mandatory, Sem I, 6 ECTS)
The goal: Course provides advanced knowledge about major algorithms and data structures techniques
Learning outcomes: On successful completion of the course, students will be able to:
1. Use advanced sorting techniques; 2. Use graph algorithms, 3.Use hashing techniques, 4. Use linked lists; 5. Know algorithms about pattern matching; 6. Use techniques from linear programming; 7. Use techniques from dynamic programming; 8. Apply combinatorial Search methods.
Course content: Review of sorting algorithms. Review of graph algorithms. Hashing techniques. Linked lists. Pattern Matching. Linear programming. Dynamic programming. Combinatorial Search.
Methods of teaching: 30 hours of lectures + 30 hours of laboratory exercises. Approximately 100 hours of personal study and exercise including homework.
Grading System: Attendance 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. R. Sedgewick (2001). Algorithms in C: F undamentals, Data Structures, Sorting, Searching and Graph Algorithms in C, Addison Wesley
2. Adam Drozdek (2000). Data Structures and Algorithms in C++, Course TechnologyLatest
3. Jeffrey J. McConnell (2001), Analysis of Algorithms: An Active Learning Approach, Jones and Bartlett Publishers

Course title: Programming Paradigms (Mandatory, Sem. I, 6 ECTS)
The goal: The objective of this course is to provide the students the advanced programming techniques. The well-designed, well-decomposed, factorized and easy-to-understand code based on the atomic approach will be the focus of this course. This means that not only the object-oriented programming paradigm but also the advantages of applying this paradigm in procedural programming will be handled in this course.
Learning outcomes: On completion of this course, students shall be able to: (1) apply the atomic approach, (2) to achieve a well open-designed system, (3) to reach a high cohesion and low-coupling, (4) to achieve a well-designed and reusable software components.
Course content: This course among others will contain: (1) software programming paradigm, (2) object-oriented programming paradigm, (3) cohesion, 4) coupling, (5) factorization, (6) open design.
Methods of teaching: 30 hours of lectures + 20 hours of tutorials exercises + 10 hours of laboratory exercises. Approximately 100 hours of personal study and exercise including appointments.
Grading System: Classroom Assessment 0%, Appointments 15%, Project 20%, Final assessment 65%
Literature:

1. Stanley Lippman, *Essential C++*, ISBN-10=0201485184, 1999
2. R. Kent Dybvig, *The SchemeProgrammingLanguageBeginning Linux Programming*, 4th Edition, ISBN=0-262-62077-4, 1990
3. David R. Musser, Gillmer J. Derge, Atul Saini, *STLTutorialandReferenceGuide*, ISBN=9780201379235, 1995

Course title (the subject): Advanced Computer Logic Design (Mandatory, Sem I, 6 ECTS)
The aim of the course (module): Through this course students will learn the procedures used in the design of complex digital circuits, including the design and practical implementation of 4-bit microprocessor that is able to execute 16 different instructions.
Learning outcomes: After completing this course the student should be able to: 1. To synthesize the basic digital circuits, such as various arithmetic circuits. 2. To analyze synchronous sequential and

asynchronous sequential circuits, using tables and diagrams of the situation and finally the presentation of their work through the situation diagrams. 3. Synthesize different sequential circuits, described by the situation tables or situation diagrams. 4. To test synthesized circuits using one of the simulation programs, such as Multisim.5. To design multi-bit circuits that are able to execute a number of basic instructions.

Contents: Basic knowledge on combinatorial and sequential digital circuits. Design and practical implementation of complex digital circuits. Multi-bit arithmetic circuits for performing basic arithmetic operations. Circuits for adding encoded numbers in NBCD and Excess-3 code. Synthesis of various sequential circuits: detectors of binary sequences, increasing/decreasing counters, counters until a certain condition, registers etc. Internal organization of digital memory. Synthesis of complex digital circuits with many inputs and outputs. Synthesis and practical realization of the digital clock. Synthesis of 4-bit microprocessor which is able to execute 16 basic operations.

Methodology of teaching 30 hours of lectures and 30 hours of laboratory exercises. Approximately 60 hours of independent work including work on independent projects.

Evaluation: Attendance 10%, Project Evaluation 30%, Final Exam 60%

Literature:

1. M. Morris Mano. **Computer Logic Design**. Prentice-Hall, Englewood Cliffs, New Jersey.
2. H. Troy Nagle, Jr., B. D. Carroli, J. D. Irwin. **An introduction to Computer Logic**. Prentice-Hall, Englewood Cliffs, New Jersey.
3. George K. Kostopoulos. **Digital Engineering**. John Wiley & Sons, New York.

Course title: Information Security (Mandatory, Sem. I, 6 ECTS)

Qëllimi i kursit (modulit):. This course provides a broad view of information assurance and security concepts, to appreciate the importance of information security , protection of information assets; access to information system; legislation and industrial standards.

Learning outcomes: This course will prepare students to: (1) Information, Information Systems and Management Information Systems, (2) Identify threats to a computer network: intrusion, Denial of Service, attacks, and malware. (3) Information Security challenges brought about by computers and the Internet. (4) Importance of protecting information assets. (5) Information Security terminology and cryptographic algorthms. (6) Database and database security. (7) Software Security.

Course content: Information, Information Systems and Management Information Systems; Information Security awareness:Training, Education, Profession opportunities; Basic Information Security terminology: Confidentiality, Integrity, Availability, Authentication and Authorization, Configuration and control, Auditing, Policies, Risk Management; Database and database security: data mart and data mining; Information Security Countermeasures: Procedures, Industrial Practices, Physical Access,Alarms and Reporting Structures, Servers Room Protection, Organizational Roles; Software Security:Configuration, Version Control, Documentation, Sandbox, Validation, Testing; Various Legislations

Methods of teaching: 30 hours of lectures + 10 hours of practical exercises + 5 hours of laboratory exercises. Approximately 100 hours of personal study and exercise including seminars.

Grading System: Seminar 10%, Midterm exams 30 %, Final Exam 60 %

Literature:

1. Conklin et al, Principlesof Computer Security: Security+ and Beyond, 1st Edition McGraw Hill, 2005
2. Merkow, M, Breithaupt, J, Information Security: Principles and Practices Prentice Hall ISBN: 0-13-154729-1, 2006
3. Cryptography and Network Security, by William Stallings, ISBN=0-13-187316-4, published by Prentice Hall, 2006.

Course title: **Artificial Intelligence** (Mandatory, Sem. I, 6 ECTS)
The goal: The objective of this course is to give a broad introduction to core concepts of artificial intelligence, including problem solving and search, constraint satisfaction problems and techniques, (meta)heuristic algorithms, and machine learning techniques.
Learning outcomes: A student completing this course should: be able to explain and use exact problem solving techniques in artificial intelligence; understand (met)heuristic techniques and be able to apply them for solving different problems;understand concepts of machine learning and be able to explain supervised machine learning techniques**;** be able to apply supervised machine learning techniques in real-life applications; be able to implement small intelligent systems, which are based on artificial intelligence techniques
Course content: Topics include: intelligent agents, problem solving and search, constraint satisfaction problems and constraint programming techniques, (meta)heuristic techniques, adversarial search and game playing, machine learning concepts, and supervised machine learning techniques.
Methods of teaching: Lectures, labs, demonstration of artificial intelligence applications, assignments/projects.
Grading System: Mid-term exam (20%), Final exam (40%), Assignments/Projects (40%)
Literature:

1. Artificial Intelligence: A Modern Approach (Third Edition) by Stuart Russell and Peter Norvig; 2009
2. Z. Michalewicz and D. B. Fogel. How to Solve It: Modern Heuristics, 2nd edition, Springer-Verlag, 2004

Course title: **Semantic Web** (Mandatory, Sem. II, 6 ECTS)
The goal: The Internet is on the verge to make the vision of the Semantic Web a reality. In Semantic Web, almost every single resource ever including people (their profiles) is anchored to the Web, and made explicit and understandable not only by humans but also by machines. This new Web thus ensures quick, accurate and enhanced web search among others when compared to the traditional Web. In this course, we will examine this exciting area by developing diverse semantic-aware applications.
Learning outcomes: Upon completion of this course, students should be able to: 1. Demonstrate their familiarity with different paradigms of modeling and manipulating data with less semantics to those with semantics as to be understood by computing machines. 2. Apply concepts and technologies of Semantic Web to develop non-traditional applications which infer new knowledge out of already known data / knowledge.
Course content: Topics to cover include: Simple ontologies in RDF and RDF Schema; OWL ontologies; The extension of OWL: OWL 2; Queries on Semantic Web: SPARQL; Rules in Semantic Web: SWRL and RIF; Identifiers and hyper-links in Semantic Web; Exporting databases, XML, etc. into RDF/RDF Schema/ontologies; Linked Data; Beyond fundamentals: applications.
Methods of teaching: 30 hours of lectures + 15 hours of auditorial exercises + 15 hours of laboratory exercises. Approximately 100 hours of personal study and exercise including project work.
Grading System: Project assignment 3 x 20% = 60%, Final Exam 40 %
Literature:

1. Foundations of Semantic Web Technologies. P. Hitzler, S. Rudolph and M. Krötzsch. Chapman & Hall, 2009.
2. Semantic Web Programming. John Hebeler, Matthew Fisher, Ryan Blace, Andrew Perez-Lopez, Mike Dean. Wiley, 2009.
3. A Semantic Web Primer (2nd edition). Grigoris Antoniou, Frank van Harmelen. The MIT Press, 2008.

Course title: Distributed Programming (Mandatory, Sem II. 6 ECTS).
The goal: The course aim is to prepare students to understand distributed programming techniques and apply them in practice.
Learning outcomes: On successful completion of the course, students will be able to: 1. To understand distributed algorithms; 2. To create distributed objects and methods; 3. To create and develop distributed applications; 4.To manage with distributed applications; 5. Realize e project relating a particular issue with distributed applications.
Course content: Introduction to distributed programming. Fundamentals algorithms and terminology. Distributed Algorithms. Remote Objects Technology. RPC. RMI. CORBA. .NET Remoting. Distributed Calculation Methods. Logical Time. Global state and snapshot recording algorithms. Message Queuing and group communications. Termination detections. Mutually exclusive distributed algorithms. Deadlock detection. Shared Distributed Memory.
Methods of teaching: 30 hours of lecture, 30 hours of auditoria exercises and laboratory exercises. Approximately 100 hours of personal study and exercise including project.
Grading System: Attendance 10%, Project 30 %, written tests or final exam 60%.
Literature:

1. Ajay D. Kshemkalyani, MukeshSinghal, "Distributed Computing Principles, Algorithms, and Systems, ©Cambridge University Press, 2008.
2. George Coulouris, Jean Dollimore, Tim Kindberg, Peter Baer Galvin dhe Greg Gagne , "Distributed Systems – Concepts and Design", 5th Edition, 2012.
3. Sarah Morgan, Bill Ryan, Shannon Horn, Mark Blomsma, Murray Gordon, Scott Allen, ".NET Framework 2.0 distributed Application Development", 2006.

Course title: Systems Programming (Mandatory, Sem. II, 6 ECTS)
The goal: The objective of this course is to provide the students with the basic knowledge needed for system programming. The issues addressed in this course are: thread/process manipulating, system i/o (input/output), memory management, file system, signals, mutexes, semaphores, pipes, sockets, etc. The development platform will be Linux (Debian) and Unix (open source Solaris), but Windows will be also used during the course.
Learning outcomes: On completion of this course, students shall: (1) Have basic knowledge about system programming, (2) have knowledge manipulating with threads/processes (3) be able to implement an inter-task (thread/process) synchronization or communication, (4) to manipulate with files and directories, and (5) to use sockets for network communication.
Course content: This course among others will contain: (1) Concept of Task (Process/Thread), (2) Deadline, (3) Mutual Exclusion, 4) Semaphores, (5) Mutexes, (6) Sockets, (7) Concurrent Programming, (8) Inter-Task (Process/Thread) Communication and Synchronisation.
Methods of teaching: 30 hours of lectures + 20 hours of tutorials exercises + 10 hours of laboratory exercises. Approximately 100 hours of personal study and exercise including appointments.
Grading System: Classroom Assessment 0%, Appointments 15%, Project 20%, Final assessment 65%
Literature:

1. Michael Kerrisk, The Linux Programming Interface – *A Linux and Unix System Programming Handbook*, ISBN-10=1-59327-220-0, 2010
2. Neil Matthew, Richard Stones, *Beginning Linux Programming*, 4th Edition, ISBN=978-0-470-14762-7, 2008
3. Kay A. Robbins, Stephen Robbins, *Unix Systems Programming – Communication, Concurrency and Threads*, ISBN=0-13-042411-0, 2003

Course title: Legal, Ethical and Social Issues in ICT (Mandatory, Sem.II, 6 ECTS)
The goal: The purpose of the course is to motivate and apply the concept of critical thinking and information technology's impact on personal, societal, legal and ethical issues.
Learning outcomes: On successful completion of the course, students will be able to:
Think critically about information technology issues, actively engage others in dialogue about them, and relate them to personal and societal values. Analyzing and critically evaluate ideas, arguments, and points of view. Express a reasoned position on an issue, both orally and in writing. Analyze the relationships among ethical, social, and political issues that are raised by information systems. Identify the main moral dimensions of an information society and specific principles for conduct that can be used to guide ethical decisions.
Course content: Introduction to Ethical Theory; Professional Ethics and Responsibility; Critical Thinking Skills; Technology and Privacy; Technology and Free Speech; Encryption and Communication; Intellectual Property; Cybernetic Crime, Security and Protection; Moral Dimension of Information System; Social Issues and Technology;
Methods of teaching: 30 hours of lectures + 15 hours of auditorial exercises + 15 hours of laboratory exercises. Approximately 90 hours of personal study and exercise including seminars.
Grading System: Seminar 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. Sara Baase, Gift of Fire, A: Social, Legal, and Ethical Issues for Computing Technology, 4/E, ISBN-10: 0132492679
2. Joseph Migga Kizza, Ethical and Social Issues in the Information Age, fourth edition, ISBN 978-1-84996-037-3
3. M. David Ermann, Michele S. Shauf; Computers, Ethics, and Society latest Edition, Oxford University Press, ISBN: 0195143027

Course title: Methodology of scientific research (Elective, Sem II, 6 ECTS)
Course objectives: To introduce some key elements of research methodology to first time research students.
Learning outcomes: At the end of this course, the students should be able to: understand some basic concepts of research and its methodologies, identify appropriate research topics, select and define appropriate research problem and parameters, prepare a project proposal (to undertake a project), organize and conduct research (advanced project) in a more appropriate manner, write a research report and thesis, write a research proposal (grants).
Course content: Overview of experimental and engineering methodological approaches to research; Basics of research design (e.g., hypothesis formulation); The research process: documenting research, sources of information, research funding, creativity and intellectual discovery; Guidelines and a framework for efficient development of research; legal and ethical issues; protecting and exploiting research; Intellectual Property rights; Managing the research project: supervision, planning and organization; problems and pitfalls; Presentation skills (written, oral); Use of relevant research tools (technology, experimental infrastructure, mathematical methods, etc.).
Teaching methodology: 30 hours of lectures+30 hours of supervised exercises. Approximately 75 hours of personal study, including homework exercises.
Grading System: Homework 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. Kothari B.L., "*Research Methodology: Tools and Techniques*", New Age International Publishers, 2009.
2. Boot C. W., "*The Craft of Research*", University Of Chicago Press, 2008.

Course title: Computer Vision (Image Understanding) (Elective,Sem II, 6 ECTS)
The goal: The goal is to provide the students with the basic knowledge of digital image processing, computer vision and image understanding so that they will be able to work extract information from images and videos and understand the relevant scientific literature. The lecture provides a set of methods and algorithms, which can be applied and tested on real imagery in the practical course.
Learning outcomes: On completion of this course, students will (1) understand the core technologies in image processing and computer vision, (2) process information out of images and videos, (2) archive and retrieve images, (4) compress images, (5) do image analysis for application like industrial inspection, robotics and similar applications. (7)The students will be able to read and understand the state-of-the-art literature and work in teams.
Course content: Image analysis techniques from image acquisition to complex scene interpretation, including: human visual system, image formation, image preprocessing, mathematical morphology, image segmentation, color image analysis, texture analysis, object recognition, data structures for image analysis, radiometric and geometric transformations, image data compression, 3d image processing, and scene understanding.
Methods of teaching: 30 hours of lectures + 30 hours of tutorials exercises. 90 hours of personal study and home exercises (5 * 30 h = 150 h).
Grading System: Classroom Assessment 5%, Home works and projects 35%, Final assessment 60 %
Literature:

1. R. Szeliski. Computer Vision, Springer 2011.
2. M. Sonka, V. Hlavac, R. Boyle: Image Processing, Analysis and Machine Vision (2nd Edition), PWS Publishing, 1999P.
3. State-of-the-art papers

"Databases and artificial intelligence"

Course title: Web Services (Mandatory, Sem III, 5 ECTS).
The goal: Course aim is to provide students with concepts and techniques on Web services with a full coverage on the development and usage of Web services.
Learning outcomes: On successful completion of the course, students will be able to:
1.To understand main concepts, web services model and architecture; 2. To compare and make distinction among Web services; 3.To allow computer applications to communicate with other applications in other computers through web services on the internet; 4. To write code and create web methods; 5. To implement a project on related issues using Web services.
Course content: What are Web services. Web services model and architecture. XML and XML Schema. XML serialization. XML Web services. SOAP protocol. WSDL. UDDI register. Web services development with Java and C#.NET. Client-Server Web Services. Web Services Programming module. Web service composition. Web service merging. Security Web services, Web service standards: BPEL4WS, WS-Policy, etc.
Methods of teaching: 30 hours of lecture, 30 hours of auditoria exercises and laboratory exercises. Approximately 100 hours of personal study and exercise including project.
Grading System: Attendance 10%, Project 30 %, written tests or final exam 60%.
Literature:

1. Eric Newcomer, "Understanding Web Services: XML, WSDL, SOAP, and UDDI", 2005.

2. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services", Pearson Education, 2004.
3. McGovern, et al., "Java Web Services Architecture", Morgan Kaufmann Publishers, 2005.

Course title: e-Governance (Mandatory, Sem III. 5 ECTS)
The goal: Introducing theelectronic governance concepts, Interoperability, design and architecture of the communication system over the Internet, Fundamentals of the public administration, process modeling and legal infrastructure.
Learning outcomes:After completing this course (course) the student will be able: (1) explain fundamentals of electronic governance, gain a policy and organizational perspective on Information Technology and its relationship to strategic planning, (2) gain a basic understanding of new technologies including the Internet, Intranets, Extranets, and Electronic Commerce and how they impact government operations and structure, (3) study the changing models of government service delivery, (4) Critically evaluate e-government projects, (5) Identify ethical dimensions of information policy.
Course content: Information technology and administrative reform, Governance in a connected world, Strategic planning and e-Government, How IT can Improve the Efficiency and Effectiveness of Government Organizations, information security and privacy , democracy online, managing digital identity, System integration and organizational barriers.
Methods of teaching:30 hours for lectures, 15 hours for exercises and approximately 90 hours of independent work including seminar paper.
Grading System: Attendance and classroom activity: 10%, intermediate evaluations 30%, final exam 60%
Literature:

1. Fountain, J. E. (2001). Building the virtual state : information technology and institutional change. Washington, D.C.: Brookings Institution Press. ISBN: 0815700784
2. Rosen, J., & Wittes, B. (2012). Constitution 3.0 : freedom and technological change. Washington, D.C.: Brookings Institution Press. ISBN: 9780815722120
3. Mayer-Schèonberger, V., & Lazer., D. (2007). Governance and information technology : from electronic government to information government. Cambridge, Mass.: MIT Press.
4. Pavlichev, A., & Garson, G. D. (2004). Digital government : principles and best practices. Hershey, PA: Idea Group Pub. ISBN: 1591401224

Course title: Nature Inspired Algorithms (Mandatory, Sem. III, 5 ECTS)
The goal: Course provides in depth knowledge about major algorithms that are inspired from nature
Learning outcomes: On successful completion of the course, students will be able to: 1. Model various complex optimisation problems; 2. Use techniques from evolutionary algorithms, 3.Use techniques from swarm algorithms, 4. Use techniques from physical algorithms; 5. Hybridize the previous techniques; 6. Perform systematic tests of the presented techniques.
Course content: Evolutionary algorithms (Genetic algorithms); Swarm Algorithms (Bees Algorithm, Ant Colony Optimization); Physical Algorithms (Extremal Optimization, Harmony Search, Cultural Algorithm, Memetic Algorithm); Hybridization of different approaches presented above.
Methods of teaching: 30 hours of lectures + 15 hours of laboratory exercises. Approximately 90 hours of personal study and exercise including homework.
Grading System: Attendance 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

1. Brownlee, Jason, Clever Algorithms: Nature Inspired Programming Recipes, First Edition. LuLu. January 2011, ISBN: 978-1-4467-8506-5

2. Michalewicz, Z., and Fogel, D. B., How to Solve It: Modern Heuristics, Springer, 1995
3. Latest related papers that utilize the presented optimization techniques.

Course title: Seminar in information systems (Mandatory, Sem. III, 5 ECTS)
The goal: To offer the students the opportunity to explore an actual research topic in the field of information systems under the guidance and supervision of the instructor, and discuss it and a range of related topics within the seminar.
Learning outcomes: Upon completion of this course, students will be able to: 1. Elaborate research questions of the corresponding field by using the up-to-date literature. 2. Acquire knowledge on selected range of actual research topics. 3. Gain experience on the presentation techniques and on how to write a report.
Course content: Topics will be covered to provide an in-depth knowledge of the given special sub- field of information systems.
The instructor provides seminar topics on the field of information systems depending on his/her current research interests, and conform to the trends in that field. These topics would usually envision the thesis subjects from the field of information systems to be offered in the fourth semester. Topics vary from semester to semester. Enrollment limits are set by the instructor, as well as the pre-requisites set at discretion of instructor.
Methods of teaching: The course consists of: the kick-off meeting with students interested for the field at the beginning of the semester and distribution of each one topic per student, provide students with the literature required, supervision of the students throughout the whole semester, student presentation sessions at the end of the semester, and deliverable of the written reports which shall summarize the student's work on the topic he/she elaborated.
Grading System: Presentation 30%, Research report 25%, Software 25% (if no software developed as part of the seminar, points considered in the research report), Active participation 20%.
Literature:
1. A comprehensive list of actual resources, i.e., book chapters, research papers, and/or Web resources on each topic of the seminar.
2. A list of tools/systems to support the development of the seminar work.

Subject Title : Strategic Management (Mandatory, Sem III, 6 ECTS)
Course/Module aim: This module aims to introduce to students the concepts of strategy and its importance in managing organizations. It also aims to provide students with enough possibilities to see and apply concepts in practice.
Expected outcomes : This course is an introduction to the field of Strategic Management. It covers the key concepts and theories in the field and how they can be applied to real business situations. All topics are illustrated with case studies about real companies in various different industries. Both lectures and classes will be organized around business cases; in the classes, students are expected to make presentations and to participate actively in the discussions.
Course contents: Topics include: Sources of competitive advantage; Strategic positioning and competition, Building capabilities: Incentives and coordination; Firm scope, vertical integration, and outsourcing; Entrepreneurial firms; Thinking strategically: Competition, strategic investments, and real options; Strategy for Information Markets / Network effects; Corporate strategy; Mergers and acquisitions.
Teaching methodology:30 hours of lectures, 30 hours of practice. Approximately 100 hours of independent work, including the case study preparation. During practice an important role is played by

guest lecturers who are usually sucessfull kosovar entreprenuers talking about their approach to strategy and the importance of strategic management in their organization.
Grading: Case Study on strategy identification 40%, Final Exam 60 % .
Literature :

1. Saloner, G., Shepard, A., and Poldony, J., *Strategic Management*. John Wiley & Sons. (2001; revised version 2005)

Course title: Patter Recognition and Machine Learning (Elective,Sem III,5 ECTS)
The goal: The aim of the lecture is to present the basic concepts and techniques of pattern recognition machine learning as well as their application for e.g. in medicine.
Learning outcomes: Student will be able to analyze practical problems, and offer a solution to the problem. On completion of this course, students will (1) understand the core technologies in pattern recognition and machine learning, (2) analyze and extracts features that are relevant for solving the problem, (2) design classifiers for e.g. perceptron, neural networks, support vectore machines, decision trees etc, (4) estimate probability distribution and usage of the Bayes theorem (5) be able to do dimensionality and feature reduction, (6) test, train and evaluate classifiers (7) and apply these teknologjies in practice. The students will be able to read and understand the state-of-the-art literature and work in teams.
Course content: In order to make these topics more understandable we will put emphasis on the analysis of (bio) image data. The main course topics will be finding robust features, feature dimensionality reduction, simple classifiers, like perceptron, basics in statistics, like conditional and marginal distributions, independence, covariance matrix and Bayes' theorem, as well as more powerful classifier like Bayes classifiers, neural networks, marginal classifiers, like support vector machines (SVN) and (random) decision trees. Many examples from the real life will be shown e.g. chromosome classification, face and object recognition by principal component analysis (PCA), shape analysis etc.
Methods of teaching: 30 hours of lectures + 30 hours of tutorials exercises. 90 hours of personal study and home exercises (5 * 30 h = 150 h).
Grading System: Classroom Assessment 5%, Home works and projects 35%, Final assessment 60 %
Literature:

1. R. Szeliski. Computer Vision, Springer 2011.
2. M. Sonka, V. Hlavac, R. Boyle: Image Processing, Analysis and Machine Vision (2nd Edition), PWS Publishing, 1999P.
3. State-of-the-art papers

Course title: Parallel Programming (Elective, Sem. III, 5 ECTS)
The goal: Introduction to concurrent programming techniques, multitasking, thread, processes and different synchronization mechanisms in kernel and user mode.
Learning outcomes: On successful completion of the course, students will be able to: 1. have basic knowledge about parallel programming 2. have basic knowledge about threads, processes, and different synchronization techniques 3. have basic knowledge about multitasking support from operating system4. have basic knowledge about Component Object Model (COM) and distributed COM, RMI and Web Services 5. be able to recognize the need (advantages and disadvantages) for concurrent programming 6.be able to apply different thread synchronization techniques
Course content: Introduction to Parallel Programming: Concepts and terminology**;** Threads and Processes: Introducing Multitasking (Cooperative and pre-emptive), Threads and processes, Thread function, Context switching, Pro and contra for using threads; Thread synchronization: Critical sections, Locks, Deadlocks and starvation, Mutexes, Semaphores, Events, Wait Functions; Network

communications: Networks, IP. TCP and UDP, Internet, Client-Server model, Socket connections, Memory map, Name pipes, Mail slots; Distributed computing – COM, DCOM & RMI: Component benefits, What is COM, The Interface, Implementing a interface, Query Interface, Dynamic Linking, GUID-s and registry, Distributed COM, Proxy and stub DLL, Java RMI; Distributed computing – Web Services: Introduction to XMP, using XML, What is Web Services?, Web Service Components, Writing a Web Service, Consuming a Web Service, Web Service Security; Designing parallel programs – Understand the problem and the program, Automatic vs. manual parallelization, Communications, Synchronization, Granularity, Load balancing, Limit and costs of parallel programming; Services and Dynamic Link Libraries: Windows services, Creating a service, Installing and removing a service, What is a DLL?, Loading and Unloading a DLL, Creating and using DLL-s, Using shared memory with DLL-s, Resource only DLL;

Methods of teaching: 15 hours of lectures + 30 hours of numerical exercises. Approximately 90 hours of personal study and exercise including seminars.

Grading System: Class activity and regular presence 10%, intermediary assessments 30 %, Final Exam 60 %

Literature:

1. Doug Lea, Concurrent Programming in Java. 2nd Edition , The Java Series, ISBN: 0-201-31009-0, 2000
2. Marshal Brain, Win32 System Services, ISBN: 0-13-324732-5, , Prentice Hall, 1996
3. Julian Templeman, Beginning Windows NT Programming, ISBN: 1-861000-17-0, Wrox Press, 1998
4. Dale Rogerson, Inside COM, ISBN: 1-57231-349-8, Microsoft Press, 1997
5. Ashish Banerjee and group of authors, C# Web Services, ISBN: 1-861004-7, Wrox Press, 2001

Course title: Hardware Programming (Elective, Sem III, 5 ECTS)

The aim of the course:Through this course students will learn the principles of hardware programming and its use in the realization of various practical devices using microcontrollers.

Learning outcomes:After completing this course student should be able to: 1 Choose a microcontroller for various practical implementations. 2. Write programs in one of the programming languages that are used for microcontroller programming. 3. Use ordinary microcontrollers to carry the work of various digital circuits, combinatorial and sequential. 4. Practically build different devices which use microcontrollers and various sensors that get information from the surrounding environment.

Contents:Languages that are used for programming of hardware. Microcontrollers and their practical use. Programming of Microcontrollers using of basic practical examples. Writing software for simulating the work of various digital circuits, such as coders, decoders, code converters and comparators. Implementation to design various arithmetic multi-bit circuits. Microcontroller programming to carry the work of various sequential circuits, such as different counters. Examples of implementation to design various devices by using ordinary microcontrollers. Implementation of digital clock with all possible options. Presentation of results in ordinary displays, or on LCD displays. Realizations of practical devices using data from different external sources (for example temperature sensors).

Methodology of teaching:30 hours of lectures and 15 hours of laboratory exercises. Approximately 60 hours of independent work including realization of various practical devices.

Evaluation:Attendance 10%, Practical Work 60% and Final Exam 30%.

Literature:

1. Max Rabiee. Programmable Logic Controllers: Hardware and Programming. Goodheart-Willcox Publisher, USA
2. Michael Barr. Programming Embedded Systems in C and C++. O'Reilly Media, Inc., USA
3. John Catsoulis. Designing Embedded Hardware. O'Reilly Media, Inc., USA
4. Simon Monk. Programming Arduiono. McGraw-Hill Professional. USA

“Computer Network Security”

Course title: Patter Recognition and Machine Learning (Mandatory,Sem III,5 ECTS)
The goal: The aim of the lecture is to present the basic concepts and techniques of pattern recognition machine learning as well as their application for e.g. in medicine.
Learning outcomes: Student will be able to analyze practical problems, and offer a solution to the problem. On completion of this course, students will (1) understand the core technologies in pattern recognition and machine learning, (2) analyze and extracts features that are relevant for solving the problem, (2) design classifiers for e.g. perceptron, neural networks, support vectore machines, decision trees etc, (4) estimate probability distribution and usage of the Bayes theorem (5) be able to do dimensionality and feature reduction, (6) test, train and evaluate classifiers (7) and apply these teknologjies in practice. The students will be able to read and understand the state-of-the-art literature and work in teams.
Course content: In order to make these topics more understandable we will put emphasis on the analysis of (bio) image data. The main course topics will be finding robust features, feature dimensionality reduction, simple classifiers, like perceptron, basics in statistics, like conditional and marginal distributions, independence, covariance matrix and Bayes’ theorem, as well as more powerful classifier like Bayes classifiers, neural networks, marginal classifiers, like support vector machines (SVN) and (random) decision trees. Many examples from the real life will be shown e.g. chromosome classification, face and object recognition by principal component analysis (PCA), shape analysis etc.
Methods of teaching: 30 hours of lectures + 30 hours of tutorials exercises. 90 hours of personal study and home exercises (5 * 30 h = 150 h).
Grading System: Classroom Assessment 5%, Home works and projects 35%, Final assessment 60 %
Literature:

1. R. Szeliski. Computer Vision, Springer 2011.
2. M. Sonka, V. Hlavac, R. Boyle: Image Processing, Analysis and Machine Vision (2nd Edition), PWS Publishing, 1999P.
3. State-of-the-art papers

Course title: Parallel Programming (Mandatory, Sem. III, 5 ECTS)
The goal: Introduction to concurrent programming techniques, multitasking, thread, processes and different synchronization mechanisms in kernel and user mode.
Learning outcomes: On successful completion of the course, students will be able to: 1. have basic knowledge about parallel programming 2. have basic knowledge about threads, processes, and different synchronization techniques 3. have basic knowledge about multitasking support from operating system4. have basic knowledge about Component Object Model (COM) and distributed COM, RMI and Web Services 5. be able to recognize the need (advantages and disadvantages) for concurrent programming 6.be able to apply different thread synchronization techniques
Course content: Introduction to Parallel Programming: Concepts and terminology**;** Threads and Processes: Introducing Multitasking (Cooperative and pre-emptive), Threads and processes, Thread function, Context switching, Pro and contra for using threads; Thread synchronization: Critical sections, Locks, Deadlocks and starvation, Mutexes, Semaphores, Events, Wait Functions; Network communications: Networks, IP. TCP and UDP, Internet, Client-Server model, Socket connections, Memory map, Name pipes, Mail slots; Distributed computing – COM, DCOM & RMI: Component benefits, What is COM, The Interface, Implementing a interface, Query Interface, Dynamic Linking, GUID-s and registry, Distributed COM, Proxy and stub DLL, Java RMI; Distributed computing – Web

Services: Introduction to XMP, using XML, What is Web Services?, Web Service Components, Writing a Web Service, Consuming a Web Service, Web Service Security; Designing parallel programs – Understand the problem and the program, Automatic vs. manual parallelization, Communications, Synchronization, Granularity, Load balancing, Limit and costs of parallel programming; Services and Dynamic Link Libraries: Windows services, Creating a service, Installing and removing a service, What is a DLL?, Loading and Unloading a DLL, Creating and using DLL-s, Using shared memory with DLL-s, Resource only DLL;

Methods of teaching: 15 hours of lectures + 30 hours of numerical exercises. Approximately 90 hours of personal study and exercise including seminars.

Grading System: Class activity and regular presence 10%, intermediary assessments 30 %, Final Exam 60 %

Literature:

1. Doug Lea, Concurrent Programming in Java. 2nd Edition , The Java Series, ISBN: 0-201-31009-0, 2000
2. Marshal Brain, Win32 System Services, ISBN: 0-13-324732-5, , Prentice Hall, 1996
3. Julian Templeman, Beginning Windows NT Programming, ISBN: 1-861000-17-0, Wrox Press, 1998
4. Dale Rogerson, Inside COM, ISBN: 1-57231-349-8, Microsoft Press, 1997
5. Ashish Banerjee and group of authors, C# Web Services, ISBN: 1-861004-7, Wrox Press, 2001

Course title: Hardware Programming (Mandatory, Sem III, 5 ECTS)

The aim of the course: Through this course students will learn the principles of hardware programming and its use in the realization of various practical devices using microcontrollers.

Learning outcomes: After completing this course student should be able to: 1 Choose a microcontroller for various practical implementations. 2. Write programs in one of the programming languages that are used for microcontroller programming. 3. Use ordinary microcontrollers to carry the work of various digital circuits, combinatorial and sequential. 4. Practically build different devices which use microcontrollers and various sensors that get information from the surrounding environment.

Contents: Languages that are used for programming of hardware. Microcontrollers and their practical use. Programming of Microcontrollers using of basic practical examples. Writing software for simulating the work of various digital circuits, such as coders, decoders, code converters and comparators. Implementation to design various arithmetic multi-bit circuits. Microcontroller programming to carry the work of various sequential circuits, such as different counters. Examples of implementation to design various devices by using ordinary microcontrollers. Implementation of digital clock with all possible options. Presentation of results in ordinary displays, or on LCD displays. Realizations of practical devices using data from different external sources (for example temperature sensors).

Methodology of teaching:30 hours of lectures and 15 hours of laboratory exercises. Approximately 60 hours of independent work including realization of various practical devices.

Evaluation: Attendance 10%, Practical Work 60% and Final Exam 30%.

Literature:

1. Max Rabiee. Programmable Logic Controllers: Hardware and Programming. Goodheart-Willcox Publisher, USA
2. Michael Barr. Programming Embedded Systems in C and C++. O'Reilly Media, Inc., USA
3. John Catsoulis. Designing Embedded Hardware. O'Reilly Media, Inc., USA
4. Simon Monk. Programming Arduiono. McGraw-Hill Professional. USA

Subject Title : Strategic Management (Mandatory,Sem III, 6 ECTS)
Course/Module aim: This module aims to introduce to students the concepts of strategy and its importance in managing organizations. It also aims to provide students with enough possibilities to see and apply concepts in practice.
Expected outcomes : This course is an introduction to the field of Strategic Management. It covers the key concepts and theories in the field and how they can be applied to real business situations. All topics are illustrated with case studies about real companies in various different industries. Both lectures and classes will be organized around business cases; in the classes, students are expected to make presentations and to participate actively in the discussions.
Course contents: Topics include: Sources of competitive advantage; Strategic positioning and competition, Building capabilities: Incentives and coordination; Firm scope, vertical integration, and outsourcing; Entrepreneurial firms; Thinking strategically: Competition, strategic investments, and real options; Strategy for Information Markets / Network effects; Corporate strategy; Mergers and acquisitions.
Teaching methodology:30 hours of lectures, 30 hours of practice. Approximately 100 hours of independent work, including the case study preparation. During practice an important role is played by guest lecturers who are usually sucessfull kosovar entreprenuers talking about their approach to strategy and the importance of strategic management in their organization.
Grading: Case Study on strategy identification 40%, Final Exam 60 % .
Literature :

1. Saloner, G., Shepard, A., and Poldony, J., *Strategic Management*. John Wiley & Sons. (2001; revised version 2005)

Course title: Web Services (Elective, Sem III, 5 ECTS).
The goal: Course aim is to provide students with concepts and techniques on Web services with a full coverage on the development and usage of Web services.
Learning outcomes: On successful completion of the course, students will be able to:
1.To understand main concepts, web services model and architecture; 2. To compare and make distinction among Web services; 3.To allow computer applications to communicate with other applications in other computers through web services on the internet; 4. To write code and create web methods; 5. To implement a project on related issues using Web services.
Course content: What are Web services. Web services model and architecture. XML and XML Schema. XML serialization. XML Web services. SOAP protocol. WSDL. UDDI register. Web services development with Java and C#.NET. Client-Server Web Services. Web Services Programming module. Web service composition. Web service merging. Security Web services, Web service standards: BPEL4WS, WS-Policy, etc.
Methods of teaching: 30 hours of lecture, 30 hours of auditoria exercises and laboratory exercises. Approximately 100 hours of personal study and exercise including project.
Grading System: Attendance 10%, Project 30 %, written tests or final exam 60%.
Literature:

4. Eric Newcomer, “Understanding Web Services: XML, WSDL, SOAP, and UDDI”, 2005.
5. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services", Pearson Education, 2004.
6. McGovern, et al., "Java Web Services Architecture", Morgan Kaufmann Publishers, 2005.

Course title: e-Governance (Elective, Sem III. 5 ECTS)
The goal: Introducing theelectronic governance concepts, Interoperability, design and architecture of the communication system over the Internet, Fundamentals of the public administration, process modeling and legal infrastructure.
Learning outcomes:After completing this course (course) the student will be able: (1) explain fundamentals of electronic governance, gain a policy and organizational perspective on Information Technology and its relationship to strategic planning, (2) gain a basic understanding of new technologies including the Internet, Intranets, Extranets, and Electronic Commerce and how they impact government operations and structure, (3) study the changing models of government service delivery, (4) Critically evaluate e-government projects, (5) Identify ethical dimensions of information policy.
Course content: Information technology and administrative reform, Governance in a connected world, Strategic planning and e-Government, How IT can Improve the Efficiency and Effectiveness of Government Organizations, information security and privacy , democracy online, managing digital identity, System integration and organizational barriers.
Methods of teaching:30 hours for lectures, 15 hours for exercises and approximately 90 hours of independent work including seminar paper.
Grading System: Attendance and classroom activity: 10%, intermediate evaluations 30%, final exam 60%
Literature:

5. Fountain, J. E. (2001). Building the virtual state : information technology and institutional change. Washington, D.C.: Brookings Institution Press. ISBN: 0815700784
6. Rosen, J., & Wittes, B. (2012). Constitution 3.0 : freedom and technological change. Washington, D.C.: Brookings Institution Press. ISBN: 9780815722120
7. Mayer-Schèonberger, V., & Lazer., D. (2007). Governance and information technology : from electronic government to information government. Cambridge, Mass.: MIT Press.
8. Pavlichev, A., & Garson, G. D. (2004). Digital government : principles and best practices. Hershey, PA: Idea Group Pub. ISBN: 1591401224

Course title: Nature Inspired Algorithms (Elective, Sem. III, 5 ECTS)
The goal: Course provides in depth knowledge about major algorithms that are inspired from nature
Learning outcomes: On successful completion of the course, students will be able to: 1. Model various complex optimisation problems; 2. Use techniques from evolutionary algorithms, 3.Use techniques from swarm algorithms, 4. Use techniques from physical algorithms; 5. Hybridize the previous techniques; 6. Perform systematic tests of the presented techniques.
Course content: Evolutionary algorithms (Genetic algorithms); Swarm Algorithms (Bees Algorithm, Ant Colony Optimization); Physical Algorithms (Extremal Optimization, Harmony Search, Cultural Algorithm, Memetic Algorithm); Hybridization of different approaches presented above.
Methods of teaching: 30 hours of lectures + 15 hours of laboratory exercises. Approximately 90 hours of personal study and exercise including homework.
Grading System: Attendance 10%, Mid-term exams 30 %, Final Exam 60 %
Literature:

4. Brownlee, Jason, Clever Algorithms: Nature Inspired Programming Recipes, First Edition. LuLu. January 2011, ISBN: 978-1-4467-8506-5
5. Michalewicz, Z., and Fogel, D. B., How to Solve It: Modern Heuristics, Springer, 1995
6. Latest related papers that utilize the presented optimization techniques.

Course title: Seminar in information systems (Elective, Sem. III, 5 ECTS)

The goal: To offer the students the opportunity to explore an actual research topic in the field of information systems under the guidance and supervision of the instructor, and discuss it and a range of related topics within the seminar.

Learning outcomes: Upon completion of this course, students will be able to: 1. Elaborate research questions of the corresponding field by using the up-to-date literature. 2. Acquire knowledge on selected range of actual research topics. 3. Gain experience on the presentation techniques and on how to write a report.

Course content: Topics will be covered to provide an in-depth knowledge of the given special sub- field of information systems.

The instructor provides seminar topics on the field of information systems depending on his/her current research interests, and conform to the trends in that field. These topics would usually envision the thesis subjects from the field of information systems to be offered in the fourth semester. Topics vary from semester to semester. Enrollment limits are set by the instructor, as well as the pre-requisites set at discretion of instructor.

Methods of teaching: The course consists of: the kick-off meeting with students interested for the field at the beginning of the semester and distribution of each one topic per student, provide students with the literature required, supervision of the students throughout the whole semester, student presentation sessions at the end of the semester, and deliverable of the written reports which shall summarize the student's work on the topic he/she elaborated.

Grading System: Presentation 30%, Research report 25%, Software 25% (if no software developed as part of the seminar, points considered in the research report), Active participation 20%.

Literature:

3. A comprehensive list of actual resources, i.e., book chapters, research papers, and/or Web resources on each topic of the seminar.
4. A list of tools/systems to support the development of the seminar work.

Course title: Master Thesis (Mandatory, Sem. IV, 30 ECTS)

The goal: Master thesis is the final scientific work that will prove the student capability to work on a scientific topic independently by using methodologically sound approaches.

Learning outcomes: At the end of this course, students will be capable to: 1. Read and understand state-of-the-art literature. 2. Independently specify, analyze and propose solutions. 3. Explain and discuss critically results. 4. Present and defend the thesis in a written and oral form.

Course content: The thesis could be proposed by the supervisor or can be chosen by the student, and should be in the accordance with the qualification profile. 1. Reading of the state of the art. 2. Understanding and specifying the problem. 3. Design and implement different solutions. 4. Analyze and discuss critically the results.

Methods of teaching:

Compliant with the actual regulation at the faculty level on how to conduct a master thesis.

Literature:

1. Jean-Luc LeBrun. Scientific Writing. World Scientific, 2007.
2. Depending on the topic covered in thesis, different bibliographic resources will be recommended by the teachers.