UNIVERSITETI I EVROPËS JUGLINDORE
УНИВЕРЗИТЕТ НА ЈУГОИСТОЧНА ЕВРОПА
SOUTH EAST EUROPEAN UNIVERSITY

Study program	Applied Informatics for IT companies (2013/2014)
Faculty	Contemporary Sciences and Technologies
Study Cycle	First Cycle (Undergraduate)
ECTS	180
Accreditation date	10.09.2013

Description of the program

The undergraduate program (Bachelor of Science) of Applied Informatics for IT Companies incorporates the best from the Informatics and Computer Science fields and the applied knowledge in the IT oriented companies. This combination of IT knowledge and its application in business, gives an impetus to the contemporary trends in the IT industry as well as preparing students for the position of experts in different areas of businesses in the state and around the World. The labor market demands such skills in applied knowledge in the field of IT in the economy, business, which indicated that the demands of the business are taken into account when suggesting such direction compliant with such student profile.

The structure of this three-year programme contains studies which by nature are dynamic, integrative and interactive. It is expected that these studies will generate high professional results adapted to the needs of the labor market, especially IT-enabled businesses in Macedonia, the region and the world, while serving as a sound basis for continuing studies at the post-graduate level.

The program also includes parts integrated with the practice, which enables students develop different applications for the needs of the business, in collaboration with companies. An important factor is that students will take 5-6 months per year of practical engagement in IT companies.

Career

This program will be offered in English, in collaboration with German integrated experts, where 50% of instruction will be held at the university, while 50% in a company. Employment rate of students in this study program is usually 100% due to the fact that students sign an agreement with a company that will support the student’s studies and meanwhile employ him or her after successful completion of studies.

Choosing the field of studies probably is one of the most important choices in the lives of young people. This is the main pillar that affects future occupation throughout one’s life. Therefore, it is time to decide about the profession that will provide respect, reputation, pleasure and of course a secure existence.

In order to create the required professionals and to retain them on a longer term, is the main task of any company. The professional worker is crucial to the company's success in the market. Therefore, the needs for training young people in accordance with the needs of the company are a necessary requirement of a contemporary market economy. The business world often requires more and more adaptation and unification of business practices in order to create a sole working culture.

Nowadays, companies and business institutions are interested in students who graduate from universities to be closer to

them and respond to their requests. Based on German advanced models, SEEU has prepared for this academic year, integrated study with practice.

Students will perform the study projects at the university according to the requirements of the company. After graduation, at the same time the graduate student will be employed by the company.

Applied Informatics for IT companies is an attractive degree that tries to fill in the gap that companies are having when dealing with young worker employability. Instead of additional training for young staff, IT companies should be focused in receiving real professionals immediately after they graduate. The investment they do in the beginning will be a return to them right after the students is employed in the IT company. What companies need is to have you as a professional in their business rather than just a diploma degree. Applied Informatics for IT companies is a new concept nowadays for new students in Macedonia and the region.

Learning outcomes

Knowledge and understanding

- Possession of knowledge and understanding of areas in Computer Science and Informatics (programming, web technologies, databases, networks, and computer and information systems).
- Ability to develop and implement original and creative ideas in IT companies.
- Ability to apply interdisciplinary knowledge and demonstrating specialist competencies of Computer Science and Informatics.
- Have knowledge of one or more subject areas that qualify the student as an expert on the application of knowledge in a given area.

Applying knowledge and understanding

- Ability to critically, independently and creatively solve problems in new and unpredicted conditions for which there is no previous experience in the IT industry.
- Planning, management and evaluation of independent research in the area of information systems but also programming and implementation of appropriate computing tools, technologies and environment.
- Creativity and originality in the interpretation of informatics knowledge in solving the problems in the IT industry.

Making judgement

- Ability for creative integration and synthesis of knowledge from several areas related to IT and business processes by utilizing computer tools and techniques.
- Ability to deal with complex situations related to specific business processes, which emerge in real-time in the IT companies.
- Ability to identify appropriate specialized instances in the IT industry and making sound judgments in situations with lack of complete information or data, and based on personal, social and ethical principles and responsibilities related to the application of knowledge and understanding.

Communication skills

- Ability to exchange findings and suggestions with argumentation and rationally reinforcing them with both professionals and unskilled people, clearly and unambiguously;
- Taking considerable responsibility for shared outcomes; running and initiating activities.

Learning skills

- Ability to identify personal needs and directions for individual and autonomous education and its performance independently and autonomously in the typical information areas.
- Ability to assume responsibility for continued individual studying in specialized business and information areas within the economy.
- Ability to assume responsibility for further professional development and training.

List of courses

Semester 1

- [6.0 ECTS] **Computer Systems**
- [6.0 ECTS] **Programming Concepts**
- [6.0 ECTS] **Calculus**
- [6.0 ECTS] **Free elective course 1**
- [3.0 ECTS] **Elective Albanian / Macedonian Language I / 1**
- [3.0 ECTS] **Elective English Language I / 2**

Semester 2

- [6.0 ECTS] **Computer programming C++**
- [6.0 ECTS] **Linear Algebra**
- [6.0 ECTS] **Web Technologies and Architectures**
- [6.0 ECTS] **Free elective course 2**
- [3.0 ECTS] **Elective Albanian / Macedonian Language II / 3**
- [3.0 ECTS] **Elective English Language II / 4**

Semester 3

- [6.0 ECTS] **Optimization Methods**
- [6.0 ECTS] **Web Technologies**
- [6.0 ECTS] **Object-Oriented Programming**
- [6.0 ECTS] **Free elective course 3**
- [6.0 ECTS] **Elective English for specific purposes I / 5**

Semester 4

- [6.0 ECTS] **Relational databases and SQL**
- [6.0 ECTS] **Applied Probability and Statistics**
- [6.0 ECTS] **Operating Systems**
- [6.0 ECTS] **Elective English for specific purposes II / 6**
- [6.0 ECTS] **Elective course / 7**

Semester 5

- [6.0 ECTS] **Web Programming**
- [6.0 ECTS] **Computer Networks**
- [6.0 ECTS] **Software Engineering**
- [6.0 ECTS] **Advanced elective course / 8**
- [6.0 ECTS] **Advanced elective course / 9**

Semester 6

- [6.0 ECTS] **Software Testing and Maintenance**
- [6.0 ECTS] **Human-Computer Interface**
- [6.0 ECTS] **Business Applications Development**
- [6.0 ECTS] **Elective course / 10**
- [6.0 ECTS] **Elective course / 11 (Capston Project)**

Description of courses

Core courses

- **Computer Systems**
  Upon completion of lectures on this subject, students should: - - Understand the fundamentals of computer systems and their organization; - - Know how to interpret the different numerical systems; - - Understand Boolean algebra and its application; - - Understand the basics of computer architecture; - - Differentiate between different operating

systems and their application; - - Understand the basics of computer networks;

- **Programming Concepts**
  Introduction to programming and problem solving concepts using algorithms and pseudo codes. Presentation of data in the computer. Data types and structures. Control structures. Algorithms and problem solving

- **Calculus**
  Through this subject students learn about and fully master the concepts: function (as a separate mapping), ways of setting a function, and continuity of essential functions. Also will be able to find the limit of a function (limes), derivatives, solving problems for the determination of the monotonicity and finding the maximum and minimum value of real functions. This is done in order to finally be able to plot graph of a function from which you can also read all the properties and characteristics of functions. Also aims to familiarize students with the notion of integral and it will be applied to various practical problems.

- **Computer programming C++**
  This is a course that presents the basic concepts of programming that further serves as an introduction to structured programming. The intention is to teach students to write clear and efficient C++ programs by applying a wide range of programming techniques.

- **Linear Algebra**
  This course is designed to train students with the concepts and methods that form the basis of the linear algebra. Linear algebra actually occurs everywhere. Concepts of the subject are used continuously anywhere without being named as such. Integral is linear, the derivative is linear and so on. Most applications of mathematics in the "real" world come to expression only by taking their linear part. This is very important knowledge that will always be important for students in this direction. After completing this course students will be able to use and apply linear equalities and their resolution. Algebra for matrices. Linear transformations and how they are used for the application. Vector spaces. Inherent values and vectors of the real matrix. Determinants and orthogonality. The important goal is to link linear algebra with other areas with or without the use of mathematics.

- **Web Technologies and Architectures**
  The purpose of the curriculum is to give students practical knowledge about basic mechanisms, services and protocols of the Internet global network. The course presents a compilation of comprehensive topics from the web architectures to web technologies with particular emphasis on practice combined with the latest web client-side technologies, such as, XHTML, HTML5, CSS, JavaScript, JQuery, Ajax/JSON and Mashups. Students from a practical point of view will know how to govern the concepts of the overall architecture of an efficient, scalable and reliable website. Students will also gain strong technical knowledge about XHTML, HTML5, CSS, JavaScript, JQuery, and Ajax/JSON by studying the syntax and semanticx of these technologies from a practical point of view, from which they will be ready without any additional training to respond to the needs and challenges of a real IT company.

- **Optimization Methods**
  The aim of this course is to present techniques of modeling and optimization in order to prepare students for developing their ability to prepare models for solving real problems in the field of computer science. The course explore the importance of matrix factorizations as an important tool which offers modality for optimizing the solutions of different numerical algorithms which are of basic interest for problem solving in the area computer sciences. The course introduces optimization theory and approach to find the optimum. The different methods of optimization will be analyzed such as the simplex method, duality problem and sensitivity of the problems of linear programming. The aim is to explore a computer implementation for each of the problems followed by the proposal of the corresponding model for optimization.

- **Web Technologies**
  The purpose of the curriculum is to give students practical knowledge about basic mechanisms, services and protocols of the Internet global network. The course presents a compilation of comprehensive topics from the web architectures to web technologies with particular emphasis on practice combined with the latest web client-side technologies, such as, XHTML, HTML5, CSS, JavaScript, JQuery, Ajax/JSON and Mashups. Students from a practical point of view will know how to govern the concepts of the overall architecture of an efficient, scalable and reliable website. Students will also gain strong technical knowledge about XHTML, HTML5, CSS, JavaScript, JQuery, and Ajax/JSON by studying the syntax and semanticx of these technologies from a practical point of view,

from which they will be ready without any additional training to respond to the needs and challenges of a real IT company.

- **Object-Oriented Programming**
  This course is intended for students who have previous knowledge in structured programming and want to apply such knowledge in C++. Objective of the course is to acquaint students with the knowledge and understanding in the field of object-oriented programming (abstract data types, classes, encapsulation, abstraction, inheritance, polymorphism, and others), to teach students to write clear and efficient C++ programs using object-oriented programming principles for creating effective business applications, to gain the ability to make evaluation of a particular object-oriented solution, and to be able to apply the concepts of abstract data types in solving problems based on the principles of object-oriented programming implemented in C++.

- **Relational databases and SQL**
  The course is an introduction to the concepts of databases and database systems. A student who successfully completes this course will be able to use models and concepts of designing databases. The student will be able to use and design simple and specific databases based relationship model databases. Using MS SQL Server database management system (DBMS), SQL language and implementation of queries.

- **Applied Probability and Statistics**
  The purpose of this course is to enable students to acquire the necessary knowledge of the subject of probability and statistics that has direct application in computer science in particular information needs for industrial purposes. The goal is to learn how to do the processing and clustering statistics, their laws, their representation, the laws of adopting appropriate conclusions based on the processed data and testing hypotheses. Also the aim is to teach the basic principles of probability and how these principles can be applied in various areas of everyday life especially in the field of computer science and for the purposes of statistical analysis.

- **Operating Systems**
  The main goal of this course is to offer students an operating system perspective and key concepts. This course examines the major problems in operating systems. The operating system is an interface between the user programs and computer hardware (or mobile devices) which they operate. Therefore the responsibility of the operating system is the management and sharing of computer resources. This course will begin with a brief introduction to the "main concepts of operating systems" and continues with the evaluation of these concepts and analysis in detail. A detailed analysis of the major components of most operating systems will be discussed. The discussion will cover the processes and threads, deadlocks, memory management, input/output, file systems and security. The following part of the course deals with the presentation of the key concepts of distributed, multimedia and smart card operating systems. At the end of the course, the concepts of mobile operating systems will be presented, analyzed and evaluated. All this will be accompanied by an analysis of case studies of specific operating systems from each category.

- **Web Programming**
  The aim of the course is to familiarize students with the problems of web development and understanding the web object-oriented programming techniques and technologies.

- **Computer Networks**
  The course is designed to provide information and knowledge on the principles of modern computer networks, and skills for the development of network applications and programming.

- **Software Engineering**
  The purpose of this course is to provide students with a deep, critical and systematic understanding of the principles and techniques for software specification, analysis and design, programming, testing and evaluation, maintenance and design of effective software management applications. Outcome of the course is to enable students to capture understanding of the tools and methodology of software development solutions.

- **Software Testing and Maintenance**
  Testing and maintenance of a software product plays a crucial role in ensuring its quality and success. Testing is the most used technique in detecting software bugs, and often takes more than half of the cost and time of development of software. Maintenance of the software, on the other hand, is crucial to ensure continuity of service, and mainly

deals with how to control the changes and evolution of the software after its release. This course aims to cover the basic concepts, principles, methods and techniques to perform effective software testing and maintenance.

- **Human-Computer Interface**
  The purpose of the course is to help students learn the principles of designing computer applications to achieve a high degree of usability by users. Specifically, students will gain knowledge of user-cantered design method which involves designing applications according to analysis of users and the conditions in which the application will be used. Additionally, different evaluation methods will be learned that will ensure that the application being developed will be usable by users.

- **Business Applications Development**
  This is a course in computer programming concepts for students that have substantial programming experience coming into the course and wish to learn how to apply that experience to Visual Basic NET. The course will provide a working knowledge of computer programming and application of programming fundamentals to problem solving techniques using Visual Basic NET and to obtain an organizational pattern for programming. It will extensively promote the usage of design patterns, OO methodologies thus aiming to teach students best practices in application development.

Elective courses

- **E - Commerce**
  Course objectives are: - Understanding and applying the concepts of electronic commerce – e-business. - Identifying business needs to adapt to the constant and continuous changes in the environment and the importance of incorporating information technology in the most important business processes. - Improving their current operating performance in order to be transformed into a competitive advantage. Developing strategic, administrative and operational planning for new businesses or improving existing planning with new technologies. - To explain: the growth of e-business to date, the term business-to-consumer and business-to-business model, using relevant theories of business, management and social sciences. - To examine: the interaction between technological trends and social business context of e-business, including the diffusion of social networks and Web 2.0 developments.

- **Fundamentals of Information Systems**
  Curriculum objectives: - To learn the basic concepts and terminology of information systems: basic information systems and concepts - hardware, software, networks; e-world — e-business and e-commerce; development processes; - To learn more about information systems and technologies that improve the business values and the different business processes in organizations; - To apply the e-concepts using various management disciplines during the process of analysis, interpretation, evaluation and decision; - To understand the process of redesigning organizations using information systems; - To describe the role of information systems in decision-making; - To examine the information security, as well as the ethical and social issues; - Be familiar with the Internet, e-commerce and e-business; - To qualify students to work on projects, both individual and group, which can be: case studies, research projects, development projects, or practical work;

- **Multimedia Systems**
  The objective of the course is to give students practical knowledge about the key multimedia systems and technologies. This course is an integration of practical part of computer science and multimedia development tools. The subject covers topics from the science behind multimedia (compression algorithms and digital / audio conversions); Usage of tools for the manipulation of images, sounds and video. Special emphasis is given to the use of the Internet and the web as an environment for multimedia presentation.

- **Data Mining**
  After completing this course, the students will: - understand the basic concepts of data mining; - understand the basic concepts of descriptive statistics; - probability and linear algebra, as well as their application in data mining; - be able to use software tools for data mining; - be able to apply algorithms that will enable data mining; - to know how to analyze, classify, and group data; - to know the basic rules of numerical regression; - be able to present the results of their analyses (data visualization and knowledge).

- **Programming Mobile Devices**
  This is a course that presents the basic concepts of designing interactive mobile applications. The intent is to teach students to write clear and effective personal and business applications by applying a wide range of programmable techniques.

- **Database Administration**
  The course's goal is to prepare students on the administration of database systems. Upon completion of this course, the student will be familiar with the basic principles of database management systems. The course covers different parts of the database management systems, the use of modules (such as maintaining databases, managing with the memory space, transactions management, procedures for backup / restore, etc...). The students will cover a variety of database management systems (DBMS) such as Microsoft SQL Server, Oracle DB Server, and MySQL on different platforms (operating systems).

- **Microcontrolers and Embedded Systems**
  The course exposes the student to the fundamental concepts and principles of embedded systems, with emphasis on studying of microcontrolers. The object of study in this course is the 8051 architecture, although other types of microcontrollers are studied, too. The machine language, Assembler, and the C programming language are used for programming microcontrollers. Various system packages are used to simulate the functionality of microcontrolers and embedded systems. The last part of the course is especially geared towards providing an introduction to the practical realization through consideration of procedures for programming microcontrollers and practical realization of embedded systems. The course represents a connection between the theory and practice, which is of special importance for gaining confidence, where students move from the preliminary design solutions in the laboratory, to concrete practical realization of simple embedded systems.

- **Data Visualization**
  After the successful completion of this course, students should: - Understand the basic methods of data visualization; - Be able to use advanced tools for data visualization; - Know how to implement 2D and 3D data visualization; - Transform databases into a format adapted for visualization; - Know the methods for visualization of multidimensional data; - Be able to implement advanced web, desktop, or mobile applications that will enable data visualisation;

- **Java Programming**
  This course presents the basic concepts of programming that will further serve as an introduction to structured programming. The aim of the course is to teach students to write clear and effective Java programs by applying a wide range of programmable techniques.

- **Development of Web Based Mobile Applications**
  The purpose of this course is to provide students with the technological fundamentals, knowledge and skills related to a variety of Internet and mobile development frameworks used for the implementation and deployment of web and mobile applications and services. Upon completion of this module, students will have a good understanding of the different methods and techniques used in the field of web and mobile engineering; have a good understanding of different development frameworks for deploying web and mobile applications and services; will understand the aspects related to the design and user requirements for the development of scalable web and mobile applications and services; would have a deep understanding of the various standards for web and mobile development; master and use different tools and development approaches for deploying web and mobile solutions and will have an understanding of the test-driven development and usability aspects related to the Internet and mobile applications and services.

- **Broadband networks**
  Introduction to the technologies and services of broadband networks, the access technologies, as well as the architecture of the networks.

- **Web Development using XML**
  The purpose of this course is to provide students with practical knowledge about key XML technologies (XML, XPath, XSL, XML schemas, RNG, DTD, XQuery, DOM) as well as specific markup languages relevant to website development (XHTML, XHTML MobileProfile, RSS, RDF, XSL-FO, SVG, DocBook, OOXML, OpenDocument, XForms). In addition, the course covers topics such as XML programming through APIs (DOM and SAX), Apache Cocoon (an open source XML publication), and the role of XML in Web 2.0 to data delivery and functionality via AJAX and Web Services (SOAP and REST). By using these technologies, students wll be able to develop dynamic, data-driven websites that are capable of delivering content in various media formats (screen, print text, graphics) for

different devices (desktop, handheld devices, mobile phones and smartphones) and for different audiences.