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

Study program	Database Management
Faculty	Contemporary Sciences and Technologies
Study Cycle	Second Cycle (Postgraduate)
ECTS	120

Description of the program

The study program aims are:

- To respond to the global market of Information and Communication Technology (ICT) in the field of database management with special emphasis on regional needs and specific prospects of the Republic of Macedonia in the direction of building a common European educational, work and research space;
- To prepare students for current and future technological challenges in the area of databases by developing critical thinking skills necessary for creativity, ethics and efficiency in a wide range of ICT contexts;
- To prepare students to approach the information needs of database management of the specific organization and to implement modern technologies and discovering innovative solutions to business and research programs;
- To prepare students for further academic or research careers.

Career

Students that complete the masters program in Database Management are offered with various ranges of perspectives regarding their career. The opportunities expand from IT sector in banking systems, corporate networks, databases and time critical environments.
The acquired knowledge involves: Databases, their design, system aspects and optimization, Data mining, data storage, distributed Databases, object and multimedia databases, The latest databases trends, such as Web and XML- technologies and modern information collection, Integration of the latest technologies, such as the intelligent systems or distributed architecture in the traditional information systems and their use for making better decisions within the organizations; General skills, such as analytical and critical thinking, team work and work in multicultural environments, planning and organizing etc.

Learning outcomes

Knowledge and understanding

- Knowledge and understanding in field of Database (design, implementation and management; Database Management Systems concepts; database programming) on a level that extends the basic acquaintance of fundamental knowledge through research oriented knowledge and ability to demonstrate expertise in solving problems in the area of database.
- Knowledge to investigate and understand existing database solutions.
- Knowledge to develop and apply original and creative ideas, solutions which require interdisciplinary knowledge (databases, business and other fields) and demonstrate competences in the field of databases.

Applying knowledge and understanding

- Able to effectively use and improve existing solutions and manage critical situations (save of data, plan of backup and recovery) in the area of database.
- Able to originally, critically, independently and creatively give a database solution of the problems in new or unfamiliar environments which require knowledge from real-life, administration, science or business and organization.
- Able to plan, perform and evaluate independent research in field of database.

Making judgement

- Ability to analyze data flows, transactions and propose implementation of Database solutions.
- Ability to creatively integrate and synthesize knowledge and helps (of specialists of other fields) and propose use of appropriate Database Management Systems and techniques.
- Ability to deal with complex and critical issues related to data organization, save and use and to address appropriate specialized solution, based on personal, technical, social and ethical responsibilities.

Communication skills

- Able to clearly and unambiguously in written and spoken form communicate study outcomes and knowledge to specialist audiences and also the ability to appropriate the style and form of expression to non-specialist audience.
- Able to critically and independently interpret and argue researches in field of database and also clearly defend and express the hypotheses and results.
- Ability for initiating, leading and taking responsibility to guide individuals or groups to work or research in field of Database and report in written or spoken form the results or their progress.

Learning skills

- Able to identify personal needs and directions for individual and autonomous study and to perform it in self-directed and autonomous manner in field of database.
- Ability to autonomously follow and learn new development trends of Database Management Systems and Database technology.
- Able to take responsibility for ongoing individual and group learning in specialized database fields, including defining learning objectives.

List of courses

Semester 1

- [6.0 ECTS] **Research Methodology**
- [6.0 ECTS] **Data Minning**
- [6.0 ECTS] **Database Design and Analysis**
- [6.0 ECTS] **Elective course 1**
- [6.0 ECTS] **Free elective course 1**

Semester 2

- [6.0 ECTS] **Artificial Intelligence**
- [6.0 ECTS] **Distributed Systems**
- [6.0 ECTS] **Database Algorithms**
- [6.0 ECTS] **Elective course 2**
- [6.0 ECTS] **Free elective course 2**

Semester 3

- [6.0 ECTS] **Advanced Databases**
- [6.0 ECTS] **Information Retrieval**
- [6.0 ECTS] **XML and Databases**
- [6.0 ECTS] **Elective course 3**
- [6.0 ECTS] **Elective course 4**

Semester 4

- [30.0 ECTS] **Master Thesis**

Description of courses

Core courses

- **Research Methodology**
  The goal of this course is to enable students with knowledge and understanding of different scientific theories and methodologies that are applied in the field of database management. After completing the course, students will be able to: - thoroughly explain and understand the importance of the basic scientific concepts; - effectively search relevant information and literature; - identify, describe and formulate scientific problems; - make a careful choice of alternative research approaches; - thoroughly describe, compare and explain the advantages and disadvantages of various scientific methods for collecting quantitative and qualitative data; - apply basic scientific methods during analysis of quantitative and qualitative data; - understand different frameworks for theory building; - assess and review scientific publications.

- **Data Minning**
  Objectives of this course are extraction of knowledge from large amounts of data analyze concepts, issues, tasks and techniques of data mining. Topics include data preparation and feature selection, association rules, classification, clustering, evaluation and validation, scalability, spatial and sequence mining, and data mining applications.

- **Database Design and Analysis**
  Organization and manipulation of data organized in data warehouses. Advanced operations and algorithms for working with data warehouses. Modeling data warehouses, data organization and manipulation of data stored in the repository, reporting from the data warehouse.

- **Artificial Intelligence**
  This course is an introduction to specific algorithms and applications in fundamental areas of Artificial Intelligence: the agents, logic, search, reasoning in environments of uncertainty, machine learning and neural networks. Practical experience in a specialized programming language Prolog and tools for processing data in the field of artificial intelligence.

- **Distributed Systems**
  This course will include: Architectures of distributed systems. Inter-process communications. Socket types and development platforms. Standard application solutions for distributed computing systems. Fundamentals of client - server programming. Node to node communication in Internet-based distributed computing systems. Middleware platforms (CORBA, JavaBeans, DCOM, .NET). Multi-agent systems in a distributed environment. Web Service technologies in distributed computer systems (architecture and implementation).

- **Database Algorithms**
  The purpose of this course is to provide students with the technological knowledge and skills notation for complex algorithms. Lists: sequential and chain lists, stack, queue, inserting and deleting elements, nonlinear list. Trees: binary trees, forest, passing through the tree, balanced search trees, inserting and deleting an element in B, B+, B*-trees. Files: organization, operations, heap files, sequentially organized files, index-sequential file organized, dissolute organized files, index files, updating, design. Request: linear, binary, m-paths, request in broken files, sorting with binary trees. Ordering: binary, inserting, replacing, bubble, quick sorting, sorting with binary trees, sorting by mixing.

- **Advanced Databases**
  In this course students will be introduced with advance concepts fromthe field of database systems. Among topics to be covered are: advanced SQL, relational algebra, query optimization, analysis of query execution plans, indexing methods, data normalization, transactions and concurrency, non relational databases (NoSql, Graph etc), object oriented databases. Additionally students will learn the concepts of building data driven applications, by using state of the art practices such as ORM systems, designing query first applications, lambda expressions etc.

- **Information Retrieval**
  Random variable: definition, moments, basic types of distributions. Random vectors: basic concepts, moments,

functions of random vectors. Elementary testing of hypotheses: Bajes MiniMAX Nejman-Pearson. Random processes. Random process: definition, characteristics and types. Stacionary and ergodic random processes. Random processes with independent stationary increments. Markov processes. Birth and death processes. Finite chains Markov. Autocorelation function and power spectral density. Transmission of random process through a linear system. Gauss process. Poisson process. Random noise. Thermal noise.

- **XML and Databases**
  Advanced XML semi-structured data and XML schemas and databases. Semantic modeling. ER models. UML models. Relational database models, logical and physical organization. Formal query languages: relational algebra and relational computation. SQL-2. Inserting query languages in programming languages. Methodologies for designing databases. Functional dependencies and normalization. Object-oriented database model. Object-relational databases. SQL-3.

- **Master Thesis**
  This module enables students to transfer their skills and knowledge to research and make more complex task of the master thesis. The module is designed to be fully practical and students to acquire the necessary knowledge and skills to approach writing the thesis. The module has unique return result-to enable students to write the master thesis with minimal difficulties, and with maximum efficiency. The course aims to improve research techniques and style of writing paper, taking account to stop illegal means, such as plagiarism and infringement of copyright, which are prohibited by the Statute of SEEU.

Elective courses

- **Seminar Paper**
  The students are given the opportunity to prepare paper work under supervision, to highlight their knowledge and skills by using software tools for tracking and monitoring of projects, software tools for teamwork, organizational decision-making potential of an effective system of management information, organizational learning, a source of competitive advantage; organization in a global arena.

- **Application of Innovative Technologies in Business Processes**
  The main objective of the course is to present and introduce creative thinking and its possible applications to the students. Challenges that businesses have to face with the introduction of the novel technologies in order to deploy innovative technology to certain processes or services. Possible risks and benefits related with deployment of novel and innovative technologies.

- **Rhetoric**
  During its long history of 2,500 years, rhetoric was used to indicate many different things; but rhetoric nowadays is considered as the art of persuasion through language. Rhetoric marks the way that an individual is linked to a particular theme or idea in order to convince the others. Rhetoric is characterized by several distinguishing features.

- **Methodology of Teaching**
  The aim of the course is to introduce the students to the basic teaching approaches and methods. They are expected to gain knowledge and skills in order to be able to apply the active educational tools. The course also offers development, learning and teaching as concepts and basic practices that allow teachers to teach about the development of thinking. Throughout this course, students will gain both theoretical background and entirety of strategies that will enable them to reflect and develop both their own and their students` critical thinking.

- **Multilingualism and multiculturalism**
  The purpose of this subject will be multilingualism in multicultural societies as a social phenomenon. This phenomenon is massive in the world. During the lectures, more precise terms such as monoculturalism and multiculturalism will be considered. The term ‘linguistic nationalism’ has at least two forms of this nationalism, which collide with each other: for the leaders of the most powerful countries nationalism means expansion, and for minorities it takes the form of defiance and struggle for the affirmation of identity, despite such pressure. The emphasis during the program will be multiculturalism in education. In the schools curricula consists of contents from different cultures.

- **Selected Chapters of Advanced Topics in IT Applications for Preparing a Scientific Paper**
  The aim of this subject is: - To display the technical elements, the structure of the text and deign of a scientific

research. - To enable students to acquire advanced knowledge and skills from selected advanced chapters of IT applications that will be needed in preparation of the scientific and research paper. - Practical application of these objectives in preparing student's individual research paper.

- **Selected Chapters of Advanced Applications for Statistical Data Processing**
  The aim of this subject is: - To display the technical elements in the field of statistics: organizing, processing, comparing through analysis and publication of data. - To enable students to acquire advanced knowledge and skills from selected advanced chapters of the applications for statistical data processing. - Practical application of these objectives in statistical processing of data obtained from questionnaires, reports, scientific studies and other documents.

- **Professional Communication**
  The course is focused on the development of those communication skills that are essential for effective functioning in the professional world. Students will study the process for analysis of different communication situations, and will accordingly comprehend them. Among the themes that will be covered are communication in organization, interpersonal and group communication, oral presentations, interviews for employment, professional business letters and interpersonal skills including group dynamics and teamwork.

- **Management Information Systems**
  This course will include: Organization, management and enterprise networks; Managing the digital firm. Information systems in the enterprise; Information systems, organizations, management, and strategy; Digital enterprises: electronic business and electronic commerce; Ethical and social aspects of the digital enterprise; Security and control; Analyzing business processes of an enterprise; Information and Communication Technologies infrastructure and platforms; Telecommunications, networks, and the Internet; Wireless revolution; Creating a new Internet business;

- **Laboratory Course in Database Programming**
  Oriented teamwork in laboratories. Application of database programming. Advanced operations and algorithms for working with data warehouses. Modeling data warehouses, data organization and manipulation of data stored in the repository, reporting from the data warehouse.

- **Team Project**
  This is an open subject where students can choose to work in a team project related to the latest advancements in the field of software engineering. Possible topics include the following areas: analysis and design of software systems, development of graphics applications, multimedia applications and e-business applications, testing, statistical data processing, metaphoric reasoning and reasoning by analogy

- **Wireless and Mobile Processing**
  The purpose of this course is to provide students with technological bases, knowledge and skills related to different web and mobile development frameworks used for implementation and deployment of Internet and mobile applications and services. After completing the course, students will be able to: have a good understanding of various methods and techniques used in web and mobile engineering; have a good understanding of various development frameworks for deploying web and mobile applications and services, understand those aspects of design and user requirements for developing scalable web and mobile applications and services, have a deep understanding of the various standards for web and mobile development, to master and use different tools and development approaches for implementing internet and mobile solutions and have understanding of test-driven development and aspects of usability-related Internet and mobile applications and services.

- **Advanced Topics in Cryptography with Applications**
  The course presents a wide-range, integrated Advanced Topics in Cryptography and Application. The following topics are elaborated: Number Theory, The Data Encryption Standard, The Advanced Encryption Standard: Rijndael, The RSA Algorithm, Discrete Logarithms, Hash Functions, Digital Signatures, Security Protocols.

- **Web Services**
  This course will include: Representation of XML documents. Describe the information in XML. Building blocks of Web services. Architecture of Web Services. Client server model. Web hosting services. Using Web services. SOAP Messaging. SOAP faults. Model for SOAP messaging. Data types. Transport of messages with SOAP. Defining data types and structures with XML schemas. Description of the interface of Web services. Samples of communication.

UDDI registries. UDDI interface. Using UDDI to publish the service. Using UDDI to find services. Generating the UDDI WSDL. XML digital signatures and encryption. SOAP security updates. Security. NET 2.0 Web Services. Review of .NET Classes for working with Web services.