**DEPARTMENT OF SOFTWARE ENGINEERING**

**Study Program “Master of Science”**

**in**

**Software Engineering**

**Course Description**

**2021-2022**

**1st Semester**

**Course: Algorithm and Data Structure I**

**Short Description**

The main objective of this course is to provide background in different data structures and algorithms for manipulating them, by using Java programming language. Students will be introduced to concepts of ADT, Linked Lists, Stack and Queues, Binary Trees, Hash Tables, Graphs, etc. Particular emphasis is given to programming techniques for processing such structures: sorting, searching, hashing and recursion as a strategy for improving the running time of these algorithms.It introduces students to a variety of methods of the evaluation of the data structure needs of particular problems as well as to consider alternative implementations using differing data structures and understand the significance of choosing a particular data structure in a real-world setting. A final project will summarize the knowledge accumulated during the semester.

**Course: Advanced Java Programming**

**Short Description**

This course is designed to introduce to students’ the paradigm of generic programming, abstract data types and the concepts, generic classes and functions. As well as, developing skills to use collections in Java. Introducing graphics in Java, as well as design application with GUI.

**Course: Database Design and Administration**

**Short Description**

During this course students will be introduced with the basic concepts of data modelling and in particular the entity relationship model, schema normalization for and optimization, relation algebra and the database query language. To conclude, some database administrative aspects will be discussed.

**Course: Advanced Project Management**

**Short Description**

This course will prepare students to design, manage, and deliver complex project solutions. The course adopts a practitioner’s focus, and is consistent with the principles laid out in the Project Management Professional (PMP) certification

Students commence their study with an investigation into the Project Management Framework from PMI. Topics covered include scoping the project, project planning, and change control. Students then study project communications, the use of project management software, and the use of modeling and analysis tools. Key factors in project success, such as people management and the identification of risk factors, are also studied. Graduates of the course will use their knowledge to successfully implement projects across a range of industry sectors.

**Course: Communication for Software Engineering**

**Short Description**

The graduate course provides a comprehensive introduction to research methods and methodologies, and foundational research theories. As such, students enrolled in this course will be provided with sound knowledge in both qualitative and quantitative research as well as the main phases of the writing process and data collection and processing methods. In addition, this course could be regarded as a foundation course for other master courses and thesis writing that students are supposed to submit by the end of their study program.

**2nd Semester**

**Course: Advanced software Evolution**

**Short Description**

This course will expose students to the challenges involved software designed, software evolution (including legacy systems and new ones), software maintenance, software refactoring and reuse. The course focuses on the research issues of software evolution and maintenance. Topics such as reverse engineering, design recovery, program analysis, program transformation, refactoring, traceability, software metrics definitions and program understanding will be investigated. It is important to distinguish the concept of evolution and maintenance which frequently is confusing. The course starts by introducing the basic concepts and notions in software evolution and maintenance. Follows the taxonomy and category of software maintenance that explain approaches used to organize the software maintenance. Models introduce the life-cycle used in software evolution and maintenance. Students are introduced to “re-engineering” concept describing how the software adapts to future needs in term of functionalities or performances.

Considering the evolution of software towards parallel and distributed systems, and the management of non-relational data, the course will cover as well practical aspects in such topics. During the laboratory work they will be introduced to parallel (multi-threaded programming in Java) and distributed programming (message passing processes) and semi- structured data management such as XML, JSON, etc. through dedicated framework. Moreover, UML based design and software project management techniques will be studied in depth.

**Course: Computer Network Security**

**Short Description**

The purpose of this course is to provide a solid understanding of Computer Network, Routing over dynamic Protocols and Static one, Access Control Lists, policies, security data and an introduction to the cryptography, authentication, standards, electronic mail and use of system devices which can implement data security. Practical solutions of Network Communication and Security data are the integral part of labs with students.

**Course: Advanced Algorithmn and Data Structure II**

**Short Description**

The main objective of this course is to provide background in different data structures, and algorithms for manipulating them, by using Java programming language. Students will be introduced to Dynamic Programming, Greedy Algorithms, Minimum Spanning Trees, Data Structures for Disjoint Set etc. Particular emphasis is given to programming techniques for processing such structures: sorting, searching, hashing and recursion as a strategy for improving the running time of these algorithms. It introduces students to a variety of methods of the evaluation of the data structure needs of particular problems as well as to consider alternative implementations using differing data structures and understand the significance of choosing a particular data structure in a real-world setting. A final project will summarize the knowledge accumulated during the semester.

**Course: Information and communication Security**

**Short Description**

During this course students will be introduced with the basic concepts of cryptography elements such as keys and Hash algorithms. Hot topics such as web security models, user authentication methods, security handshake pitfalls and security certificates as well as major security threats of today. An interesting point of view for students is the Real Time Communication security and algorithms attached with it. Finally the e-mail security extensions and standards will cover the subject.

**Course: Intellectual Property Law**

**Short Description**

Intellectual property (IP) is one of the fastest and growing industry globally, including Albania. The protection of IP is critical for protecting both the authors and the company's proprietary designs, processes, and inventions. Violation of IP law can harm the author and investment and can have dare consequences to the market advantage of the investor and reputation of the author. Engineers are often on the front line of innovation. As consultants, they also share intimate details of their clients' designs, materials, products, and processes—highly confidential work. In this context study of the IP law for software engineers becomes paramount and crucial for a safe investment in this area of industry.

This course will focus on intellectual property laws pertaining to the field of software engineering by dwelling in detail about patent, copyright, trademark, computer programs, database management, industrial design and geographic. The following topics should be covered, with emphasis on issues that are most important to engineers.

1. Introduction to the basic law concepts, understanding information as property, constitutionality and understanding the relationship between statute and common law.
2. Understanding confidential information, how action can arise, interaction with legislation and remedies.
3. Everything to know about patents such as conditions for patentability, novelty, ownership, duration & assignments, enforcing patents, and issues in the International Patent Regime - Selected Articles.
4. Understanding registered trademarks with topics on registration, ownership, duration and assignment, enforcement and international trademarks.
5. Copyright issues that engineers should know such as: What is copyright, conditions for copyright, what are moral rights, what is protected, ownership, duration and assignment.

**3rd Semester**

**Course: Advanced Software System Development**

**Short Description**

The purpose of this course is to provide a thorough description of advanced software systems development methodologies and models. Moreover, special attention will be paid to refactoring as a technique for improving the quality of software, for making object-oriented code simpler and easier to maintain. Additionally, reusability, modular and design pattern methodologies and techniques will be analyzed together with state-of-the-art software quality improving methods More specifically, since refactoring requires considerable design know-how, it will be analyzed how once suitable tools become available, all programmers should be able to improve their code using Refactoring techniques. During this course students will be introduced with the basic concepts of refactoring, reusability, design patterns and modular-componentware techniques and will be shown how to improve existing code based on these concepts. All the state-of-the-art techniques that will be presented herein for improving quality of source coding, with special attention put on Refactoring and Design Patterns, is sure to be essential reading for anyone who writes or maintains object-oriented software. Essential not only for their profession but for lifelong learning too.

**Course: Wireless Networks: LANs&WANs**

**Short Description**

This course provides a comprehensive understanding of the fundamentals of Wireless LANs and WANs. Specific areas of attention include concepts and principles behind wireless technologies and their implementation in wireless networks. Special focus is on the areas of design, planning, implementation, operation, and troubleshooting.

**Course: Soft Computing and Intelligent System**

**Short Description**

The main focus in this course will be on applying in practice knowledge and principles surrounding the field of Data Intelligence, such as obtaining, synchronising and maintaining the data, cleaning and structuralising the data, posing questions that are useful and answerable, analysing and evaluating results and understanding the applicability of data mining and machine learning. Specific focus is on techniques such as artificial neural networks, genetic algorithms and their combinations.

**Course: Principles Methods and tools for software testing**

**Short Description**

This course is designed to improve students’ ability to analyze and evaluate software quality and improving software quality through testing. As such, it helps students improve technical aspects and documentation skills needed to assess, evaluate and test softwares Furthermore, students will be exposed to various readings and arguments coming from a wide array of methods and techniques such as unit testing, control and data flow testing and domain testing. The second part of the course will focus on quality aspects related to softwares such as software test design, planning and execution. The purpose of this course is to provide an introduction to the design and use of testing methods, discuss the key issues in building and executing such test, provide an introduction to software quality.