

# **M.Sc. in Informatics Engineering**

## **Software Engineering Branch**

### **Requirements Engineering: 1<sup>st</sup> year – 1<sup>st</sup> semester**

#### **Objectives**

Know the theory and practice of the requirements engineering area. Know and apply advanced requirements analysis techniques. Exemplify the application of this knowledge to real problems.

#### **Learning Outcomes**

At the end of the course students shall be able to

- Analyze a problem, identify its characteristics and design a solution.
- Recognize the advantages and limitations of using the presented methodologies.
- Develop new strategies in an independent and autonomous fashion.

### **Software Design and Architectures: 1<sup>st</sup> year – 1<sup>st</sup> semester**

#### **Objectives**

This curricular unit has as main objective to provide students with the knowledge and competence about models, structural patterns and software design techniques.

#### **Learning Outcomes**

At the end of the course students shall be able to

- Understand the concepts of software design and architecture.
- Understand the role of software design and architecture in the context of a project, with respect to system requirements.
- Know object-oriented analysis methodologies and other design approaches
- Know and apply design patterns.
- Know how to apply enterprise patterns

### **Software Development Methodologies: 1<sup>st</sup> year – 1<sup>st</sup> semester**

#### **Objectives**

This curricular unit covers several software development methodologies, including traditional and agile, and addresses software processes, maturity and standards. It aims to provide students with the ability to choose the best approach for the development of a software project.

#### **Learning Outcomes**

At the end of the course students shall be able to

- Identify the different phases of a software life cycle.
- Know agile and traditional software development methodologies.
- Understand the objectives and levels of software maturity.
- Develop small applications using agile methodologies.
- Justify the application of different methodologies to specific projects.
- Analyze real software development projects.
- Write clear, concise and tangible artifacts.

## **Machine Learning: 1<sup>st</sup> year – 1<sup>st</sup> semester**

### **Objectives**

This curricular unit aims to provide students with knowledge and skills in the area of Machine Learning. Therefore, it is intended that students gain a set of skills that allow them to analyze, in a structured way, real problems of data analysis.

### **Learning Outcomes**

At the end of the course students shall be able to

- Know the stages of a real project based on Machine Learning
- Analyze and prepare a data set
- Correctly identify the aspects related to the validation of the different approaches (metrics, validation strategies,...)
- Know and apply the most relevant algorithms in Supervised Learning
- Know and apply the most relevant algorithms in Unsupervised Learning

## **Ambient Intelligence: 1<sup>st</sup> year – 2<sup>nd</sup> semester**

### **Objectives**

Provide students with a set of knowledge and skills in the area of Ambient Intelligence (Aml): support technologies (such as sensors, actuators, location systems, context awareness, Internet of Things), application of these technologies to collect data, to apply intelligent algorithms and machine learning for Aml, regulations of data privacy and anonymization techniques, intelligent user interfaces.

### **Learning Outcomes**

At the end of the course students shall be able to

- Know and understand the concepts and technologies
- Know, understand and apply data acquisition and fusion techniques from different sensors
- Select and apply appropriate machine learning techniques to the data collected to infer patterns about the context and its dimensions
- Understand the requirement for adaptability of interfaces to user needs
- Know and promote privacy in the acquisition, protection and treatment of the data collected

## **Big Data: 1<sup>st</sup> year – 2<sup>nd</sup> semester**

### **Objectives**

This curricular unit aims to provide students with concepts, techniques, tools and platforms of big data processing, with focus on NoSQL databases.

### **Learning Outcomes**

At the end of the course students shall be able to

- Known and understand the principles and concepts of storage, processing and analysis of data (Big Data).
- Identify and apply the concepts and storage techniques, processing and analysis of data (Big Data) to solve practical problems.
- Use No SQL databases

- Select and use appropriate tools, for storage, processing and analysis of large volume of data (Big Data)

## **Test and Software Quality: 1<sup>st</sup> year – 2<sup>nd</sup> semester**

### **Objectives**

To provide students the fundamental concepts about software testing analysis, design and implementation, as well as software quality management.

### **Learning Outcomes**

At the end of the course students shall be able to

- Understand the concepts related to software quality
- Know and understand software quality metrics
- Plan and execute software tests.
- Evaluate the quality of software at each development stage.
- Identify the appropriate testing techniques to use based on the product and development stage.
- Know and apply test coverage criteria.
- Use testing tools.

## **Development Platforms: 1<sup>st</sup> year – 2<sup>nd</sup> semester**

### **Objectives**

To provide students with knowledge and experience in the development and delivery of medium and large-scale software products. Current platform solutions, automation of procedures, architectures, etc. are addressed, complemented with a strong practical approach to their implementation.

### **Learning Outcomes**

At the end of the course students shall be able to

- Know, understand and apply the concepts of continuous development and continuous delivery.
- Know, choose and apply the supporting tools for continuous development and continuous delivery.
- Plan and implement pipelines for continuous development and continuous delivery.
- Know and understand the architecture based on micro-services
- Plan and implement systems according to the micro-service-based architecture

## **Industrial Seminars: 2<sup>nd</sup> year – 1<sup>st</sup> semester**

### **Objectives**

The main objective of this course is to provide a close contact between the students and the industry and to train some important soft skills, namely related to the ability of effectively writing and presenting technical reports and scientific papers.

### **Learning Outcomes**

At the end of the course students shall be able to

- *Understand and analyze real problems of the industry.*
- *Propose and justify solutions for specific cases in industrial scenarios.*
- *Write scientific papers.*

## **Software Project: 2<sup>nd</sup> year – 1<sup>st</sup> semester**

### **Objectives**

The main objective of this course is to provide knowledge, understanding and practice of managing and developing software projects, as an engineering activity. Students participate in the development of a software project, being involved in all activities related to project management, from requirements elicitation, analysis, architecture, implementation and quality assurance. Issues related to communication, group dynamics, professional practice are also put to the test.

### **Learning Outcomes**

At the end of the course students shall be able to:

- Prepare a software development plan, including estimates, scheduling, resources allocation, configuration management, change control management and risk management.
- Track and control scheduling, risk, resources, changes.
- Write a quality assurance plan and apply different quality control techniques to guarantee the quality of the delivered software product.

# **M.Sc. in Informatics Engineering**

## **Intelligent Data Analysis Branch**

### **Software Development Methodologies: 1<sup>st</sup> year – 1<sup>st</sup> semester**

#### **Objectives**

This curricular unit covers several software development methodologies, including traditional and agile, and addresses software processes, maturity and standards. It aims to provide students with the ability to choose the best approach for the development of a software project.

#### **Learning Outcomes**

At the end of the course students shall be able to

- Identify the different phases of a software life cycle.
- Know agile and traditional software development methodologies.
- Understand the objectives and levels of software maturity.
- Develop small applications using agile methodologies.
- Justify the application of different methodologies to specific projects.
- Analyze real software development projects.
- Write clear, concise and tangible artifacts.

### **Machine Learning: 1<sup>st</sup> year – 1<sup>st</sup> semester**

#### **Objectives**

This curricular unit aims to provide students with knowledge and skills in the area of Machine Learning. Therefore, it is intended that students gain a set of skills that allow them to analyze, in a structured way, real problems of data analysis.

#### **Learning Outcomes**

At the end of the course students shall be able to

- Know the stages of a real project based on Machine Learning
- Analyze and prepare a data set
- Correctly identify the aspects related to the validation of the different approaches (metrics, validation strategies,...)
- Know and apply the most relevant algorithms in Supervised Learning
- Know and apply the most relevant algorithms in Unsupervised Learning

### **Data Warehousing: 1<sup>st</sup> year – 1<sup>st</sup> semester**

#### **Objectives**

This curricular unit aims to provide knowledge of data warehousing and data warehouse projects, including fundamental concepts, architectures, multidimensional modeling, data extraction and transformation.

#### **Learning Outcomes**

*At the end of the course students shall be able to*

- *Have knowledge and understand Data Warehousing subjects.*

- *Analyze, design, build and manage a data warehouse.*
- *Apply the knowledge acquired in solving specific problems in professional life.*
- *Have a professional attitude in the development of their tasks due to the acquired knowledge and the ability to understand its scope, applicability and opportunity in the face of specific everyday situations.*

## **Decision Support Systems: 1<sup>st</sup> year – 1<sup>st</sup> semester**

### **Objectives**

The aim of this curricular unit to provide students with the necessary concepts to a specialist who can serve as an interface between a Decision Support System (DSS) and the staff of a company. On the other hand, the student must be able to implement the model subsystem of a DSS itself. The knowledge acquired can be applied in solving similar algorithms/problems in a real context.

### **Learning Outcomes**

At the end of the course students shall be able to

- Understand the importance of decision support systems and the main concepts related with decision support systems.
- Identify the different types of optimization and decision problems, as well as the distinct methodologies that can be used to solve them.
- Identify the suitable algorithm that can be used to solve a simple decision problem.
- Solve simple practical problems using the appropriate optimization algorithms and interpret the obtained solution(s).
- Perform autonomous study and research work.

## **Ambient Intelligence: 1<sup>st</sup> year – 2<sup>nd</sup> semester**

### **Objectives**

Provide students with a set of knowledge and skills in the area of Ambient Intelligence (Aml): support technologies (such as sensors, actuators, location systems, context awareness, Internet of Things), application of these technologies to collect data, to apply intelligent algorithms and machine learning for Aml, regulations of data privacy and anonymization techniques, intelligent user interfaces.

### **Learning Outcomes**

At the end of the course students shall be able to

- Know and understand the concepts and technologies
- Know, understand and apply data acquisition and fusion techniques from different sensors
- Select and apply appropriate machine learning techniques to the data collected to infer patterns about the context and its dimensions
- Understand the requirement for adaptability of interfaces to user needs
- Know and promote privacy in the acquisition, protection and treatment of the data collected

## **Big Data: 1<sup>st</sup> year – 2<sup>nd</sup> semester**

### **Objectives**

This curricular unit aims to provide students with concepts, techniques, tools and platforms of big data processing, with focus on NoSQL databases.

### **Learning Outcomes**

At the end of the course students shall be able to

- Known and understand the principles and concepts of storage, processing and analysis of data (Big Data).
- Identify and apply the concepts and storage techniques, processing and analysis of data (Big Data) to solve practical problems.
- Use No SQL databases
- Select and use appropriate tools, for storage, processing and analysis of large volume of data (Big Data)

### **Data Analysis: 1<sup>st</sup> year – 2<sup>nd</sup> semester**

#### **Objectives**

This curricular unit aims to present a set of techniques and methodologies based on deep neural networks to solve real data analysis problems. By understanding the potential of these systems and by gaining the ability to develop architectures with these characteristics will give students a set of specialized skills to work in the area of computational data analysis.

#### **Learning Outcomes**

At the end of the course students shall be able to

- Know and understand advanced concepts in the field of intelligent data analysis
- Understand the main architectures of deep neural networks, namely convolutional networks and recurrent networks.
- Develop deep neural networks for application to practical problems
- Understand the main characteristics of reinforcement learning and understand the situations in which it should be applied
- Use machine learning tools for the development, training and validation of data analysis models

### **Business Intelligence: 1<sup>st</sup> year – 2<sup>nd</sup> semester**

#### **Objectives**

Provide students with knowledge about modern techniques and tools to support business decision-making based on data extraction and analysis. These include datawarehouses, OLAP and datamining techniques.

#### **Learning Outcomes**

At the end of the course students shall be able to

- Know, understand and use data warehouses, OLAP systems, data mining algorithms and development tools.
- Implement data warehouses, OLAP systems, KPI's.
- Implement pivot tables, dashboards and reports.
- Apply, evaluate and get conclusions from data mining techniques.
- Supervise and implement projects in the BI field.
- Have a perspective of the use and importance of BI in models such as Balanced Scorecards.

## **Industrial Seminars: 2<sup>nd</sup> year – 1<sup>st</sup> semester**

### **Objectives**

The main objective of this course is to provide a close contact between the students and the industry and to train some important soft skills, namely related to the ability of effectively writing and presenting technical reports and scientific papers.

### **Learning Outcomes**

At the end of the course students shall be able to

- Understand and analyze real problems of the industry.
- Propose and justify solutions for specific cases in industrial scenarios.
- Write scientific papers.

## **Data Analysis Laboratory: 2<sup>nd</sup> year – 1<sup>st</sup> semester**

### **Objectives**

This curricular unit has as main objective to guide understanding the main stages of the data analysis process, to study the main characteristics of some of the most relevant problems in the area of data analysis, as well as the techniques used in data analysis problems.

### **Learning Outcomes**

At the end of the course students shall be able to

- Understand the main steps of the data analysis process
- Apply pre-processing and visualization techniques to real data
- Select, adapt and apply learning techniques to create useful predictive models of real context data
- Assess the quality of the models created in all relevant areas
- Know and understand the main characteristics of some of the most relevant problems in the area of data analysis



## **Project/Internship/Dissertation: 2<sup>nd</sup> year – Annual**

### **Objectives**

This course can take the form of Internship, Project or Dissertation. The objectives associated with each of these strands are as follows:

- i. Internship: Work carried out in a business environment, in the context of one of ISEC's partner companies. The main objectives are the acquisition of work experience, improvement of skills and application of technical and scientific knowledge acquired during the degree. The work to be carried out in the company must have an innovation component relevant to the scope of the master's degree.
- ii. Project: Work supervised by the teachers of the study programme, whose main objectives are the analysis and resolution of a problem that may consist of a more practical and experimental or a software development work. Eventually, a partner company may be involved.
- iii. Dissertation: Corresponds to a research work of a scientific nature on a topic in the area of knowledge of the degree. The main objectives focus on the acquisition of essential skills for the understanding of a research topic and the consequent design and development of innovative solutions that contribute to its resolution.

### **Learning Outcomes**

During work, students are faced with real business situations or scientific / research questions for which it is necessary to design and develop innovative IT solutions, which requires a non-trivial application of the knowledge and skills acquired during master's.

Successful completion of this course allows students to improve their skills and prepare for the job market or to continue their studies in the next study cycle.