



ANNEX B - STRUCTURE AND CONTENTS OF THE “MASTER UNIVERSITARIO EN INGENIERIA INFORMÁTICA” AT THE UNIVERSIDAD DE MÁLAGA

OVERALL STRUCTURE

FIRST YEAR	60
Management of Technology and Innovation in TIC	4,5
Design and Configuration of Secure Networked Systems	6,0
Data Science and Engineering I	6,0
Application Development in the Cloud	4,5
Technologies for developing IoT systems	4,5
Graphics and Multimedia Systems	4,5
Information System and Technology Strategy Management	7,5
Security and Privacy in Application Environments	4,5
Data Science and Engineering II	4,5
High performance for Data and Cybersecurity	4,5
Infrastructure for Cloud computing	4,5
Industrialization and deployment of IoT systems	4,5
SECOND YEAR	30
<i>Optative courses</i>	18
Master's thesis	12

STRUCTURE AND CONTENTS OF THE FIRST YEAR AT THE UNIVERSIDAD DE MÁLAGA

Course Title	Aims and Contents	Cred.	Sem.
Management of Technology and Innovation in TIC	This course focuses on the knowledge and skills aimed at training the relevant technological knowledge responsible for the management and leadership of innovation projects, defining standards for the company and managing relationships with other agencies and businesses.	4,5	1
Design and Configuration of Secure Networked Systems	The main aim of the course is to learn specific aspects related to the design, deployment and configuration of secure networked systems. More precisely, the course will cover network perimetral security and network hardening (firewalls, VPNs and IDSs) as well as operating systems security (Unix and Windows) problems and countermeasures. Further, the course will pay attention to security issues in Trusted Platforms and Virtualization Platforms.	6,0	1
Data Science and Engineering I	Computational and statistical techniques form the core of the modeling and inference phases in the data analysis workflow. The course offers students the theoretical and practical knowledge necessary to face data analysis in the important areas of Machine Learning, Deep Learning, Big Data, or Data Mining.	6,0	1
Application Development in the Cloud	In this course, the students will learn the different service models of Cloud Computing, together with the basics of cloud application development, using	4,5	1



	languages like Java or Python, web development frameworks, and NoSQL databases. In addition, students will get guidelines to choose among different cloud providers the best suited for deploying a particular application, considering also financial issues.		
Technologies for developing IoT systems	Developing an IoT system for a real application is the main objective of this subject. Through this example, we will study the main technologies required for a IoT system, including hardware platforms, sensors and actuators, energy optimization strategies, and communication protocols. Furthermore, the project allows reviewing other aspects, such as requirement definition, technologies integration, standards, planning, teamwork, documentation, etc.	4,5	1
Graphics and Multimedia Systems	Learning of the basics (both technical and mathematical) concepts behind the generation of 3D and stereoscopic computer graphics, and of advanced techniques to combine them with multimedia contents (as, for example, real-time live video grabbing in augmented-reality systems).	4,5	1

Course Title	Aims and Contents	Cred.	Sem
Information System and Technology Strategy Management	Students will acquire skills for making long-term technological decisions. Especially important is to equip students with tools to decide between different products that constitute major software acquisitions for a large company and mark its strategy, the dependencies between them, prioritization, etc.	7,5	2
Security and Privacy in Application Environments	This course covers the study of most common privacy and security threats in different application scenarios such as Mobile, Cloud and IoT, as well as their mitigation strategies. It will focus on how the use of those technologies impact security and privacy.	4,5	2
Data Science and Engineering II	This course aims at introducing students in the Big Data technologies for Data Engineering and Data Science. Thus, the students will learn the differences between NoSQL data models and how to design a data repository for each case. Traditional data sources (relational databases, CVS files, etc.) and NoSQL databases will be the source for data analytics processes that will be introduced with Python.	4,5	2
High performance for Data and Cybersecurity	The main objective of the course is to show the knowledge necessary to carry out an optimization project and improve the performance of an application in the areas of data analytics and cybersecurity. The orientation is eminently practical, showing with simple examples the optimization phases and the most significant techniques, using representative tools of the state of the art. The second part of the course focuses on a collaborative project that will allow students to face, with the knowledge acquired,	4,5	2



	the problem of the optimization of a real application.		
Infrastructure for Cloud computing	his course focuses on the implementation details of infrastructures for cloud computing in a data center including the virtualization of computation, networking and storage services. All the concepts are illustrated by deploying and managing an OpenStack software platform.	4,5	2
Industrialization and Deployment of IoT systems	The objective of the course is to know the most representative technologies and tools to convert a IoT system prototype into a marketable system. Tools for testing and validation will be learned. The technologies for the development of human-machine interfaces for IoT and the integration of these systems in the cloud will be studied. The learning of the contents will follow a methodology based on projects.	4,5	2

STRUCTURE AND CONTENTS OF THE SECOND YEAR AT THE UNIVERSIDAD DE MÁLAGA

Course Title	Aims and Contents	Cred.	Sem.
Subsidiary courses	Every year different subsidiary courses are offered by the MS In the CS among the ones provided in the list reported below.	18	1&2
Master's Thesis		12	1&2

List of possible subsidiary courses that may be offered by the MS in CS at UMA

Specialty in Cybersecurity

Course Title	Aims and Contents	Cred.	Sem.
Computer Forensics	During this course of specialization, the student will acquire the technical skills to carry out computer forensic analysis and those methodologies that are fundamental for the successful training of a forensic computer practitioner. In particular, the course covers in a horizontal manner the different phases of identifying, obtaining, analyzing and presenting electronic evidences. These skills will be consolidated through a complete use case.	4,5	TBD
Malware Analysis	The ability to detect, analyze, understand, control, and eradicate malware is an increasingly important issue at all levels of business and Defense. This course will introduce students to malware analysis techniques through readings and interactive analysis of real samples. Consequently, students will acquire the necessary ability to analyze the presence and behavior of malware through static and dynamic analysis techniques.	4,5	TBD



Security Engineering	This course will address the problem of the creation of secure software-based systems, focusing on engineering and systematic aspects and approaches, such as "security-by-design" and "privacy-by-design". Students will learn the main components of security engineering such as security requirements, processes and standards, modeling, analysis, design, evaluation and documentation, including latest trends such as security compliance, certification and design-for-certification. We will use a Project Based Learning (PBL) methodology in order to ensure that students reinforce the theoretical content by applying it in a realistic project.	4,5	TBD
Secure programming	This course covers the principles and practices of secure programming. Security models, threats, design principles and secure coding practices will be exposed. A developer with the knowledge of these techniques will minimize vulnerabilities in the software, avoiding to be exploited by attackers. The most representative platforms will be considered, from traditional platforms to mobile devices.	4,5	TBD
Advanced Cryptographic Technologies	This course covers the study of most common cryptographic technologies in wireless, mobile and personal communication systems, including design guidelines, weaknesses identification and cryptanalysis. It will particularly focus on wireless personal area networks, RFID systems, sensor and mobile networks, considering the National Scheme for Security as a global reference.	4,5	TBD
Security in Industrial and Cyber-Physical Systems.	The goal of this course is to study common security threats in control applications and industrial scenarios, as well as their mitigation strategies. It will particularly focus on how the use of the new control technologies, and more precisely, Cyber-Physical Systems (integrated processing and communication components), as well as other relevant paradigms such as Industrial Internet of Things and Industry 4.0, have a big impact on security and privacy of critical sectors.	4,5	TBD

Specialty in Data Science and Engineering

Data Storytelling and Visual Thinking	Data is the new oil and, thus, one of the hot topics in the Computer Science's new challenges. This new oil also has to be processed and packed to become such a valuable good. In this subject, we will learn how to achieve the knowledge paradigm, providing visualization metaphors to represent the insights, and building scripts to effectively communicate them, i.e., telling the story behind the raw data.	4,5	TBD
Data Streams Engineering	Nowadays there are many sources of information where data arrive sequentially and at high speed (sensor networks, financial markets, social networks ...). They are called data streams and mining them requires special techniques because of different restrictions (real time, partial data, concept drift, etc.) The students will learn algorithms and techniques used in data stream mining and real-time analytics.	4,5	TBD



Engineering and Data Science in Social Networks	In today's competitive business environment, there is a need for businesses to collect, monitor, and analyse user-generated data on social media sites, to achieve a competitive advantage. In this subject, the student will learn to create a social media analytics framework that allow businesses to compare customer sentiment on social media to understand where businesses are doing well and improve.	4,5	TBD
Deep Learning	The aim of the course is to introduce the importance of modelling, design, and development of intelligent systems in data science and engineering. The following topics will be covered: Deep neural networks; Training for deep models; Convolutional neural networks; Auto-encoders; Recurrent and recursive networks; Reinforcement learning. The students will develop these ideas in practical projects.	4,5	TBD
Big Data	This subject is aimed at providing the students with a practical background on state-of-the-art Big Data technologies including the Apache projects Hadoop, Spark, and Flink. The main focus will be the distributed processing of batch and streaming data sources with these technologies by developing applications with the Scala and Python programming languages.	4,5	TBD
Accelerating Analytics	This course aims at achieving three main goals: i) to provide a high-level survey of key analytics models and algorithms; ii) to analyze the usage patterns of these models; and iii) to discuss HW and SW opportunities for accelerating analytics workloads.	4,5	TBD

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