MASTER OF SCIENCE IN DATA SCIENCE AND ARTIFICIAL INTELLIGENCE

PROGRAMME STRUCTURE

Hours of total learning: 2.250
Total Contact Hours: 450
Supervised Placement and Practice Hours: 400
Self Study Hours: 600
Assessment Hours: 800
Program Credits: 90 ECTS
EQF/MQF level 7
Duration: 18 months- 72 weeks
Mode of Delivery: Fully Online Learning
Language of Instruction: English
Mode of Attendance: Full Time

The programme structure includes different study and assessment material and activities that will be developed in a synchronous and asynchronous modality. The following units will delivered asynchronously:

- Pre-recorded lectures
- Assignment
- Project and research activities

To guarantee the direct interaction among students and professors and to monitor the student's progress and results, the following units are offered synchronously:

- Webinars (live class sessions)
- Forums
- Synchronous section (one to one meeting with tutors or professors)

In addition, the following involve synchronous invigilation so as to maintain the integrity of the exam and assessment model:
- Mid term tests
- Final term Tests
- Final exam (open question)

The master's degree lasts 18 months and is divided into 3 semesters of 6 months each. Each semester includes:
1st semester: 4 courses
2nd semester: 4 courses
3rd semester: 1 course + final project

Module/Unit Title	Compulsory (C) or Elective (E)	ECTS (Figures must be whole integers and with a value of at least 1 ECTS)	MQF Level of each module	Mode of Teaching (Lectures, workshop, placement, asynchronous, forums, VLE, etc.)	Mode of Assessment (Examination, assignment, project, blog, etc.)
CS501 Python	C	6	7	Pre-recorded lectures, webinars, forums, synchronous sections	Mid-term assessment Final exam open question Assignments Project and research activities
CS502 Data science	C	8	7	Pre-recorded lectures, webinars, forums, synchronous sections	Mid-term assessment Final exam open question Assignments Project and research activities
CS503 Big Data	C	8	7	Pre-recorded lectures, webinars, forums, synchronous sections	Mid-term assessment Final exam open question Assignments Project and research activities
CS504 Data management	C	6	7	Pre-recorded lectures, webinars, forums, synchronous sections	Mid-term assessment Final exam open question Assignments Project and research activities
CS505 Artificial Intelligence	C	8	7	Pre-recorded lectures, webinars, forums, synchronous sections	Mid-term assessment Final exam open question Assignments Project and research activities
CS506 Machine Learning	C	8	7	Pre-recorded lectures, webinars, forums, synchronous sections	Mid-term Assessment Final exam open question Assignments Project and research activities
CS507 Deep Learning	C	8	7	Pre-recorded lectures, webinars, forums, synchronous sections	Mid-term assessment Final exam open question Assignments Project and research activities
CS508 Artificial Intelligence applications	C	8	7	Pre-recorded lectures, webinars, forums, synchronous sections	Mid-term Assessment Final exam open question Assignments Project and research activities
CS509 Neural networks	C	8	7	Pre-recorded lectures, webinars, forums, synchronous sections	Mid-term Assessment Final exam open question Assignments Project and research activities
CS510 Project Work	C	20	7	Pre-recorded lectures, webinars, forums, synchronous sections	Project work presentation to the master committee

PYTHON: MQF/EQF Level 7 – 6 ECTS

This course introduces computer programming using the Python programming language. In this course, students will analyse the different programming systems, with particular attention to the Python programming language, which is today the most widely used for many types of applications, from networking to the web, to animation, and up to machine learning. Emphasis is placed on common algorithms and programming principles utilising the standard library distributed with Python. Upon completion, students will have a good knowledge of the Python syntax and the most important mechanisms of object-oriented programming, and should be able to design, code, test, and debug Python programs.

DATA SCIENCE: MQF/EQF Level 7 – 8 ECTS

In this course, the goal is to give students an introduction to, and hands-on experience with, all phases of the data science process using real data and modern tools.
The main topics that will be covered are data formats, loading and cleaning; statistical and exploratory data analysis using Python; basics of data visualisation; and some fundamental ethical issues in data science. At the end of the module/unit the learner will have acquired the following skills:

- use effectively data aggregation and transformation;
- understand how visualise data;
- comprehend the difference between linear and logistic regression;
- understand the different ethics involved in data.

BIG DATA: MQF/EQF Level 7 – 8 ECTS

In this course, students are introduced to data analysis to improve their skills and understanding of how big data creates value in the business and public sectors. The course also introduces the data analysis lifecycle and the three types of data analytics: descriptive, predictive, and prescriptive. Students will use Anaconda (Python with its libraries) extensively to create a data pipeline to acquire, analyse, and visualise data. They will identify the likelihood of future outcomes through the use of data, statistical algorithms, and machine learning techniques based on historical data. The course prepares students to work effectively with heterogeneous, real-world data, training them to become experts in extracting useful insights for business. It provides a unique blend of information technology, mathematical, analytical, and managerial skills. Moreover, the course covers the concept of big data privacy, the management of big data, and the systems and processes used to minimise risk and protect sensitive data.

DATA MANAGEMENT: MQF/EQF Level 7 – 8 ECTS

In this course, students will gain the fundamental theory and practical knowledge needed to use Database Management Systems to support MIS. It introduces the main concepts of designing a relational database, as well as mapping business requirements to the logical and physical design of Database Management Systems. In addition, OLAP tools for extracting critical information to support business decisions will also be covered. The course also prepares students to address privacy issues and data breaches. Proper data management is presented as essential for all organisations that handle sensitive information and large volumes of data.

ARTIFICIAL INTELLIGENCE: MQF/EQF Level 7 – 8 ECTS

In this course, students will be introduced to the fundamental theories and applications of artificial intelligence. The course provides intensive knowledge in designing intelligent agents and observing their behaviour in connection with their surrounding environment. In addition, search algorithms for problem-solving will be covered in depth, supported with appropriate applications and examples. The main goal of the course is to enable students to apply these concepts to solve problems using intelligent agents and their adopted algorithms. Moreover, the concept of AI security will be introduced, along with the impact and implications of AI on cybersecurity.

MACHINE LEARNING: MQF/EQF Level 7 – 8 ECTS

This module introduces students to the basics of machine learning and data analytics in the current age of big data. After an initial section on numbers and concepts related to big data, and on the motivation for a new type of analytics based on machine learning, algorithms for both supervised and unsupervised learning are presented in theory and in practice through hands-on labs, preparing students for research or industry applications of machine learning techniques.

DEEP LEARNING: MQF/EQF Level 7 – 8 ECTS

Deep learning is machine learning driven by deep artificial neural networks. Assuming a general knowledge of the basic concepts introduced in machine learning, the course explores in depth why and how artificial neural networks go beyond generalised linear models and provide a universal function approximation by learning non-linear, multi-dimensional spaces as output. After a broad discussion on general deep and wide feedforward neural networks (also known as multilayer perceptrons), two specialised deep learning Solutions, namely convolutional neural networks and recurrent neural networks, are introduced and thoroughly described to show how to effectively learn and process grid-shaped data and sequential data, respectively. Theoretical concepts and practical examples are intermingled throughout the course. Moreover, the course introduces the latest developments in deep learning techniques as applied to audio analysis, computer vision, and natural language processing. Through the course, students learn how computer systems can interpret images and videos, and then automate tasks based on that understanding.

Finally, deep unsupervised neural networks are described as powerful solutions for learning unlabelled data by fine-tuning the reconstruction error of the input. Various types of autoencoders are covered.

ARTIFICIAL INTELLIGENCE APPLICATIONS: MQF/EQF Level 7 – 8 ECTS

The course builds on a relational understanding of Artificial Intelligence (AI) and focuses on the opportunities, limitations, and challenges related to the organisational use of AI for value creation. It introduces different types of AI technologies and how they have emerged. Through theories on how the relationship and dynamics between organisations and technology can be understood, the course highlights how AI triggers new organisational and societal challenges. Against this backdrop, it explores how, at both operational and strategic levels, businesses can work on understanding, managing, and creating value using AI.

NEURAL NETWORKS: MQF/EQF Level 7 – 8 ECTS

In this course, we will examine the history of neural networks and state-of-the-art approaches to deep learning. Students will learn to design neural network architectures and training procedures through hands-on assignments. They will read current research articles to appreciate state-of-the-art approaches, as well as to question some of the hype surrounding the resurgence of popularity. The course also introduces and uses a critical software tool for modern deep learning: TensorFlow.

PROJECT WORK: MQF/EQF Level 7 – 20 ECTS

The Master's Project provides an opportunity for both the practical application of the knowledge and skills obtained through coursework and extended, in-depth work on a focused project. Through the project, students gain experience in specific areas of interest or career development. Students are required to consider possible topics for the project at the end of the second semester or the beginning of the third semester. Suitable topics often originate from forum or class discussions. Each student will be assigned a faculty member who will serve as their Project Advisor. The Project Advisor provides primary research guidance and mentorship by suggesting resources, which may include lab or working space, instruments, computers, software, or other technical equipment.
In consultation with the Project Advisor, the student is responsible for selecting an appropriate project topic, developing an overall plan of work, and establishing a time schedule for completion. Students must present a project proposal that includes:

- an introduction to the problem,
- a statement of the problem,
- its significance and impact,
- the aims of the project,
- a description of the methods, and
- a realistic project timeline.

The Master's Project is approximately 10,000 words in length, equivalent to 20 pages single-spaced and 40 pages double spaced. However, the length may vary according to the topic and method of analysis; the appropriate length will be determined by the student and the Project Advisor. Once the project has been completed and approved by the Project Advisor, the student must present it via videoconference to the Master's Committee, which will evaluate the project results and assign a grade.