**The Fundamentals of Digital Science for Chemists**

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| 13/06/2022 9h-12h (OCA)   1. Internet of things | **Objective:** This part gives an introduction to different themes related to Internet of things required for chemists  It will cover the following topics:   * History of Internet of Things (IoT) * Definition of IoT * Applications : Industry 4.0, circular economy * IoT architectures * Fog/Edge/Cloud computing |
| 14/06/2022 9h-12h (JSA)   1. Introduction to Data Science | **Objective:** This part is an introduction to different themes related to data science required for chemists  We will take a look at different concepts related to data science   * History of Data Science and computing * Computer Architecture and Systems * Major phases of data analysis * Algorithms for data acquisition and process control * Applications: sustainable cities, energy transitions |
| 15/06/2022 9h-12h (OCA)   1. Data acquisition protocols and technologies for IoT | **Objective:** This part presents data acquisition protocols and technologies for IoT  We will take a look at the key concepts of IoT   * IoT Technologies * Data acquisition protocols like SPI, I2C * Sensors * Actuators |
| 21/06/2022 9h-12h (JSA)   1. Fundamentals of Programming | **Objective:** This part gives a general overview of programming in Python with the goal of using it for data analysis  The student will be able to get an overview of   * Fundamentals of Python programming * Manipulation of files, especially reading, writing and modifying text files and CSV/TSV and JSON files * Interaction with the user * Data Analysis (basic) using built-in Python methods |
| 21/06/2022 13h-17h (JSA)   1. Data Analysis and visualization | **Objective:** This part gives the fundamentals of data analysis and visualization  It will cover the following topics   * Clustering algorithms * Classification algorithms * Linear regression models * Recommender systems * Visualization techniques |
| 22/06/2022 9h-12h (OCA)   1. Practical session on Microcontrollers | **Objective:** This part gives a hands-on experience on the microcontrollers  The student will be able to perform the following   * Coding, compiling and flashing a firmware for microcontroller * Interacting with sensors and actuators using SPI and I2C protocols * Reading digital and analog measures |
| 22/06/2022 13h-17h (OCA)   1. Network protocols for IoT | **Objective:** This part gives an introduction to the network protocols for data communication  We will cover the following topics   * Network protocols like LPWAN and WPAN * Message exchange protocols like MQTT |
| 27/06/2022 9h-12h (JSA)   1. Data Mining | **Objective:** This part gives an opportunity to the students to use data mining tools  We will look at the following topics:   * Introduction of Python libraries like numpy, matplotlib and pandas * Manipulating CSV and JSON files using the above libraries * Data analysis * Data visualization techniques for different types of data * Clustering, classification and linear regressing using the library Scikit-learn. |
| 29/06/2022 9h-12h (OCA)   1. Scaling up IoT | **Objective:** This part introduces ways to scale up the IoT architectures  The students will discover   * The challenges while scaling up IoT * IoT Lab infrastructure |
| 30/06/2022 9h-12h (JSA)   1. Machine Learning | **Objective:** This part gives an introduction to machine learning techniques  We will cover the following topics   * Supervised, unsupervised and semi-supervised learning * Neural network models including single and multilayered perceptron * Analysis of sensor data * Image analysis * Prediction * Recognition of handwriting |
| 04/07/2022 9h-12h (OCA)   1. Practical session on IoT-Lab | **Objective:** This part introduces ways to use message and network protocols for IoT lab  The students will work on   * LoRa WAN * MQTT |
| 06/07/2022 9h-12h (JSA)   1. Big Data | **Objective:** This part will introduce the key concepts of Big Data  Following are the topics covered in this module:   * 5V of Big Data * Data storage of voluminous data, especially non-relational databases * Artificial Intelligence * Open databases and extraction of information |
| 07/07/2022 9h-11h (OCA-JSA)  Evaluation | Final exam of two hours based on all the topics covered in this module. |