**The Fundamentals of Digital Science for Chemists**

|  |  |
| --- | --- |
| 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 chemistsIt 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 chemistsWe 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 IoTWe 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 analysisThe 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 microcontrollersThe 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 communicationWe 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 toolsWe 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 architecturesThe 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 techniquesWe 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 labThe 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 DataFollowing 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. |