

The Fundamentals of Digital Science for Chemists

<p>19/06/2023 9h-12h (JSA) 1. Introduction to Data Science</p>	<p>Objective: This part is an introduction to different themes related to data science required for chemists</p> <p>We will take a look at different concepts related to data science</p> <ul style="list-style-type: none"> • 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
<p>19/06/2023 14h-17h (OCA) 2. Internet of things</p>	<p>Objective: This part gives an introduction to different themes related to Internet of things required for chemists</p> <p>It will cover the following topics:</p> <ul style="list-style-type: none"> • History of Internet of Things (IoT) • Definition of IoT • Applications : Industry 4.0, circular economy • IoT architectures • Fog/Edge/Cloud computing
<p>20/06/2023 9h-12h (OCA) 3. Data acquisition protocols and technologies for IoT</p>	<p>Objective: This part presents data acquisition protocols and technologies for IoT</p> <p>We will take a look at the key concepts of IoT</p> <ul style="list-style-type: none"> • IoT Technologies • Data acquisition protocols like SPI, I2C • Sensors • Actuators
<p>22/06/2023 9h-12h (JSA) 4. Fundamentals of Programming</p>	<p>Objective: This part gives a general overview of programming in Python with the goal of using it for data analysis</p> <p>The student will be able to get an overview of</p> <ul style="list-style-type: none"> • Fundamentals of Python programming • Manipulation of files, especially reading, writing and modifying text files and CSV/TSV and JSON files • Interaction with the user

	<ul style="list-style-type: none"> • Data Analysis (basic) using built-in Python methods
<p>26/06/2023 14h-17h (JSA) 5. Data Analysis and visualization</p>	<p>Objective: This part gives the fundamentals of data analysis and visualization</p> <p>It will cover the following topics</p> <ul style="list-style-type: none"> • Clustering algorithms • Classification algorithms • Linear regression models • Recommender systems • Visualization techniques
<p>27/06/2023 9h-12h (OCA) 6. Practical session on Microcontrollers</p>	<p>Objective: This part gives a hands-on experience on the microcontrollers</p> <p>The student will be able to perform the following</p> <ul style="list-style-type: none"> • Coding, compiling and flashing a firmware for microcontroller • Interacting with sensors and actuators using SPI and I2C protocols • Reading digital and analog measures
<p>29/06/2023 14h-17h (JSA) 7. Data Mining</p>	<p>Objective: This part gives an opportunity to the students to use data mining tools</p> <p>We will look at the following topics:</p> <ul style="list-style-type: none"> • 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 regression using the library Scikit-learn.
<p>30/06/2023 9h-12h (OCA) 8. Network protocols for IoT</p>	<p>Objective: This part gives an introduction to the network protocols for data communication</p> <p>We will cover the following topics</p> <ul style="list-style-type: none"> • Network protocols like LPWAN and WPAN • Message exchange protocols like MQTT

<p>03/07/2023 9h-12h (JSA) 9. Machine Learning</p>	<p>Objective: This part gives an introduction to machine learning techniques</p> <p>We will cover the following topics</p> <ul style="list-style-type: none"> • Supervised, unsupervised and semi-supervised learning • Neural network models including single and multilayered perceptron • Analysis of sensor data • Image analysis • Prediction • Recognition of handwriting
<p>03/07/2023 13h-17h (OCA) 10. Scaling up IoT</p>	<p>Objective: This part introduces ways to scale up the IoT architectures</p> <p>The students will discover</p> <ul style="list-style-type: none"> • The challenges while scaling up IoT • IoT Lab infrastructure
<p>04/07/2023 9h-12h (OCA) 11. Practical session on IoT-Lab</p>	<p>Objective: This part introduces ways to use message and network protocols for IoT lab</p> <p>The students will work on</p> <ul style="list-style-type: none"> • LoRa WAN • MQTT
<p>06/07/2023 14h-17h (JSA) 12. Big Data</p>	<p>Objective: This part will introduce the key concepts of Big Data</p> <p>Following are the topics covered in this module:</p> <ul style="list-style-type: none"> • 5V of Big Data • Data storage of voluminous data, especially non-relational databases • Artificial Intelligence • Open databases and extraction of information
<p>10/07/2023 9h-11h (OCA-JSA) 13. Evaluation</p>	<p>Final exam of two hours based on all the topics covered in this module.</p>

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