



Title of the course	Advanced Topics in Data Science
Department	Data Science
Specialization	
Academic Year	2022-2023
Semester Duration	Spring2023
Credit Number	4
Number of Hours	40

I. Course Description

This course introduces advanced techniques in data science. The first part of the course is about the major component of the Internet of Things, data acquisition and sensing. The second part is a research-like approach where students individually select one topic to develop and understand throughout the semester.

II. Course Learning Outcomes :

After completing the course, the student should be able to:

- Distinguish role and use of various sensors.
- Understand IoT architectures.
- Understand IoT Communications and networking protocols.
- Understand IoT data storage and retrieval.
- Design and implement a data acquisition system to generate a dataset.
- Apply analytics techniques and skills accumulated over the last 5 semesters to datasets.
- Learn IoT case studies and Projects.
- Understand cloud computing concepts and fundamentals.
- Learn key Drivers of cloud computing.

III. Assessment Methods

The success of the student in this course is based on:

- 1- His/her active participation in class.
- 2- His/her scientific contribution through research done outside the classroom.
- 3- His/her reading notes, research reports and practical applications as requested by course instructor.

The assessment of the student is carried out according to the following grid:

Assessment Type	Final Grade Weighting (%)	Dates/Deadlines
Research Project	20%	
Midterm Exam	20%	
Final exam	60%	
Total	100%	

IV. Reference Book

Electronic copies made available in the classroom.



V. **Course Project**

The project is worth 20% of the overall grade. This is an individual effort where the student selects a topic in IoT or cloud computing to develop and learn throughout the semester. The first part of the research project is to conduct a comprehensive literature review on the selected topic, trying to learn more about the topic, what other people did on this topic etc. Then, try to add some contribution to the work and hopefully publish a conference paper out of your work.

The project report is produced on an IEEE two column conference template. See classroom files.

Here is the plan:

Week1	Identify the topic by doing an exhaustive research and quick readings
Week2-Week4	Produce an initial literature review on the topic
Week5-Week6	Deepen your literature review to include more recent work
Week7-Week8	Include your contribution, simulation results etc. Produce the final manuscript.
Week9	Submit project deliverables that include, project report, slides, codes, ... Present your work to the committee.

VI. **More sources**

Some interesting links:

<http://www.hands-on-books-series.com/students.html>

Block chain case studies:

<https://www.datasciencecentral.com/profiles/blogs/six-use-cases-in-blockchain-analysis>

SAS' materials:

- Downloadable free SAS eBooks: <https://support.sas.com/en/books/free-books.html>, and
- SAS Global Forum (https://www.sas.com/en_us/events/sas-global-forum.html) and especially the proceedings: https://www.sas.com/en_us/events/sas-global-forum/program/proceedings.html
- Free SAS Publications Text Books for Educators and students: <https://support.sas.com/en/books/request-evaluation-copies.html>
- The SAS Case Study Library could also be a useful resource: https://www.sas.com/en_gb/learn/academic-programs/resources/the-sas-case-library.html

Videos

- [IoT Explained Simply](#)
- [How It Works: Internet of Things](#)
- [UML State Diagrams](#)
- [Mealy vs. Moore State Machines](#)

Articles and Papers

- [The Internet of Things: Networked Objects and Smart Devices](#)
- [Internet of Things \(IoT\): A Vision, Architectural Elements, and Future Directions](#)
- [Ethical Design in the Internet of Things](#)
- [Privacy of the Internet of Things: A Systematic Literature Review \(Extended Discussion\)](#)
- [Block chains and Smart Contracts for the Internet of Things](#)
- [Network Design \(pages 1 - 56\)](#)



- Comparison of Internet of Things (IoT) Data Link Protocols

Python Programming

- Python Essentials

Raspberry Pi Documentation

- Raspberry Pi Essentials

Suggested References, Platforms, and Applications:

- Articles & Videos:
 - IoT Explained Simply
 - How it works: IoT
 - IBM Smarter Planet
 - Bloomberg - IoT: 19 Trillion Dollar Market
 - Microsoft - IoT Use Cases
- IoT Device Development Toolkits
 - Arduino - How Arduino is open-sourcing imagination
 - Raspberry Pi
 - ARTIK - Samsung IoT HW Platform
 - How to connect ARTIK 710 to ARTIK Cloud using ARTIK IDE
- Smart Home
 - Nest - acquired by Google for \$3.2 Billion (Jan. 2014)
Smart Learning Thermostat, Works with Nest
 - SmartThings - Samsung acquired SmartThings in Aug. 2014 for \$200 Million
SmartThings Hub
 - Phillips Personal Wireless Lighting - Hue
Phillips Hue
- Smart Flower/Plant
 - Parrot Smart Flower Pot
- IoT Platforms:
 - IoTivity
 - ARTIK IoT Cloud
 - Daliworks, Thing+
 - openMobius
 - Postscapes
- Smart Wearable Devices:
 - Google Glass
 - Oculus/Samsung Gear VR
 - Microsoft HoloLens
 - GoPro
 - Myo Gesture Control Armband
 - Zepp Sports Analyzer (Tennis, Golf, Baseball)
 - Fitbit
 - Jawbone
 - Pebble Smart Watch
 - LG Smart Watch