DeCAIR Course Syllabus Form

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Work Package Number & Title	Work Package 2: Development of new MSc and BSc programs in AIR		
Activity Number & Title	Activity 2.2: Designing and developing syllabi and content for the agreed upon courses in the new programs		
Work Package Leader	Francesco Masulli, University of Genoa		
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Revision History

Version	Date	Author	Description	Action *	Page(s)
1	11/4/2021	Ramzi Saifan	Original (base) document	C	1-5
2	9/12/2021	Ramzi Saifan	Update based on 27/11/2021 meeting	U	1-4
3	19/1/2022	Ramzi Saifan	Update based on the surveys feedback	U	1-4
4	26/2/2023	Gheith Abandah	Modifications for Term Spring 2023	U	1-4

(*) Action: C = Creation, I = Insert, U = Update, R = Replace, D = Delete

Disclaimer

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Course title	Applied Data Science Spring 2023
Course number	0907761
Credit hours (lecture and lab)	3 (3 + 0)
ECTS (weekly contact and self-study load)	6 (3 + 3)
Prerequisites/co-requisites by course number and name	Applied machine learning, 0907743
Prerequisites by topic (other than the formal prerequisites above)	Students are assumed to have good background in mathematics, particularly, calculus, linear algebra, and statistics. Additionally, the students should have good programming skills using Python.
Level and type (compulsory, elective)	Masters' elective course
Year of study and semester	Second year, first semester
Catalogue description	Definitions and applications; Market trends; Data analytics lifecycle; Data exploration and preprocessing; Data visualization; Theory, tools and methods; Introduction to Big data management, warehousing and processing. This course has practical assignments and term project.
Objectives	1. Introduce students to the practical techniques used in data analytics including loading, cleaning, preparation, wrangling, visualization, and analysis. 2. Introduce students to the basic concepts and techniques in big data.
Intended learning outcomes	Upon successful completion of this course, students will be able to: **No** | **Intended learning Outcome (ILO)** | **Program learning outcome (PLO)*** 1 | Use Python and its specialized libraries to gain insight from data and solve problems. | 3 2 | Know the main concepts and techniques used in handling big data and performing data analytics. | 1 (*) The PLOs are listed in the appendix
Teaching and learning methods	Development of ILOs is promoted through the following teaching and learning methods: • Lectures will be in class. • The AI lab is open for the students to practice the practical aspects and solve the programming homework assignments. • The student attends the class presentations and participates in the discussions.

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The student joins the related online team/group and participates in its discussions.
The student studies the reference material, including books and videos.
The student solves the programming assignments in data science.
The student carries out a term project for solving a problem using data science techniques.
The student develops a professional report for the term report.
The student presents the term project in class.

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<tr><td>Learning material type</td><td>Textbook, class handouts, some instructor keynotes, selected YouTube videos, and access to a personal computer and the internet.</td></tr>
<tr><td>Resources and references</td><td>A- Required book(s), assigned reading and audio-visuals:
1. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Ipython, O'Reilly Media, 2nd Edition, 2018.
2. Arshdeep Bahga and Vijay Madisetti, Big Data Analytics: A Hands-On Approach, 2019.
3. Course web page: https://www.abandah.com/gheith/?page_id=3031

B- Recommended book(s), material, and media:
1. Jake VanderPlas, A Whirlwind Tour of Python, O'Reilly Media, 2016.
2. Joel Gurs, Data Science from Scratch, O'Reilly Media, 2015.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow: Concepts: Tools, and Techniques to Build Intelligent Systems, 3rd Edition, O'Reilly Media, Oct 2022.</td></tr>
<tr><td>Topic outline and schedule</td><td>
<table>
<tr><th>Week</th><th>Topic</th><th>ILO</th><th>Resources</th></tr>
<tr><td>1</td><td>Course Introduction</td><td>1</td><td>3</td></tr>
<tr><td>2+3</td><td>Pandas Data Structures, Essential Functionality & Descriptive Statistics</td><td>1</td><td>1</td></tr>
<tr><td>4+6</td><td>Data Loading, Storage and File Formats</td><td>1</td><td>1</td></tr>
<tr><td>6+7</td><td>Data Cleaning and Preparation</td><td>1</td><td>1</td></tr>
<tr><td>8</td><td>Data Wrangling: Join, Combine and Reshape</td><td>1</td><td>1</td></tr>
<tr><td>9+10</td><td>Plotting and Visualization with Matplotlib and Seaborn</td><td>1</td><td>1</td></tr>
<tr><td>11</td><td>Data Aggregation and Group Operations</td><td>1</td><td>1</td></tr>
<tr><td>12</td><td>Time Series</td><td>1</td><td>1</td></tr>
<tr><td>13</td><td>Introduction to Big Data</td><td>2</td><td>2</td></tr>
<tr><td>13</td><td>Big Data Architectures and Patterns</td><td>2</td><td>2</td></tr>
<tr><td>14</td><td>MapReduce Patterns</td><td>2</td><td>2</td></tr>
<tr><td>15</td><td>Project Presentations</td><td>1+2</td><td>3</td></tr>
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<tr><td>Evaluation tools</td><td>Opportunities to demonstrate achievement of the ILOs are provided through the following assessment tools:
<table>
<tr><th>Assessment tool</th><th>Mark</th><th>Topic(s)</th><th>Time</th></tr>
<tr><td>Homework assignments</td><td>10%</td><td>Programming aspects</td><td>W2-W14</td></tr>
<tr><td>Midterm exam</td><td>30%</td><td>First 8 weeks</td><td>W8</td></tr>
<tr><td>Term project report and presentation</td><td>20%</td><td>Practical and presentation aspects</td><td>W15</td></tr>
<tr><td>Final exam</td><td>40%</td><td>All material</td><td>W16</td></tr>
<tr><td>Total</td><td>100%</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Student requirements</td><td>The student should have a computer and internet connection.</td></tr>
<tr><td>Course policies</td><td>A- Attendance policies:
Attendance is required. Class attendance will be taken every class and the university polices will be enforced in this regard.
B- Absences from exams and not submitting assignments on time:
A makeup exam can be arranged for students with acceptable absence causes.
Assignments submitted late, but before announcing or discussing the solution can be accepted with 25% penalty.
The project report must be handed in in time.
C- Health and safety procedures:
All health and safety procedures of the university and the school should be followed.
D- Honesty policy regarding cheating, plagiarism, misbehavior:
Open-book exams
All submitted work must be of the submitting student.
Other text or code must be properly quoted with clear source specification.
Cheating will not be tolerated.
E- Available university services that support achievement in the course:
Microsoft Teams team: Link
AI Lab for practicing the practical aspects and solving the programming assignments.
Program announcements Facebook page: Link</td></tr>
<tr><td>Additional information</td><td>None</td></tr>
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Appendix

Learning Outcomes for the MSc in Artificial Intelligence and Robotics

Students who successfully complete the MSc in Artificial Intelligence and Robotics (AIR) will be able to:

1. Demonstrate a sound understanding of the main areas of AIR including artificial neural networks, machine learning, data science, industrial and service robots, and intelligent and autonomous robots.

2. Apply a critical understanding of essential concepts, principles and practices of AIR, and critically evaluate tools, techniques and results using structured arguments based on subject knowledge.

3. Apply the methods and techniques of the AIR fields in the design, analysis and deployment of AIR solutions and solving practical problems.

4. Demonstrate the ability to produce a substantial piece of research work from problem inception to implementation, documentation and presentation.

5. Demonstrate life-long learning, independent self-learning and continuous professional development skills in the AIR fields.

6. Demonstrate a sound understanding of the ethical, safety and social impact issues of AIR solutions and products.