DeCAIR Course Syllabus Form

Author(s)	Gheith Abandah		
Author Organization Name(s)	The University of Jordan		
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		
Due Date of Delivery	1/2/2022	**Project Month**	M14
Submission Date	23/11/2021	**Project Month**	M10

Revision History

Version	Date	Author	Description	Action *	Page(s)
1	18/7/2021	Gheith Abandah	Original (base) document	C	1-6
2	23/11/2021	Gheith Abandah	Drop "AI" from the course name	U	1-3
3	3/1/2022	Gheith Abandah	Revision based on Peer Review 1	U	1-3
4	23/1/2022	Gheith Abandah	Modifications for applying modern teaching methods in the Spring 2023 term	U	1-6
5	11/10/2023	Gheith Abandah	Modifications for Fall 2023 term	U	1-6

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

Disclaimer

This project has been co-funded by the Erasmus+ Programme of the European Union.

Email: DeCAIR@ju.edu.jo

Project Website: http://DeCAIR.ju.edu.jo/

Course title	Applied Machine Learning Fall 2023
Course number	0907726
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	None
Prerequisites by topic (other than the formal prerequisites above)	Students are assumed to have good background in mathematics, particularly, calculus, linear algebra, statistics, and probability. Additionally, the students should have good programming skills, preferably, using Python.
Level and type (compulsory, elective)	Masters' compulsory course
Year of study and semester	First year, first semester
Catalogue description	This graduate course concentrates on the application of state-of-the-art AI and machine learning algorithms for solving real-world problems. This course starts with reviewing the Python programming language and its important related packages. The covered topics include data preparation, training, evaluation, metrics, supervised learning (regression, classification, neural networks, deep learning, convolutional neural networks, and recurrent neural networks), basics of unsupervised and reinforcement learning, and recommender systems. The course uses active learning techniques to guarantee better engagement from the students. Also, experts from the industry are invited to talk about the practical applications in this domain. This course includes assignments and a practical term project.
Objectives	1. Introduce students to the techniques used in ML including data preparation, training models, regression, classification, neural networks, and deep learning. 2. Introduce students to the practical techniques used in developing ML systems including sample collection, training, and evaluation. 3. Introduce students to the programming techniques and libraries used in ML (Python, Scikit-Learn, Keras, and TensorFlow). 4. Enable the students to gain practical skills in solving wide range of problems using ML techniques.

<table>
<tr><td>Intended learning outcomes</td><td>Upon successful completion of this course, students will be able to:
<table>
<tr><th>No</th><th>Intended learning Outcome (ILO)</th><th>Program learning outcome (PLO)*</th></tr>
<tr><td>1</td><td>Demonstrate a sound understanding of the main techniques and algorithms in ML.</td><td>1</td></tr>
<tr><td>2</td><td>Solve a practical problem by developing an appropriate ML system.</td><td>3</td></tr>
<tr><td>3</td><td>Communicate the development of a ML system through a detailed technical report.</td><td>4</td></tr>
<tr><td>4</td><td>Use Python and its specialized libraries to develop programs for solving ML problems.</td><td>3</td></tr>
</table>
(*) The PLOs are listed in the appendix</td></tr>
<tr><td>Teaching and learning methods</td><td>Development of ILOs is promoted through the following teaching and learning methods:
• Flipped Classroom: A type of blended learning, which aims to increase student engagement and learning by having student complete readings at home and work on live problem-solving during class time.
• Assignment Based Learning
• Project Based Learning
• 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 and solving problems.
• 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 machine learning.
• The student carries out a term project for solving a problem using ML techniques.
• The student develops a professional report for the term report.</td></tr>
<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. 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.
2. François Chollet, Deep Learning with Python, 2nd Edition, Manning Pub. Oct 2021.
3. Course web page at: https://www.abandah.com/gheith/?page_id=3117
B- Recommended book(s), material and media:
4. Alberto Artasanchez, Prateek Joshi, Artificial Intelligence with Python, 2nd Edition, Packt Publishing, Jan 2020.</td></tr>
</table>

5. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Ipython, O'Reilly Media, 3rd Edition, Aug 2022.
6. K. Koutroumbas, S. Theodoridis, Pattern Recognition, 4th ed. Academic Press, Oct 2008.
7. Richard O. Duda, Peter E. Hart and David G. Stork, Pattern Classification, 2nd ed. Wiley Interscience, 2001.

Topic outline and schedule

Week	Topic	ILO	Resources
1-2	Introduction to ML	1	1
3-4	Python programming language	4	5
5-6	Data preparation and regression	1, 2, 4	1
7	Classification	1, 2	1
8	Training models	1	1
9	Classical techniques: SVM, decision trees and ensembles	1, 2	1
10	Unsupervised learning and clustering	1, 2	1
11-12	Neural networks	1, 2	1
13	Deep neural networks	1	1, 2
14	Recurrent neural networks	1, 2	1
14	Reinforcement learning	1, 2	1
14	Recommendation systems	1, 2	4

Evaluation tools

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment tools:

Assessment tool	Mark	Topic(s)	Time
Two Short Exams	10%	Programming aspects	W2-W14
Midterm exam	30%	Theoretical and practical aspects	W4, W8, W12
Term project report	20%	Practical and reposting aspects	W15
Final exam	40%	All material	W16
Total	**100%**		

Student requirements

The student should have a computer and internet connection.

Course policies

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 group: Link
Additional information	None

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. Analyze and discuss the basic concepts, principles, techniques, and theories in AIR including artificial neural networks, machine learning, data science, industrial and service robots, and intelligent and autonomous robots.

2. Use critical thinking on concepts, principles, and practices related to AIR, and rigorously evaluate tools, techniques, and outcomes using structured arguments based on subject knowledge.
3. Apply the methods and techniques of AIR in the design, analysis, and deployment of AIR solutions and solving practical problems.

4. Show the ability to produce distinguished research work from problem inception to implementation, and write quantitative and qualitative reports, and deliver them orally and in writing.

5. Demonstrate life-long learning, independent self-learning, and continuous professional development skills, and apply new AIR knowledge.

6. Take responsibility, work effectively within a team, abide by professional ethics and societal values in performing tasks and work, and apply work ethics and professional honor codes.

7. Use practical research methodologies to analyze and investigate issues related to AIR.