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	18/7/2021	Wafa Batayneh	Original (base) document	C	1-5
2	1/9/2021	Ahmad Bataineh, Laith Sawaqed		U	
3					
4					

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

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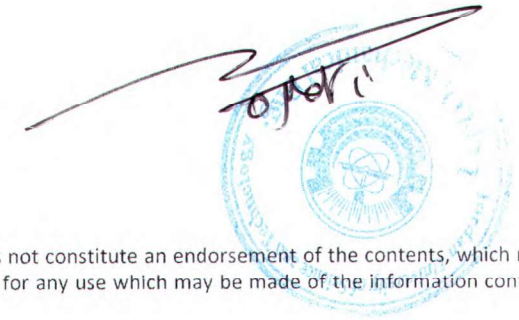

Course title	**ARTIFICIAL INTELLIGENT SYSTEMS**
Course number	**ME 781**
Credit hours (lecture and lab)	3 (3 + 0)
ECTS (weekly contact and self-study load)	6 (3 + 3)
Prerequisites/co-requisites by course number and name	None
Prerequisites by topic (other than the formal prerequisites above)	Students are assumed to have good background in mathematics, particularly, calculus and linear algebra, and linear control systems. Additionally, the students should have good programming skills, preferably, using MATLAB.
Level and type (compulsory, elective)	Masters' compulsory course
Year of study and semester	Any Semester
Catalogue description	This course will introduce students to the basic concepts regarding soft computing approaches used to enhance the artificial intelligence systems and incorporate the human knowledge in computing processes. Special emphasis will be placed on fuzzy logic, neural networks, hybrid systems and their application in designing intelligent systems, Deep Learning and Data Science with Application.
Objectives	1) Introduce the students to the different Artificial Intelligence systems. 2) Introduce the students to the Fuzzy Logic and its applications in Engineering Sciences. 3) Introduce the students to the different types of neural networks and its applications in Engineering Sciences. 4) Introduce the students to hybrid Artificial Intelligent techniques with a focus on Adaptive Neuro-Fuzzy Inference system (ANFIS) and its applications in Engineering Sciences. 5) Introduce the students to different searching algorithms with a focus on Genetic Algorithms and its applications.
Intended learning outcomes	Upon successful completion of this course, students will be able to:

No	Intended learning Outcome (ILO)	Program learning outcome (PLO)*
1	Demonstrate a sound understanding of the main techniques and algorithms in AI and its applications in Engineering Sciences.	1, 3
2	Solve linear and nonlinear problems by using different AI methods.	1, 3
3	Use MATLAB and its specialized Toolboxes to solve AI problems.	3

(*) 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 delivered in class or through Microsoft Teams /Zoom and will be recorded for later access in case of online learning. • The student attends the class presentations and participates in the discussions. • The student studies the reference material, including books and videos. • The student carries out a term project for solving a problem using AI methods. • The student presents the term project in class.
Learning material type	Class handouts, some instructor keynotes, selected YouTube videos,
Resources and references	A- Required book(s), assigned reading and audio-visuals: 1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani," Neuro-fuzzy and soft computing: a computational approach to learning and machine intelligence", Prentice Hall, 1997 François Chollet, Deep Learning with Python, Manning Pub. 2018. B- Recommended book(s), material and media: 2. Zilouchian A. & Jamshidi M., "Intelligent Control Systems Using Soft Computing Methodologies", CRC press, 2001. 3. Yen J. & Langari R., "Fuzzy Logic Intelligence Control & Information", Prentice Hall, 2000. 4. Hagan M. & Demuth H., "Neural Network Design", PWS Publishing, 1996. 5. Lee K., "First course on fuzzy theory and applications", Springer, 2005.
Topic outline and schedule	

Week	Topic	ILO	Resources
1	Introduction to AI and soft computing methods	1	
2	Introduction to Fuzzy Set Theory	1	
3	Generalized Modus Ponens (GMP), Mamdani vs. Sugeno Reasoning	1	
4	Control using Fuzzy Logic	2	
5	Apply using Matlab	3	
6	Introduction to Neural networks	1	
7	Supervised, Unsupervised, and Reinforcement Learning	1	
8	Feedforward Neural Networks	1	
9	Mid-Term Exam		
10	Recurrent neural networks	1	
11	Deep neural networks	1	
12	Apply Neural Networks using Matlab	2, 3	
13	ANFIS	2, 3	
14	Genetic Algorithms	2, 3	
15-16	Term Project Presentations		

<table>
<tr><td></td><td></td></tr>
<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>15%</td><td>Programming aspects</td><td>W2-W14</td></tr>
<tr><td>Midterm exam</td><td>20%</td><td>Introduction through classical techniques</td><td>W9</td></tr>
<tr><td>Term project report and presentation</td><td>15%</td><td>Practical and presentation aspects</td><td>W15</td></tr>
<tr><td>Final exam</td><td>50%</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 policies 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 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 and E-Learning course page
Program announcements Facebook group</td></tr>
<tr><td>Additional information</td><td>None</td></tr>
</table>

Appendix

Learning Outcomes for the MSc in in Mechatronics Engineering

Students who successfully complete the MSc in Mechatronics Engineering will be able to:

1- Integrated systems: Work with, and develop, integrated systems through all stages. This includes design, operation, fault diagnosis and troubleshooting.
2- Leadership: Lead industry modernization and automation effort; make decisions when selecting, procure and commission advanced engineering systems; lead and manage their multidisciplinary technical teams.
3- Innovation: Develop competitive and innovative technical solutions to complex engineering problems while driving innovations into the resulting product.
4- Broad-based: Adapt research and development to achieve optimal technical solutions, and take into account socioeconomic, environmental, and innovative technology.