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		
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Revision History

Version	Date	Author	Description	Action *	Page(s)
1	1/11/2021	Iyad Jafar	Original (base) document	C	1-6
2	7/12/2021	Iyad Jafar	Revised based on 27-11-2021 meeting	U	1-6
3					
4					

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

Disclaimer

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Course title	Computational Intelligence
Course number	0907553
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	AI and Machine learning (0917451)
Prerequisites by topic (other than the formal prerequisites above)	Students are assumed to have good background in machine learning and neural networks. Additionally, the students should have good programming skills, preferably, using Python or Matlab.
Level and type (compulsory, elective)	Bachelor's elective course
Year of study and semester	Fifth year, first or second semesters
Catalogue description	The course discusses the fundamentals and advances of soft computing-based design approaches using tools such as fuzzy logic, neural networks, evolutionary computing, and swarm intelligence. These tools could be useful in many areas such as information retrieval, smart grid control, driverless cars, intelligent transportation, intelligent mechatronics, optimization, communication, robotics, and manufacturing. The course involves tutorials on implementation of the major algorithms taught in class as applied to examples of real-world systems
Objectives	1. Describe in-depth about theories, methods, and algorithms in computational Intelligence. 2. Compare and contrast traditional algorithms with nature-inspired algorithms. 3. Examine the nature of a problem at hand and determine whether a computational intelligent technique/algorithm can solve it efficiently enough. 4. Design and implement Computational Intelligence algorithms and approaches for solving real-life problems.
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 computational intelligence.	1
2	Solve real world problems using computational intelligence techniques.	1, 2
3	Communicate the development of a solution using computational intelligence through a detailed technical report.	3

	4 | Use appropriate and common computational tools and libraries for computational intelligence. | 6, 7 (*) The PLOs are listed in the appendix
Teaching and learning methods	Development of ILOs is promoted through the following teaching and learning methods: • 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. • 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~~ computational intelligence (CI). • The student carries out a term project for solving a problem using ~~ML~~ CI techniques. • The student develops a professional report for the term report.
Learning material type	Textbook, class handouts, some instructor keynotes, selected YouTube videos, and access to a personal computer and the internet.
Resources and references	A- Required book(s), assigned reading and audio-visuals: 1. S.N. Sivanandam and S.N. Deepa, Principles of Soft Computing, 3rd Edition, Wiley, 2018. 2. Andries P. Engelbrecht, Computational Intelligence: An Introduction, John Wiley & Sons, 2008. 3. Christian Blum and Daniel Merkle, Swarm Intelligence: Introduction and Applications, Springer, 2008. 4. Course web page at: … B- Recommended book(s), material and media: 5. S. Sumathi and S. Paneerselvam, Computational Intelligence Paradigms: Theory & Applications using MATLAB, 1st Edition, CRC Press, 2010. 6. M. Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems, 3rd Edition Pearson/Addison Wesley, 2011.
Topic outline and schedule	

Week	Topic	ILO	Resources
1	Introduction to Computational Intelligence	1	1, 2
2-3	Review on Artificial Neural Networks	1, 4	1, 2
4	Introduction to Fuzzy logic	1	1, 2
5	Classical Relations, Fuzzy Relations and Membership Function	1, 4	1, 2
6	Fuzzy Arithmetic and Fuzzy Measures	1, 4	1, 2
7	Fuzzy Rule Base and Approximate Reasoning	1, 4	1, 2

	8	Fuzzy Decision Making	1, 4	1, 2
	9-10	Genetic Algorithms	1, 4	1, 2
	10-11	Hybrid Soft Computing Techniques	1, 4	1, 2
	12-13	Swarm Intelligence (Particle Swarm Optimization and Ant Colony Optimization)	1, 4	2, 3
	14-15	Applications of Soft Computing	1	1, 2

Evaluation tools

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

Assessment tool	Mark	Topic(s)	Time
Homework assignments	10%	Programming aspects	W2-W14
Midterm exam	30%	Introduction through fuzzy decision making	W8
Term project report	10%	Practical and communication aspects	W15
Final exam	50%	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 and Moodle course page
- AI Lab for practicing the practical aspects and solving the programming assignments.

	• Program announcements Facebook group
Additional information	None

Appendix

Learning Outcomes for the BSc in Computer Engineering

Students who successfully complete the BSc in Computer Engineering will be have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. An ability to communicate effectively with a range of audiences.

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.