DeCAIR Course Syllabus Form

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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	23/11/2021	Gheith Abandah	Original (base) document	C	1-6
2	3/1/2022	Gheith Abandah	Revision based on Peer Review 1	U	1-3
3					
4					

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

Disclaimer

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Course title	AI and Machine Learning
Course number	0917451
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	Computer Applications Lab (0907311) and Linear Algebra (0301241)
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 Python programming skills.
Level and type (compulsory, elective)	BSc compulsory course
Year of study and semester	Fourth year, second semester
Catalogue description	This undergraduate course gives an introduction to artificial intelligence (AI) and concentrates on the application of state-of-the-art machine learning (ML) algorithms for solving real-world problems. The covered topics include data preparation, training, evaluation, various 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. This course has practical assignments and term project.
Objectives	1. Introduce students to basics of AI. 2. Introduce students to the techniques used in ML including data preparation, training models, regression, classification, neural networks, and deep learning. 3. Introduce students to the practical techniques used in developing ML systems including sample collection, training, and evaluation. 4. Introduce students to the programming techniques and libraries used in ML (Python, Scikit-Learn, Keras, and TensorFlow). 5. Enable the students to gain practical skills in solving wide range of problems using ML techniques.
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 ML.	1
2	Solve an AI problem by developing an appropriate ML system.	1
3	Communicate the development of a ML system	3

	<table><tr><td></td><td>through a detailed technical report.</td><td></td></tr><tr><td>4</td><td>Use Python and its specialized libraries to develop programs for solving ML problems.</td><td>2</td></tr></table> (*) 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. • The student carries out a term project for solving a problem using ML 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. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow: Concepts: Tools, and Techniques to Build Intelligent Systems, 2nd Edition, O'Reilly Media, Oct 2019. 2. Prateek Joshi, Artificial Intelligence with Python, Packt Publishing, 2017. 3. Course web page at: … B- Recommended book(s), material and media: 4. François Chollet, Deep Learning with Python, Manning Pub. 2018. 5. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Ipython, O'Reilly Media, 2nd Edition, 2018. 6. Theodoridis S, Koutroumbas K, Pattern Recognition, 3rd ed. Academic Press, 2006. 7. Richard O. Duda, Peter E. Hart and David G. Stork, Pattern Classification, 2nd ed. Wiley Interscience, 2001.
Topic outline and schedule	<table><tr><th>Week</th><th>Topic</th><th>ILO</th><th>Resources</th></tr><tr><td>1</td><td>Introduction to AI</td><td>1</td><td>2</td></tr><tr><td>2</td><td>Introduction to AI</td><td>1</td><td>2</td></tr><tr><td>3</td><td>Introduction to ML</td><td>1</td><td>1</td></tr><tr><td>4</td><td>Data preparation and regression</td><td>1, 2, 4</td><td>1</td></tr><tr><td>5</td><td>Data preparation and regression</td><td>1, 2, 4</td><td>1</td></tr><tr><td>6</td><td>Classification</td><td>1, 2</td><td>1</td></tr></table>

	7	Training models	1	1
	8	Classical techniques: SVM, decision trees and ensembles	1, 2	1
	9	Unsupervised learning and clustering	1, 2	1
	10	Neural networks	1, 2	1
	11	Deep neural networks	1	1, 4
	12	Convolutional neural networks	1, 2	1
	13	Recurrent neural networks	1, 2	1
	14	Reinforcement learning	1, 2	1
	15	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
Homework assignments	10%	Programming aspects	W2-W14
Midterm exam	30%	Introduction through classical techniques	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 able to demonstrate:

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.