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		
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Revision History

Version	Date	Author	Description	Action *	Page(s)
1	24/11/2021	Gheith Abandah	Original (base) document	C	1-6
2				U	
3					
4					

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

Disclaimer

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Email: DeCAIR@ju.edu.jo

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

Course title	Research Methodology
Course number	0907703
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, statistics and probability.
Level and type (compulsory, elective)	Masters' compulsory course
Year of study and semester	First year, first semester
Catalogue description	Issues in Research Methodologies. Formulating Research Problems. Literature Surveys and Writing Research Papers and Reports. Ethical Issues and Engineering Responsibility. Performance Evaluation and Benchmarking. Choice of Metrics. Measurement Tools and techniques. Workload Characterization. Data Presentation. Statistical techniques for Performance Evaluation. Design of Experiments. Trace Driven and Execution Driven Simulation.
Objectives	The purpose of this course is to introduce the main research methodologies in AI and computer engineering to the graduate student. It is designed to achieve the following objectives: • Provide awareness about research methodologies and performance evaluation and benchmarking • Introduce various sources of information for literature review and data collection • Develop an understanding of the ethical dimensions of conducting applied research and engineering responsibility • Appreciate the components of scholarly writing and evaluate its quality • Introduce measurement tools and techniques • Introduce various experiment design methodologies • Introduce trace driven and execution driven simulation
Intended learning outcomes	Upon successful completion of this course, students will be able to:

No	Intended learning Outcome (ILO)	Program learning outcome (PLO)*
1	Define research; explain and apply research terms; describe the research process and the principal	4, 5, 6

		activities, skills and ethics associated with the research process.	
	2	Demonstrate the ability to choose methods appropriate to research aims and objectives.	5
	3	Understand the limitations of particular research methods.	5
	4	Develop skills in qualitative and quantitative data analysis and presentation.	2, 4
	5	Understand the importance of research ethics and integrate research ethics into the research process.	6
	6	Develop advanced critical thinking skills.	2
	7	Demonstrate enhanced writing and presentation skills.	4
	(*) The PLOs are listed in the appendix		
Teaching and learning methods	Development of ILOs is promoted through the following teaching and learning methods: • 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 carries out a research project in AI or computer architecture that surveys original and recent research papers where the student studies basic ideas, state-of-the-art solutions, and expected future directions. • The student develops a professional report for the term report. • The student presents the term project in class.		
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. Wayne Booth, George Colomb, Joseph Williams, Joseph Bizup, and William FitzGerald, The Craft of Research, 4th Edition, The University of Chicago Press, 2016. 2. Raj Jain, The Art of Computer Systems Performance Analysis, Wiley, 1991. 3. Course web page at: … B- Recommended book(s), material and media: 1. Hennessy and Patterson. Computer Architecture: A Quantitative Approach, 6th ed., Morgan Kaufmann, Elsevier Inc., 2017. 2. Peter Bock, Getting It Right: R&D Methods for Science and Engineering, Academic Press, 2001. 3. C.R. Kothari, Research Methodology, Methods and Techniques, 2nd Edition, New Age International Publishing, 2004.		

Topic outline and schedule

Week	Topic	ILO	Resources
1	Research, Researchers, and Readers	1	1(I)
2	Asking Questions, Finding Answers	1	1(II)
3	Making an Argument	1	1(III)
4	Writing Your Argument	1, 7	1(IV)
5	The Ethics of Research	1, 5	1(V)
6	Engineering Responsibility and Ethical Issues	5	3
7	Performance Evaluation Introduction, Common Mistakes, Selection of Techniques and Metrics	2, 3, 4	2(1-3)
9	Types of Workloads, Workload Selection, Monitors	2	2(4-7)
10	Data Presentation, Ratio Games	4	2(10-11)
11	Summarizing Measured Data, Comparing Systems	4	2(12-13)
12	Introduction to Experimental Design, 2k Factorial Designs	2, 3, 4	2(16-17)
13	Introduction to Simulation, Analysis of Simulation Results	2	2(24-25)
14	Project Presentations	1 – 7	1-6

Evaluation tools

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

Assessment tool	Mark	Topic(s)	Time
Midterm exam	30%	Weeks 1 – 8 topics	W8
Term project report and presentation	30%	Practical and presentation 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 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 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.