

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	24/11/2021	Project Month	M10

Revision History

Version	Date	Author	Description	Action *	Page(s)
1	24/11/2021	Gheith Abandah	Original (base) document	C	1-6
2	15/10/2022	Gheith Abandah	Modifications for offering Fall 2022	U	1-6
3	11/10/2022	Gheith Abandah	Modifications for offering Fall 2023	U	1-6
4					

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

Disclaimer

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Course title	Research Methodology Fall 2023
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	This course introduces the research process like: Formulating research problems, asking research questions and finding answers, making arguments, writing research arguments, and ethics of research. Topics in performance evaluation: Selection of evaluation techniques and metrics, types of workloads and workload selection, data presentation and ratio games, summarizing measured data and comparing systems, introduction to experimental design, and introduction to simulation and analysis of simulation results. Ethical, safety, and social impact issues related to engineering solutions. This course includes assignments and a term project that focuses on preparing and presenting a research proposal or research report.
Objectives	<p>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:</p> <ul style="list-style-type: none"> • 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	<p>Upon successful completion of this course, students will be able to:</p> <table border="1" data-bbox="485 327 1481 947"> <thead> <tr> <th data-bbox="485 327 560 398">No</th> <th data-bbox="560 327 1235 398">Intended learning Outcome (ILO)</th> <th data-bbox="1235 327 1481 398">Program learning outcome (PLO)*</th> </tr> </thead> <tbody> <tr> <td data-bbox="485 398 560 546">1</td> <td data-bbox="560 398 1235 546">Define research; explain and apply research terms; describe the research process and the principal activities, skills and ethics associated with the research process.</td> <td data-bbox="1235 398 1481 546">4, 5, 6, 7</td> </tr> <tr> <td data-bbox="485 546 560 618">2</td> <td data-bbox="560 546 1235 618">Demonstrate the ability to choose methods appropriate to research aims and objectives.</td> <td data-bbox="1235 546 1481 618">5, 7</td> </tr> <tr> <td data-bbox="485 618 560 689">3</td> <td data-bbox="560 618 1235 689">Understand the limitations of particular research methods.</td> <td data-bbox="1235 618 1481 689">5, 7</td> </tr> <tr> <td data-bbox="485 689 560 761">4</td> <td data-bbox="560 689 1235 761">Develop skills in qualitative and quantitative data analysis and presentation.</td> <td data-bbox="1235 689 1481 761">2, 4</td> </tr> <tr> <td data-bbox="485 761 560 833">5</td> <td data-bbox="560 761 1235 833">Understand the importance of research ethics and integrate research ethics into the research process.</td> <td data-bbox="1235 761 1481 833">6</td> </tr> <tr> <td data-bbox="485 833 560 869">6</td> <td data-bbox="560 833 1235 869">Develop advanced critical thinking skills.</td> <td data-bbox="1235 833 1481 869">2</td> </tr> <tr> <td data-bbox="485 869 560 947">7</td> <td data-bbox="560 869 1235 947">Demonstrate enhanced writing and presentation skills.</td> <td data-bbox="1235 869 1481 947">4</td> </tr> </tbody> </table> <p>(*) The PLOs are listed in the appendix</p>	No	Intended learning Outcome (ILO)	Program learning outcome (PLO)*	1	Define research; explain and apply research terms; describe the research process and the principal activities, skills and ethics associated with the research process.	4, 5, 6, 7	2	Demonstrate the ability to choose methods appropriate to research aims and objectives.	5, 7	3	Understand the limitations of particular research methods.	5, 7	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
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Teaching and learning methods	<p>Development of ILOs is promoted through the following teaching and learning methods:</p> <ul style="list-style-type: none"> • The student attends the online class presentations and participates in the discussions. The link of the class team is MS Teams Link • 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	<p>Textbook, class handouts, some instructor keynotes, selected YouTube videos, and access to a personal computer and the internet.</p>																								
Resources and references	<p>A- Required book(s), assigned reading and audio-visuals:</p> <ol style="list-style-type: none"> 1. Wayne Booth, George Colomb, Joseph Williams, Joseph Bizup, and William FitzGerald, <i>The Craft of Research</i>, 4th Edition, The University of Chicago Press, 2016. 2. Raj Jain, <i>The Art of Computer Systems Performance Analysis</i>, Wiley, 1991. 3. Course web page at: https://www.abandah.com/gheith/?page_id=3115 <p>B- Recommended book(s), material and media:</p> <ol style="list-style-type: none"> 1. Hennessy and Patterson. <i>Computer Architecture: A Quantitative</i> 																								

	<p>Approach, 6th ed., Morgan Kaufmann, Elsevier Inc., 2017.</p> <p>2. Peter Bock, Getting It Right: R&D Methods for Science and Engineering, Academic Press, 2001.</p> <p>3. C.R. Kothari, Research Methodology, Methods and Techniques, 2nd Edition, New Age International Publishing, 2004.</p>																																																								
Topic outline and schedule	<table border="1"> <thead> <tr> <th>Week</th> <th>Topic</th> <th>ILO</th> <th>Resources</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Research, Researchers, and Readers</td> <td>1</td> <td>1(I)</td> </tr> <tr> <td>2</td> <td>Asking Questions, Finding Answers</td> <td>1</td> <td>1(II)</td> </tr> <tr> <td>3</td> <td>Making an Argument</td> <td>1</td> <td>1(III)</td> </tr> <tr> <td>4</td> <td>Writing Your Argument</td> <td>1, 7</td> <td>1(IV)</td> </tr> <tr> <td>5</td> <td>The Ethics of Research</td> <td>1, 5</td> <td>1(V)</td> </tr> <tr> <td>6</td> <td>Engineering Responsibility and Ethical Issues</td> <td>5</td> <td>3</td> </tr> <tr> <td>7</td> <td>Performance Evaluation Introduction, Common Mistakes, Selection of Techniques and Metrics</td> <td>2, 3, 4</td> <td>2(1-3)</td> </tr> <tr> <td>9</td> <td>Types of Workloads, Workload Selection, Monitors</td> <td>2</td> <td>2(4-7)</td> </tr> <tr> <td>10</td> <td>Data Presentation, Ratio Games</td> <td>4</td> <td>2(10-11)</td> </tr> <tr> <td>11</td> <td>Summarizing Measured Data, Comparing Systems</td> <td>4</td> <td>2(12-13)</td> </tr> <tr> <td>12</td> <td>Introduction to Experimental Design, 2k Factorial Designs</td> <td>2, 3, 4</td> <td>2(16-17)</td> </tr> <tr> <td>13</td> <td>Introduction to Simulation, Analysis of Simulation Results</td> <td>2</td> <td>2(24-25)</td> </tr> <tr> <td>14</td> <td>Project Presentations</td> <td>1 – 7</td> <td>1-6</td> </tr> </tbody> </table>	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
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Evaluation tools	<p>Opportunities to demonstrate achievement of the ILOs are provided through the following assessment tools:</p> <table border="1"> <thead> <tr> <th>Assessment tool</th> <th>Mark</th> <th>Topic(s)</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>Midterm exam</td> <td>30%</td> <td>Weeks 1 – 8 topics</td> <td>W8</td> </tr> <tr> <td>Term project report and presentation</td> <td>30%</td> <td>Practical and presentation aspects</td> <td>W15</td> </tr> <tr> <td>Final exam</td> <td>40%</td> <td>All material</td> <td>W16</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> </tr> </tbody> </table>	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%																																						
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Student requirements	The student should have a computer and internet connection.																																																								
Course policies	<p>A- Attendance policies:</p> <ul style="list-style-type: none"> Attendance is required. Class attendance will be taken every class and the university polices will be enforced in this regard. <p>B- Absences from exams and not submitting assignments on time:</p> <ul style="list-style-type: none"> A makeup exam can be arranged for students with acceptable absence 																																																								

	<p>causes.</p> <ul style="list-style-type: none"> • 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. <p>C- Health and safety procedures:</p> <ul style="list-style-type: none"> • All health and safety procedures of the university and the school should be followed. <p>D- Honesty policy regarding cheating, plagiarism, misbehavior:</p> <ul style="list-style-type: none"> • 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. <p>E- Available university services that support achievement in the course:</p> <ul style="list-style-type: none"> • Microsoft Teams team: Link • Program announcements Facebook group: Link
<p>Additional information</p>	<p>None</p>

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.