DeCAIR Course Syllabus Form

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WP Number & Title	Work Package 6: Improving Existing B.Sc. Programs in Jordan and Lebanon by Implementing or Including AI and Robotics Courses		
Activity Number & Title	Task 6.1: Developing syllabi and content for added/modified courses in existing BSc programs in universities of partner countries		
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Revision History

Version	Date	Author	Description	Action *	Page(s)
1	8/11/2021	Musa Al-Yaman	Original (base) document	C	1-5
2	9/12/2021	Mohammad Mashagbeh	Update original document	U	1-4
3					
4					

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

Disclaimer

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Course title	Mobile Robotics
Course number	0918552
Credit hours (lecture and lab)	3 (3 + 0)
ECTS (weekly contact and self-study load)	6 (3 + 3)
Prerequisites/co-requisites	0908474 (Robotic Manipulator) or 0917433
Prerequisites by topic	Students are assumed to have good background in mathematics, and basic knowledge in linear feedback control systems. Additionally, the students should have good programming skills.
Level and type (compulsory, elective)	BSc elective course
Year of study and semester	Fifth year, second semester
Description	An introduction to mobile robot essentials covering the following topics: mobile robot types, categories, platforms, locomotion mechanisms, kinematics, modeling, autonomous systems sensing / perception, motion and feedback control, path planning and navigation. This course includes a term project carried out in teams.
Objectives	1. Introduce basic knowledge about Mobile Robot types and categories. 2. Provide the basic concepts and algorithms required to develop mobile robots that act autonomously in complex environments. 3. Introduce mobile robot locomotion and kinematics. 4. Introduce mobile robot environment perception and map-based localization and mapping. 5. Introduce mobile robot motion planning and control. 6. Introduce students to the programming techniques and toolboxes used in robotic manipulator 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	Describe the characteristics of different mobile robot configurations or geometry.	1
2	Derive mobile robot kinematics	2
3	Design and implement estimation algorithms	3
4	Solve mobile robot localization and mapping problems	4
5	Control a mobile robot to map and plan its way in unknown environment.	5

(*) The PLOs are listed in the appendix

<table>
<tr><td>Teaching and learning methods</td><td>Development of ILOs is promoted through the following teaching and learning methods:
Lectures will be delivered through Microsoft Teams and will be recorded for later access.
The robotics lab is open for the students to practice the practical aspects and solve the 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 assignments in robotics field.
Student will carry out a term project in groups. Deliverables includes a professional report and a presentation for the project in class towards end of the semester.</td></tr>
<tr><td>Learning material</td><td>Textbook, class handouts, some instructor keynotes, selected YouTube videos, and access to a personal computer and the internet.</td></tr>
<tr><td>Resources and references</td><td>A- Required book(s), assigned reading and audio-visuals:
Siegwart, Nourbakhsh and Scaramuzza, Introduction to Autonomous Mobile Robots, 2nd edition, MIT press, 2011.
B- Recommended book(s), material, and media:
Corke P., Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Springer Tracts in Advanced Robotics, 2011.
Guowei Cai, Ben M. Chen, Tong Heng Lee, Unmanned Rotorcraft Systems, Springer Tracts in Advanced Robotics, 2011.
Sebastian T., Wolfram B., Dieter F., Probabilistic Robotics, MIT press, 2005.
Bruno Siciliano, Robotics: modelling, planning and control, springer, 2009.
S. G. Tzafestas, Introduction to mobile robot control, Elsevier, 2013.
Alonzo, Mobile Robotics: Mathematics Models and Methods, Cambridge press, 2014.</td></tr>
<tr><td>Topic outline and schedule</td><td>
<table>
<tr><th>Week</th><th>Topic</th><th>ILO</th><th>Resources</th></tr>
<tr><td>1</td><td>Introduction to mobile robotic systems</td><td>1</td><td>A1</td></tr>
<tr><td>2</td><td>Probability, state space</td><td>2</td><td>A1</td></tr>
<tr><td>3, 4</td><td>Coordinates transformation and Kinematics of mobile robots</td><td>2</td><td>A1</td></tr>
<tr><td>5, 6</td><td>Measurement and Modeling</td><td>1, 2</td><td>A1</td></tr>
<tr><td>7</td><td>Mobile robot locomotion mechanisms</td><td>1, 2</td><td>A1</td></tr>
<tr><td>8, 9</td><td>Estimation</td><td>3</td><td>A1</td></tr>
<tr><td>10-12</td><td>Mapping</td><td>3</td><td>A1</td></tr>
<tr><td>13</td><td>Mobile robot Control</td><td>4, 5</td><td>A1</td></tr>
</table>
</td></tr>
</table>

	<table><tr><td>14</td><td>Mobile robot path planning and navigation</td><td>5</td><td>A1</td></tr><tr><td>15</td><td>Project Presentations</td><td></td><td></td></tr><tr><td>16</td><td>Review and Evaluation (Final Exam)</td><td></td><td></td></tr></table>
Evaluation tools	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>Midterm exam</td><td>30%</td><td>Introduction to Mobile robot to locomotion.</td><td>W7</td></tr><tr><td>Term project report and presentation</td><td>20%</td><td>Practical and presentation aspects</td><td>W14</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>
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 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 • Robotics Lab for practicing the practical aspects and solving the assignments. • Program announcements Facebook group

Additional information	None

Appendix

Learning Outcomes for the BSc in Mechatronics Engineering

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

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.