DeCAIR Course Syllabus Form

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Organization Name(s)	Lebanese University		
WP Number & Title	Work Package 6: Improving curricula of current BSc programs in JO and LB		
Activity Number & Title	Activity 6.1: Developing syllabi and content for added/modified courses in existing bachelor programs in universities of partner countries.		
WP Leader	Jorge Casillas, UGR		
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Revision History

Version	Date	Author	Description	Action *	Page(s)
1	20/9/2021	Clovis Francis	Updated Syllabus of BE courses in Electrical Eng'g	U	1-6
2	22/10/2021	Clovis Francis	Version 2	U	
3	15/11/2021	Clovis Francis	Version 3	U	
4	8/02/2022	~~Clovis Francis~~	Version 4	U	

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

Disclaimer

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Course title	Sensors and IOT
Course number	ELEC313
Credit hours (lecture and lab)	2
ECTS (weekly contact and self-study load)	2 (2 contact hours per week)
Prerequisites/co-requisites	Electronics: Analog and Digital/ Signal Processing and Filtering
Prerequisites by topic	Students are assumed to have good background in linear and nonlinear electronics. Students are assumed to have good background in digital electronics. Additionally, the students should have good programming skills, preferably, using Labview®.
Level and type (compulsory, elective)	BE compulsory course
Year of study and semester	Third year, second semester
Description	This BE course concentrates on the different types of sensors used in industrial applications and in the robotics field.
Objectives	1. Introduce students to the different industrial sensors and mainly those used for mobile robot's development. 2. Introduce students to the methods and techniques for sensors output conditioning 3. Introduce students to IOT and connected sensors, wireless sensor networks 4. Enable the students to gain practical skills in interfacing sensors with data acquisition systems.
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 for sensors signal conditioning	1
2	Solve a signal acquisition problem by developing an appropriate perception and sensing system.	3
3	Communicate the development of a sensor based system through a detailed technical report and a short presentation.	4
4	Use Labview® and its specialized libraries to develop programs for solving data acquisition problems.	3

(*) The PLOs are listed in the appendix

Teaching and learning methods	Development of ILOs is promoted through the following teaching and learning methods:

<table>
<tr><td></td><td>

Lectures will be delivered through Microsoft Teams and will be recorded for later access. Lectures could be delivered in class also depending on the local situation.
The Electronics 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 system design.
The student carries out a term project for solving a problem using data acquisition techniques.
The student develops a professional report for the term report.
The student presents the term project in class.

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<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>Recommended book(s), material and media:
1. Class notes prepared by the instructor.
2. Les capteurs en instrumentation industrielle. Dunod. Georges Asch et al.
3. Introduction to Instrumentation, Sensors, and Process Control William C. Dunn, ARTECH HOUSE, 2006</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>Performance indicators: accuracy, fidelity, precision, resolution, linearity. List of symbols of sensors.</td><td>1</td><td>1, 2</td></tr>
<tr><td>2</td><td>Sensors and Transmitters: active and passive sensors.</td><td>4</td><td>1, 2</td></tr>
<tr><td>3</td><td>Signal filtering, amplification and conditioning.</td><td>1, 2, 4</td><td>1, 2</td></tr>
<tr><td>4</td><td>Sensors for mobile robots: LIDAR, RADAR, IMU, Gyroscope, GNSS,…</td><td>1, 2, 4</td><td>1, 2</td></tr>
<tr><td>5</td><td>Kinematic and dynamic sensors: analog and digital sensors</td><td>1, 2</td><td>1, 2</td></tr>
<tr><td>6</td><td>Flow sensors.</td><td>1</td><td>1, 2,3</td></tr>
<tr><td>7</td><td>Level sensors</td><td>1, 2</td><td>1, 2,3</td></tr>
<tr><td>8</td><td>Pressure sensors</td><td>1, 2</td><td>1, 2,3</td></tr>
<tr><td>9</td><td>Force sensors</td><td>1, 2</td><td>1, 2,3</td></tr>
<tr><td>10</td><td>Temperature sensors</td><td>1</td><td>1, 2,3</td></tr>
<tr><td>11</td><td>Thermocouples</td><td>1, 2</td><td>1, 2,3</td></tr>
<tr><td>12</td><td>Control valves</td><td>1, 2</td><td>1, 2,3</td></tr>
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</td></tr>
</table>

	13	Case study and applications: mobile robot sensors interfacing	1, 2	1, 2,3
	14	IOT and sensors	1, 2	1
	15	IOT and sensors	3, 4	1

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%	Sensors interfacing aspects	W2-W14
Midterm exam	30%	Introduction through classical techniques	W8
Term project report and presentation	20%	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 for students and Instructors

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
- AI Lab for practicing the practical aspects and solving the programming assignments.

	• Program announcements Facebook group F- Faculty member's obligations are provided by the University Bylaws: • Office hours (4 hours per week) are dedicated to the students support and must be announced on the Faculty member's office doo • Continuous support to the students within their projects and activities related to the course
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.