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Project Title: Modernization of Teaching Methodologies in Higher Education: Eu Experience For Jordan And Palestinian Territory

Project acronym: METHODS

Project Number: 561940-EPP-1-2015-1-JO-EPPKA2-CBHE-JP

Funding scheme: Erasmus+ Programme (Capacity-Building projects in the field of Higher Education (E+CBHE))

Start date of the project: 15/10/2015 **Duration:** 36 months

Deliverable title	Course Outline
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WP Number	5
WP Leader	Birzeit University

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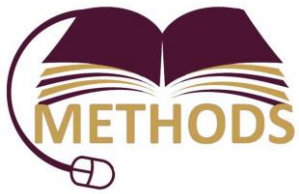
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Birzeit University

Engineering and Technology

Course title/code	Interfacing Techniques	ENCS438
Instructor /office	Dr. Wasel Ghanem	TEC117
Semester- Year	First Semester 2017/2018	
Compulsory/Elective	Compulsory	
Prerequisites	Electronics	

Course Description	<p>Modern systems consist of mechanical, electrical, electronics and microcomputers. The synergy between these multi- disciplinary systems leads to a modern smart systems like robotics. In this course, modern sensors, actuators, microcomputers will be introduced and these will be used to create a smart system like robot. This course will increase the awareness and understanding of the modern sensors and the related interfacing issues with other systems as introduction to 3rd industrial revolution.</p>
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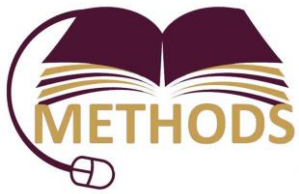
Generic Competences*	<ol style="list-style-type: none"> 1. Describe the Essence of Interfacing Techniques in Engineering 2. Apply mathematical formulations and framework of Interfacing Techniques and their essential building blocks. 3. Express and apply different sensors in different systems. 4. Apply and integrate knowledge in practice in developing different applications like robotics, etc. 5. Develop research skills and presentation skills in presenting a specific system completely. 6. Develop teamwork competences and engineering ethics.
Specific Competences (SCs)	<ol style="list-style-type: none"> 1. An ability to apply knowledge of mathematics, science and engineering (A). 2. An ability to design and conduct robot system, as well as, analyze and interpret data (B). 3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (C)

- These competences related also to the project Methods

	Course contents	SC1	SC2	SC3	SC4
1	Performance Characteristics of Sensors and Actuators	X		X	
2	Analog Signal Conditioning	X			
3	Digital Signal Conditioning	X	X	X	
4	Interfacing to microcontrollers i.e. Arduino μ C		X	X	
5	DC Motors		X	X	
6	Thermal Sensors and its Interfacing	X	X	X	
7	Mechanical Sensors and its interfacing	X	X	X	
8	Optical Sensors and its Interfacing		X	X	
9					
10					

Schedule				
Week	Subject	Activity Description *	Evaluation Criterion	
			Description	%
1	Orientation to the course	Students will be asked to build a simple robot they can use different materials such as corks, toothbrushes, and more to complete their robots	Every group should develop a prototype for a robot and submit it to the portal MethodsX	5
2	Build circuits and discuss the fundamental concepts of analog input and output	In this activity the first part of the robot should be developed: light follower robot without brain	Every group should develop a prototype for a robot to follow light and submit it to the portal MethodsX	5
3	Voltage divider and Wheatstone Bridge	In this activity the groups should develop the eye and the speaker of the robot using bridge and comparators	Every group should develop a an eye and speaker for the robot and submit it to the portal MethodsX	5
4,5	Arduino microcontroller	Practical applications on analog and digital inputs on the controller should be discussed, i.e. LED control, LDR, potentiometer, push button, etc.	Groups should develop different experiments on Arduino using different types of sensors (LDR, push button, thermistor, etc.) and submit report on MethodsX	5
6	Architecture of Data Acquisition System	Apply instrumentation amplifier as basic block for	Every group should design and analyze an interfacing circuit	5

		analog signal amplification and discussing its different configuration	that converts Vout that was obtained from Wheatstone bridge in the last module into 0 volts in case of dark and 5 volts in case of full light.	
7	Filter Design	In this activity the students should design different types of passive and active filters i.e.LPF, HPF, BPF, BSF to use them in signal conditioning circuits of the robot	Every group should submit a homework about deigning different types of filter using Pspice and implement them using opamp, R,C	5
8	Microphone Amp Frequency Response	In this activity the students should develop the hearing system of the robot (the mic circuit) and measure the frequency response	The groups should develop the mic system of the robot and test it and submit a report to MethodsX	5
9,10	DC Motors and H – bridge	Different type of motors , i.e DC, stepper, and servo should be characterized and discussed . Different possible driving circuits and applications for each type should be defined	The groups should test different types of DC motors practically and characterize the driving circuits and submit a report to MethodsX (assignment)	5
11	ADC/DAC	In this activity different type of ADCs and DACs should be discussed as basic blocks in any interfacing system. Comparison between them with pros and cons.	The students should submit a survey about different types and ADCs and DACs and develop as a case study Arduino microcontroller (assignment)	5
12	Thermal Sensors	Different types of temperature sensors i.e. thermistor, thermocouple, RTD, PTAT with their suitable signal conditioning circuits will be discussed	A design questions on different types of thermal sensors with signal conditioning circuits to be connected to microcontroller should be submitted to the portal	10
13,14	Optical Sensors	Different types of optical sensors i.e. LEDs, IR sensors, laser, photodiodes, photocells, with their suitable	A design questions on different types of optical sensors with signal conditioning circuits to be connected to the portal	10



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		signal conditioning circuits will be discussed	microcontroller should be submitted to the portal	
15,16	Final Project Discussion	Every group should design a complete functioning robot that can hear, see, talk and walk with all modules developed before and add new features to it like controlling it through the sound of the developer only. A report with website should be submitted	Practical exam for every group on the robot, website, report, feedback and discussion on the forum on MothedsX portal	55

* All activities mentioned above are implemented based on BPL

Textbook and References	<ul style="list-style-type: none"> • Process Control Instrumentation Technology, 8th Edition, Curtis Johnson, 2013 (Textbook) • J. Fraden, AIP Handbook of Modern Sensors, Physics, Designs and Applications, American Institute of Physics, 2012 • Sensor Technology Handbook, John, S. Wilson, 2005 Instrumentation for Engineers and Scientists, Turner, and Hill, 2000	
Overall Assessment Criteria	Method	Weight [%]
	Quizzes	5
	Midterm	15
	Project	35
	Assignments	5
	Final Exam	40