The University of Jordan
School of Engineering
Department of Computer Engineering
Summer Term - A.Y. 2022 - 2023

Course:	Embedded Systems Lab – 0907334 (1 Cr. – Core Course)
Catalog Data:	Introduction to embedded systems design tools and hardware programmers. Experiments using both simulation and practical implementation of the basic building blocks of a microcontroller including timers, counters, I/O techniques and requirements, A/D conversion, serial communication. Experiments to explore the system design process using hardware-software co-design process. Design project.
Pre-requisites by Course:	Embedded Systems (0907333)
Prerequisites by Topic:	Good background in electronics, circuits, digital logic, and assembly programming.
Textbook:	The lab manual which consists of a set of experiments is posted on the lab website.
References:	• Designing Embedded Systems with PIC Microcontrollers (principles and applications), 2nd Ed. By: Tim Wilmshurst, Newnes, 2007. • An Introduction to the Design of Small-Scale Embedded Systems, 2nd Ed. By: Tim Wilmshurst Palgrave, 2010. • Microchip Website: www.microchip.com
Course Website:	https://sites.google.com/view/iyadjafar
Schedule & Duration:	8 Weeks, 9 Labs, 3 hr. each (including exams)
Student Material:	Textbook, lab handouts, some instructor keynotes, calculator and access to a personal computer and internet.
College Facilities:	Lab with whiteboard, personal computers, PIC development boards, PIC programmers, oscilloscopes and server.
Course Objectives:	The objectives of this lab are: • Introduce students to embedded systems design tools and hardware programmers. • Develop students' skills in both simulation and practical implementation of the basic building blocks of a microcontroller including timers, counters, I/O techniques and requirements, A/D conversion, serial communication. • Improve students' communication skills and ability to formulate and solve engineering problems through the complete designing of a medium embedded system with detailed documentation and oral presentation.

Course Outcomes and Relation to ABET Program Outcomes:

Upon successful completion of this course, a student should be able to:

- Use a set of tools for embedded systems simulation, programming, debugging, system integration, testing, validation and verification. [6]
- Implement several embedded systems with particular focus on the interaction between multiple devices. [1, 6]
- Take part of a multidisciplinary team to design products using microcontrollers and various analog and digital ICs. [5]
- Read the datasheet of any embedded system and understand how it works. [7]
- Develop existing embedded systems by formulating the system design problem including the design constraints, creating a design that satisfies the constraints, implementing the design in hardware and software, and measuring performance against the design constraints. [2]
- Communicate effectively with lab instructor and lab mates through clear documentation and presentation of the designed project. [3]

Lab Schedule:

Week of	Experiment and Event
July 9th	Introduction + Hardware Exercise
July 16th	Introduction to MPLAB+ MPLAB and Instruction Set Analysis 1 Instruction Set Analysis 2 & Modular Programming Techniques
July 23rd	Basic Embedded System Analysis and Design LCD
July 30th	Embedded C **Quiz** Timers
August 6th	**Midterm Exam** A/D + Project Announcement
August 13th	USART
August 20th	Project Submission & Discussion
August 24th	**Final Exam**

Attendance:

Lab attendance will be taken and the university's polices will be enforced in this regard.

Assessments:

Quizzes, exams, project and in-lab assessment

Grading policy:

Labsheets	10%
Quiz	10%
Midterm Exam	20%
Project + Report	15% + 5%
Final Exam	40%

Instructors:

Prof. Iyad Jafar (iyad.jafar@ju.edu.jo)
Eng. Ola Jaloudy (o.jaloudy@ju.edu.jo)

Sections:

(1) Sunday/Wednesday	12:15-14:45
(2) Monday/Thursday	12:15-14:45

Program Outcomes (PO)

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

Last Updated: July 9th, 2023