The University of Jordan
School of Engineering
Department of Computer Engineering
Summer Term - A.Y. 2020 - 2021

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.
Co-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:	www.driyad.ucoz.net
Schedule & Duration:	8 Weeks, 8 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	Event
11/7	Introduction
11/7	Introduction to MPLAB + MPLAB and Instruction Set Analysis 1
25/7	Instruction Set Analysis 2 & Modular Programming Techniques
25/7	Basic Embedded System Analysis and Design + Hardware exercises
Saturday 31/7	**Quiz**
1/8	LCD
1/8	Embedded C
8/8	Timers
Thursday 12/8	**Midterm Exam**
15/8	A/D
15/8	USART
29/8	Project Submission & Discussion
TBA	**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	5%
Quiz	10%
Midterm Exam	25%
Project + Report	20%
Final Exam	40%

Instructors:

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

Sections:

(1) Sunday & Tuesday	13:30-16:30
(2) Monday & Wednesday	13:30-16:30

Lab Delivery:

- The lab for this semester will be taught fully online except for the midterm and final exams and the project discussion.
- **Microsoft Teams** will be used as platform to deliver the lab and communicate with students.
- www.driyad.ucoz.net **website** will be used to post experiments and lab sheets.
- On every week, recorded 30-minute videos for the experiments in that week will be posted on **Saturday 3:00 PM** on YouTube to explain the experiments and what are students are expected to deliver. Students are required to watch the video before their scheduled session.
- For every lab section, a live session will be held using MS Teams every week starting at the scheduled time for each section. This session is dedicated to answer students' questions.
- Students are expected to perform the experiment using the simulator adopted in the lab, fill the lab sheet, and submit their work Through MS. Teams to the lab engineer by **6:00 PM on the day the lab is scheduled**. No late submissions will be accepted.

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, 2021