

EEE4742C – Embedded Systems

Module 0 – Getting Started

Hadi Kamali

Department of Electrical and Computer Engineering (ECE)
University of Central Florida

Office Location/phone: HEC435 – (407) 823-0764
webpage: <https://www.ece.ucf.edu/~kamali/>
e-mail: kamali@ucf.edu

HAVEN Research Group
<https://haven.ece.ucf.edu/>





Agenda

- Course Introduction & Overview (Q&A)
 - About the Instructor
 - Course Overview
 - Course Syllabus
 - Course Schedule
 - Labs, Homework, Exams
 - Grading



About the Instructor

- Hadi Kamali, Ph.D.
 - Assistant Professor, Department of Electrical and Computer Engineering (ECE)
 - Cyber Security and Privacy Cluster (CyberSP@UCF)

E-mail: kamali@ucf.edu

Office Location & Phone Number: HEC 435 - +1 (407) 823 – 0764

Personal Webpage: <https://www.ece.ucf.edu/~kamali/>

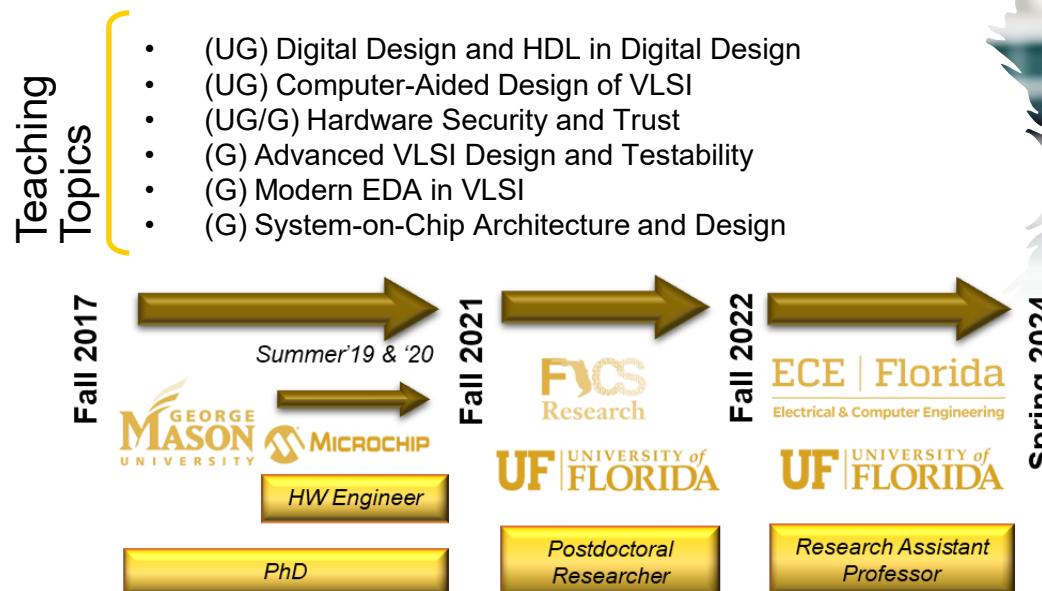


Hardware Assurance and Verification Excellence (HAVEN) Lab

Research Group Webpage: <https://haven.ece.ucf.edu/>

Office Hours and Location

Date/Time: Mondays/Wednesdays 10:30AM - 12:00PM
HEC 435 (or Zoom by prior Email)





Course Overview

- Objective of the Course & Learning Outcomes

Understanding Embedded Systems

- Components of embedded systems.
- Architecture of embedded systems.
- chip organization, programming environment

μcontroller/processor Programming

- Proficiency in programming language
- Logic-level (Bit Manipulation)

Working with Texas Instrument MSP430

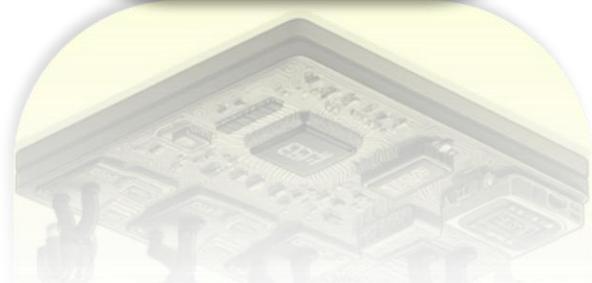
- Acquire skills in designing and implementing embedded systems
- Working with different sensors on LaunchPad.

Hardware Interfacing

- Interactions between SW and HW
- Learning to work with Interfaces, like timers, interrupts, I2C, SPI, UART
- Understanding basics of pixel display

Understanding Real-time Systems

- principles of real-time operating systems
- Application of Real-time operating systems
- Interfaces and handlers in RTOS





Syllabus Overview

Module 0: Course Overview

Module 1: Intro to Embedded Systems & Basics of Programming

Module 2 – Introduction to MSP430, Peripherals and Interfaces

Module 3 – Embedded System Design | Timer in ESD

Module 4 – FSM and Interrupts

Module 5 – Low Power Mode and LCD Display

Module 6 – UART (Asynchronous Per.)

Module 7 – I2C and its Operational Modes

Module 8 – Analog to Digital Converter (ADC)

Module 9 – SPI and serial communication

Module 10 – Timer-based Channels and I/O

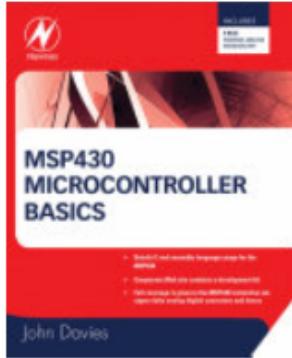
Module 11 – Concurrent Handling & Interrupt Handlers

Module 12 – Real-time Operating Systems & Advanced ESD



Textbook

- Recommended ones (Specially for the labs)!



MSP430 Microcontroller Basics

ISBN: 9780080951577

Authors: John H. Davies

Publisher: Newnes

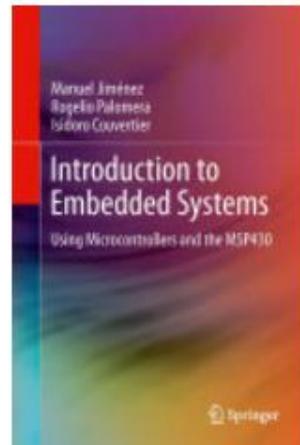
Publication Date: 2008-08-21

Notes: The digital version of the course textbook is available for free through the UCF Libraries.



Online Access:

<https://go.openathens.net/redirector/ucf.edu?url=https%3A%2F%2Fwww.sciencedirect.com%2Fbook%2F9780750682763%2Fmsp430-microcontroller-basics>



Introduction to Embedded Systems

ISBN: 9781461431435

Authors: Manuel Jiménez, Rogelio Palomera, Isidoro Couvertier

Publisher: Springer Science & Business Media

Publication Date: 2013-09-11



Schedule

| Week | Monday | Wednesday | Friday | Lab |
|------------------------------------|---|---|--|---|
| Week 1 (Aug 18, Aug 20, Aug 22) | Module 0: Course Overview | Module 1: Introduction to Embedded Systems | Module 1: Basic Programming Skills for Embedded Systems (Ready for Lab 1) | No Lab |
| Week 2 (Aug 25, Aug 27, Aug 29) | Module 2: Introduction to Microcontrollers (MSP430, Interfaces, & Peripherals) | Module 2: Introduction to MSP430, Interfaces, & Peripherals | Module 2: Introduction to MSP430, Interfaces, & Peripherals (Ready for Lab 2) | Lab 1 - Flashing LEDs |
| Week 3 (Sep 1, Sep 3, Sep 5) | Module 3: Embedded System Designs (Flow) Quiz 1 (Lab 1 & 2) | Module 3: Timer (Modes) | Module 3: Timer Configurations (Ready for Lab 3) | No Lab (Labor Day) HW 1 Assignment: Sep 5 |
| Week 4 (Sep 8, Sep 10, Sep 12) | Module 4: Finite State Machine (FSM) for ESD | Module 4: Interrupt | Module 4: Interrupt (Ready for Lab 4) | Lab 2 - Push Buttons HW 1 Due: Sep 12 |
| Week 5 (Sep 15, Sep 17, Sep 19) | Module 5: Low Power Mode (LPM) Quiz 2 (Lab 3 & 4) | Module 5: LCD | Module 5: LCD (Ready for Lab 5) | Lab 3 - Timer HW 2 Assignment: Sep 19 |
| Week 6 (Sep 22, Sep 24, Sep 26) | Module 6: The Basics of UART | Module 6: UART Configuration | Module 6: UART Configuration | Lab 4 - Interrupt & Low Power Mode HW 2 Due: Sep 26 |



Schedule

| Week | Monday | Wednesday | Friday | Lab |
|-------------------------------------|--|---|---|---|
| Week 7 (Sep 29, Oct 1, Oct 3) | Module 6: UART Examples (Ready for Lab 6) | Midterm 1 Review | Midterm 1 on Oct 3 3:30PM – 4:20PM | Lab 5: LCD |
| Week 8 (Oct 6, Oct 8, Oct 10) | Module 7: The Basics of I2C Quiz 3 (Lab 5) | Module 7: I2C Operation Modes | Module 7: I2C Configuration & Examples (Ready for Lab 7) | Lab 6: UART HW 3 Assignment: Oct 10 |
| Week 9 (Oct 13, Oct 15, Oct 17) | Module 8: The Basics of Analog to Digital Conversion (ADC) [ONLINE VIDEO] | Module 8: Signal Conversion in ADCs [ONLINE VIDEO] | Module 8: ADC in MSP430 - Registers | Lab 7: I2C HW 3 Due: Oct 17 |
| Week 10 (Oct 20, Oct 22, Oct 24) | Module 8: ADC Configuration & Examples (Ready for Lab 8) Quiz 4 (Lab 6 & 7) | Module 9: The Basics of SPI | Module 9: SPI Configuration (Ready for Lab 8) | Lab 8: ADC HW 4 Assignment: Oct 24 |
| Week 11 (Oct 27, Oct 29, Oct 31) | Module 9: SPI Application & Graphics (Ready for Lab 9) [ONLINE VIDEO] | Module 10: Timer Channels [ONLINE VIDEO] | Module 10: Timer Channels [ONLINE VIDEO] | Lab 9: SPI & Pixel HW 4 Due: Oct 31 |



Schedule

| Week | Monday | Wednesday | Friday | Lab |
|-------------------------------------|--|--|--|--|
| Week 12 (Nov 3, Nov 5, Nov 7) | Module 10: Timer-based Input/Output (Ready for Lab 10) Quiz 5 (Lab 8 & 9) | Midterm 2 Review | Midterm 2 on Nov 7 3:30PM – 4:20PM | Lab 10: Advanced Timer |
| Week 13 (Nov 10, Nov 12, Nov 14) | Module 11: Advanced Interrupts [ONLINE VIDEO] | Module 11: Concurrent Event Handling (Ready for Lab 11) [ONLINE VIDEO] | Module 12: Inline Interrupt & DMA Overview | No Lab HW 5 Assignment: Nov 14 |
| Week 14 (Nov 17, Nov 19, Nov 21) | Module 12: RTOS Features Quiz 6 (Lab 10 & 11) | Module 12: Advances in ESD | Final Exam Review | Lab 11: Interrupt-based Concurrency HW 5 Due: Nov 21 |
| Week 15 (Nov 24, Nov 26, Nov 28) | Final Exam Review | NO Classes (Thanksgiving) | NO Classes (Thanksgiving) | |
| Week 16 (Dec 1, Dec 3, Dec 5) | NO Classes (Exam Week) | NO Classes (Exam Week) | Final Exam on Dec 5 1:00 PM – 3:50 PM | |



Evaluation and Grading

- Grading for this course is based on a combination of homework assignments, a midterm exam, a final exam, and a project. The distribution of grades is as follows:

Homework: 15%

5 all through Webcourses

Lab: 15%

11 labs (in the lab)

Lab Quizzes + Bonus: 20% + 10%

Quiz/Activities

Midterm 1 Exam: 15%

*For the first 5 Modules
(week 6)*

Midterm 2 Exam: 15%

*For the first 10 Modules
(week 12)*

Final Exam: 20%

*All 12 Modules
(week 16)*

- Grades will be assigned based on the following scale:
- Lab Quizzes will be in the class.

| Letter Grade | Percentage |
|--------------|------------|
| A | 94-100% |
| A- | 90-93% |
| B+ | 87-89% |
| B | 84-86% |
| B- | 80-83% |
| C+ | 77-79% |
| C | 74-76% |
| C- | 70-73% |
| D+ | 67-69% |
| D | 64-66% |
| D- | 61-63% |
| F | 0-60% |



Teaching Assistants at the Lab

- TAs info will be added soon (Already assigned buy might change)
- TA Office (at Lab)
 - ENG1 0257
- Lab Time (check your section – 0011, 0012, 0013, or 0014)
 - Based on the number of enrollment, please only attend in the lab session you enrolled in.

Your Valuable Feedback

- If it is boring ...
- If you need more basic knowledge and you think you are lost...
- If the pace of the class is not as you prefer...
- If I can be of any assistance for your success throughout the semester...
- If you need to find a better way to communicate and show your progress...



Thank You!

Questions?

Email: kamali@ucf.edu

UCF HEC 435 (407) 823 - 0764

<https://www.ece.ucf.edu/~kamali/>

HAVEN Research Group

<https://haven.ece.ucf.edu/>



UNIVERSITY OF
CENTRAL FLORIDA