

# EEE4742C – Embedded Systems

## Module 0 – Getting Started

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*HAVEN Research Group*

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



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# 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](mailto:kamali@ucf.edu)

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

Teaching Topics

- (UG) Digital Design and HDL in Digital Design
- (UG) Computer-Aided Design of VLSI
- (UG/G) Hardware Security and Trust
- (G) Advanced VLSI Design and Testability
- (G) Modern EDA in VLSI
- (G) System-on-Chip Architecture and Design



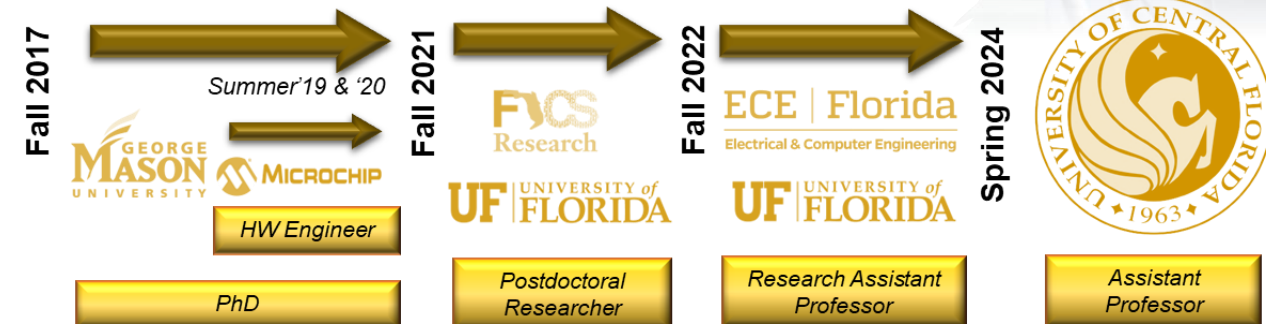
## Hardware Assurance and Verification Excellence (HAVEN) Lab

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/μprocessor Programming

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

### Working with Texas Instrument MSP430

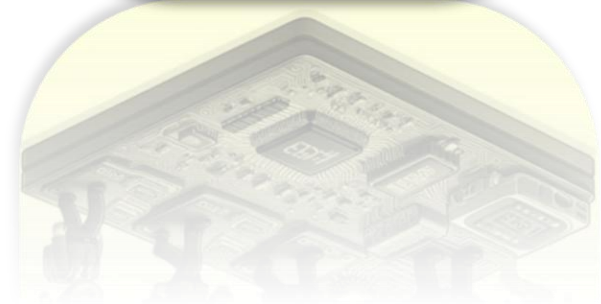
- Acquire skills in designing and implementing embedded systems
- Working with different sensors on LaunchPad.

### 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

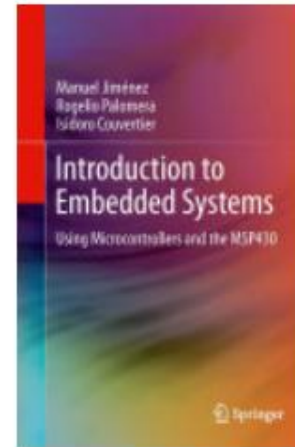
**Publication Date:** 2008-08-21

**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) <b>Quiz 1 (Lab 1 &amp; 2)</b>	Module 3: Timer (Modes)	Module 3: Timer Configurations (Ready for Lab 3)	No Lab (Labor Day) <b>HW 1 Assignment: Sep 5</b>
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 <b>HW 1 Due: Sep 12</b>
Week 5 (Sep 15, Sep 17, Sep 19)	Module 5: Low Power Mode (LPM) <b>Quiz 2 (Lab 3 &amp; 4)</b>	Module 5: LCD	Module 5: LCD (Ready for Lab 5)	Lab 3 - Timer <b>HW 2 Assignment: Sep 19</b>
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 <b>HW 2 Due: Sep 26</b>

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



# Schedule



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

# 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%	Lab: 15%	Lab Quizzes + Bonus: 20% + 10%
<i>5 all through Webcourses</i>	<i>11 labs (in the lab)</i>	<i>Quiz/Activities</i>
Midterm 1 Exam: 15%	Midterm 2 Exam: 15%	Final Exam: 20%
<i>For the first 5 Modules (week 6)</i>	<i>For the first 10 Modules (week 12)</i>	<i>All 12 Modules (week 16)</i>

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%

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

# 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...

*start early*



*exercise as much as you can*



*read materials*



*participate*



*research deeper*



*Be open*



*Think in class*



*Check deadlines*



*Be ready for Labs*



# Thank You!

## Questions?

Email: [kamali@ucf.edu](mailto:kamali@ucf.edu)

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