



## **Embedded Systems - Shape The World**

The best way to understand what you will learn in this class is to list the labs you will complete and the example projects we will build. You will complete each lab first in simulation and then on the real board. For each module we will design a system and you will build and test a similar system.

[YouTube video showing the kit and some completed labs](#)

### **Module 1: Welcome and introduction to course and staff**

### **Module 2: Fundamental concepts: numbers, computers, and the ARM Cortex M processor**

Example. Develop a system that toggles an LED on the LaunchPad

Lab 2. Run existing project on LaunchPad with switch input and LED output

### **Module 3: Electronics: resistors, voltage, current and Ohm's Law**

### **Module 4: Digital Logic: transistors, flip flops and logic functions**

### **Module 5: Introduction to C programming**

Example. Develop a system that inputs and outputs on the serial port

Lab 5. Write a C function and perform input/output on the serial port

### **Module 6: Microcontroller Input/Output**

Example. Develop a system that inputs from a switch and toggles an LED output

Lab 6. Write C software that inputs from a switch and toggles an LED output

## **Module 7: Design and Development Process**

Example. Develop a system that outputs a pattern on an LED

Lab 7. Write C functions that inputs from two switches and toggles an LED output

## **Module 8: Interfacing Switches and LEDs**

Example. Develop a system with an external switch and LED

Lab 8. Interface an external switch and LED and write input/output software

## **Module 9: Arrays and Functional Debugging**

Example. Develop a system that debugs by dumping data into an array

Lab 9. Write C functions using array data structures that collect/debug your system

## **Module 10: Finite State Machines**

Example. Develop a simple finite state machine

Example. Develop a vending machine using a finite state machine

Example. Develop a stepper motor robot using a finite state machine

Lab 10. Interface 3 switches and 6 LEDs and create a traffic light finite state machine

## **Module 11: UART - The Serial Interface, I/O Synchronization**

Example 11. Develop a communication network using the serial port

Lab 11. Write C functions that output decimal and fixed-point numbers to serial port

## **Module 12: Interrupts**

Example 12. Develop a system that outputs a square wave using interrupts

Example 12. Develop a system that inputs from a switch using interrupts

Example 12. Develop a system that outputs to a DC motor that uses pulse width modulation

Lab 12. Design and test a guitar tuner, producing a 440 Hz tone

### **Module 13: DAC and Sound**

Example 13. Develop a system that outputs analog signal with a R-2R digital to analog converter

Lab 13. Design and test a digital piano, with 4 inputs, digital to analog conversion, and sound

### **Module 14: ADC and Data Acquisition**

Example 14. Develop a system that inputs an analog signal with an analog to digital converter

Example 14. Develop an autonomous robot that uses two DC motors and two distance sensors

Lab 14. Design and test a position measurement, with analog to digital conversion and calibrated output

### **Module 15: Systems Approach to Game Design**

Lab 15. Design and test a hand-held video game, which integrates all components from previous labs

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