Fall 2024

ECE 395 - MICROPROCESSOR LABORATORY

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New Jersey Institute of Technology

Electrical and Computer Engineering

Course Outline ECE 395 [**Microprocessor Lab**], Fall 2024

Instructor: Azeez Bhavnagarwala

To contact instructor: **bhavnaga@njit.edu**

Class/Lab: **Mondays 6:00 PM – 9:50 PM,** *Room:* **FMH 204**

Office hours: **Mondays 5PM-5:50 PM** (Room: 342, ECE Building, Tel: 973-596-3663) or by appointment

Course Pre-requisites: Microprocessors (ECE 252) is required. Please see instructor if you have an equivalent background.

Summary Course Description: ECE 395 introduces students to Microprocessor Interfacing using a RISCV 32b microcontroller. In this laboratory, students get the opportunity to apply the conceptual background developed in ECE 252 on the RISCV Instruction Set Architecture to real hardware and the Platform IO Integrated Development Environment. The Course offers a basic set of 4 labs which begin with the use of the industry grade IDM (Platform IO) to observe and document operation of microprocessor core as it executes code, an understanding of the 32b microcontroller's Memory Map and an understand of how to use its General Purpose I/O (GPIO) pins. The labs continue with the task of designing and building a simple finite state machine using the 32b microcontroller dev board and also the task of setting up and operating serial communication ports using industry standard interfacing protocols – UART/SPI/I2C etc.

Course structure:

Grades in the course for each Lab are based on successful demonstration of each of at least 4 Labs to the instructor. (25% of total grade for each of a minimum of 4 Labs). Also required are Lab reports for each Lab that articulate the purpose of the Lab a description of relevant considerations of the hardware and any issues encountered and how the were debugged. A video of the Lab during demonstration to the instructor documents student work and must be included in the report.

ECE 395 Schedule:

Week	ECE 395 Content	Meet
1	Review RISC V Instruction Set Architecture	FMH 205
2	Introduction to Microprocessor Interfacing – C code compilers with Platform IO and VSC Setup	FMH 205
3	**Lab 1:** Learn to create a PlatformIO project and write, assemble and debug code. Observe and document operation of microprocessor core as it executes code	FMH 204A
4	Review the RISC V memory map and the RISC V GPIO complex that manages the connection of digital I/O pads to digital peripherals, including SPI, UART, and PWM controllers, as well as for regular programmed I/O operations	FMH 205
5	**Lab 2:** Learn how to configure MCU internal peripherals. Learn how to use the GPIO pins	FMH 204A
6	Review Examples of Finite State Machines used in Embedded Systems – Washing Machine, Vending Machine and Home Security System	FMH 205
7	**Lab 3:** Apply what was learned in Lab 2 to real world Finite State Machine Application of an 'annunciator'	FMH 204A
8	Serial communications in microprocessor systems. Standards of UART, SPI, I2C	FMH 205
9	**Lab 4:** Learn how to setup and operate MCU serial ports, create functions for serial port initialization and utilization, learn how to use oscilloscope to observe serial waveform	FMH 204A
10	**Review**	
11	Interrupts & RISC V Privileged Mode	FMH 205
12	**Lab 5*:** Implement Calculator using UART	FMH 204A
13-14	**Lab 6*:** Demonstrate with Code Interrupts FMH 204A	
15	**Final Week to ensure All reports in**	

* If Labs 1→4 completed

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