Course number and name – ECE 252- Microprocessors

Credits— 3 Credits

Contact hours— 3 Credits

Name(s) of instructor(s) or course coordinator(s)—Mahmoud Nazzal

Instructional Materials—

- John Hennessey & David Patterson, Computer Organization & Design, The Hardware Software Interface, RISCV edition
- Harris, S., Harris, D. (2021). Digital Design and Computer Architecture, RISC-V Edition. Netherlands: Elsevier Science.

Specific course information (Brief description of the content of the course (catalog description))
ECE 252 introduces students to Microcontrollers and the trends that are shaping their design and use – markets for billions of pervasive, low cost, connected and energy efficient IoT systems. ECE 252 focusses on the RISC V instruction set architecture (ISA) - an 'open source' ISA that enables IoT systems to deliver on three key capabilities: improved interoperability among vendors, higher performance, energy efficiency and a much lower cost than systems built with proprietary architectures – ARM, x86 etc. ECE 252 reviews the basic organization of and components used by the processor and details the ISA with its encoding, formats and extensions. The class reviews 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. ECE 252 also develops the background for students to pursue ECE 395 (Microprocessor Lab) with use of an online RISC V simulator, an introduction to the Arduino Integrated Development Environment and an introduction to IoT system design

Prerequisites or corequisites— Digital Design and Computer Organization (ECE 251) is required

Educational objectives for the course (e.g. The student will be able to explain the significance of current research about a particular topic.)—

- Be able to quantitatively compare performance & energy efficiency of different computers, ISAs and hardware implementations for a given workload and assess best opportunities for improving performance.
- Understand and be able to use the RISC V ISA – formats, encoding, extensions.
- Understand and be able to use 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. Be able to use an online tool to program a RISC V controller.

Brief list of topics to be covered—

- Intro to ECE 252
- Introduction to RISC V & Basic Organization
- RISC V Instructions
- RISC V Instruction Formats
- Floating Point Arithmetic and IEEE 754 representation
- Instruction execution in Hardware
- Introduction to Memory Hierarchy
- Revision and tutorial sessions
- Communication interfaces, GPIO, SPI, UART, and PWM controllers
- Dev Board review for ECE 395