EECE 344
Digital Systems Design

4 Units: 3 hours lecture, 3 hours lab (Engineering Topic)

Course Supervisor/Main Instructor: Hadil Mustafa/Hadil Mustafa

Required Textbook and Other Course Materials

Textbook: Introduction to ARM Cortex-M Microcontrollers (5th edition), Jonathan W. Valvano. ISBN: 978-1477508992

Suggested Textbooks: Embedded Systems with ARM Cortez-M Microcontrollers in Assembly Language and C (3rd Edition), Yifeng Zhu (supplementary textbook)

Course Description: Extends the study of digital circuits to LSI and VLSI devices. Microcontrollers, architecture, bus organization and address decoding. Design concepts for microcontroller systems, including A/D and D/A conversion, serial communications, bus interfacing, interrupt processing, power regulations, timers, pulse width modulation, programmable I/O ports, and error control coding. 3 hours lecture, 3 hours laboratory.

Prerequisites: EECE 144, EECE 237; either EECE 110 or both EECE 211 and EECE 211L

Learning Objectives:

This course is designed to teach students to:

- Design and analyze digital systems using polling and interrupts in C. (SO 1, 2, and 6)
- Design, simulate, and implement a complete embedded system using advanced Computer Aided tools and C programming. (SO 1, 2, and 6)
- Use digital systems to input and output signals. (SO 1, 2, and 6)
- Implement and develop I/O device drivers. (SO 1, 2, 6, and 7)
- Use digital systems to interface sensors and analog devices. (SO 1, 2, and 6)
- Design real-time systems using interrupt synchronization, real-time ADC sampling, Digital communication protocols (UART and SSI) and multithreaded programming. (SO 1, 2, 6, and 7)
- Use data structures to implement state machines and controllers. (SO 1, 2, 6, and 7)
- Test and evaluate system performance with common laboratory equipment. (SO 1, 2, and 6)
- Work in multidisciplinary teams to design, build and test a complete embedded system. (SO 1, 2, 3, 5, and 6)

Course Topics:

Week	Topic
1	Introduction to computers and electronics
2	Embedded Systems applications, production and design
3	Debugging, Board, switch input and LED outputs
4	ARM Cortex Processor Architecture
5	C-Programming Review, Input/Output concept and ports, Debugging methods
6	Pointers and Data structures
7	Finite state machines, Stepper Motors
8	Phase-Lock-Loop (PLL), SysTick Timer
9	I/O Synchronization and Interrupts, Variables and Parameters
10	ARM interrupts and interrupts processing, music generation and DAC
11	Analog I/O Interfacing
12	Fixed point and floating-point format
13	A/D conversion, ADC conversion, Numerical calculations
14	Digital Communications and UART
15	Project Presentation

Grading Scheme:

Class Participation and Homework (10%)
Lab assignments (30%)
Project (10%)
Midterm (20%, 2 Midterms)
Final exam (30%)

Weighted Final Grade	Minimum Final Letter Grade
90%	A-
80%	B-
70%	C-
60%	D