University of Toledo
Electrical Engineering Technology
Master Syllabus

Course Title: Embedded Systems Design **Course Code & Number:** EET-3350

Credit Hour Total: 4 **Weekly Contact Lecture Hours:** 3 **Lab Contact Hours:** 2

Pre-requisite: (EET-2210 and EET 3150) or (EET 2210 and CSET 2230)

Text: Embedded Systems: Introduction to the Arm(R) Cortex (Tm)-M3, 2nd Edition, Jonathan Valvano, 2012.

Course Coordinator: Evans

A. Course Description

This course covers different aspects of real-time embedded systems implementation with low-level access to hardware resources of microcontrollers. Topics include but not limited to low-level and high-level microcontroller programming covering assembly and C, I/O access, interrupt-driven programming, timers, serial interfacing, analog-to-digital (ADC), and digital-to-analog (DAC). Uses system design approach, such as flow charts, finite state machines (FSM) while implementing embedded system is emphasized.

B. Related Program Outcomes:

ABET/Student Outcomes

a. An understanding of the analytical and laboratory skills associated with electrical engineering technology.
b. An ability to apply current knowledge and adapt to emerging applications of mathematics, science and technology.
c. An ability to conduct, analyze, and interpret experiments concerning digital circuits.
d. An ability to use creativity in the design and use of digital systems and processes.
e. An ability to function as part of a team.
f. An ability to identify, analyze and solve technical problems associated with digital systems design.
g. An ability to communicate effectively.
k. A commitment to quality and continuous improvement.

EET Program Outcomes

None

C. Course Objectives:

Embedded systems are ubiquitous nowadays. The overall course objective is to help the students to understand how embedded systems interact with the external world environment. The course aims to provide hands-on experiences of how an embedded system could be used to solve some daily life problems through automation. The focus will be given to understand basic building blocks of an embedded system instead of complex system design. However, the final project will demonstrate the students ability to design a real-world system using the concepts learned throughout the course.

D. Course Outline – Major Content Areas

- Embedded Systems
- Embedded System Architecture
- ARM Machine Language
- Assembly and C language programming
- I/O Port Interfacing
- Timer and Phase-Locked Loop (PLL)
- Finite State Automation
- I/O Synchronization & Interrupts
- UART
- Analog/Digital Conversion (ADC and DAC)

E. Major Laboratory Topics

- Behavioral VHDL Design, Simulation, and Verification of Digital Circuits using ModelSim.
- Structural VHDL Design, Simulation, and Verification of Digital Circuits using ModelSim.
- Design of Half and Full Adders Using VHDL.
- Design of Flip Flops using VHDL.
- Design of Mixed Circuits using VHDL.
- Design of Shift Registers and Counters using State Cad Tools from Xilinx.
- Design of Traffic Light Controller Using CAD Tools.