1. Course number and name
   ENGR 478: Design with Microprocessors

2. Credits and contact hours
   4 credits
   Contact hours: two 75-minute lecture sessions/week and one 2-hour-45-minute lab session/week

3. Instructor’s or course coordinator’s name
   Instructor: Xiaorong Zhang, Assistant Professor of Computer Engineering
   Course coordinator: Xiaorong Zhang, Assistant Professor of Computer Engineering

4. Text book, title, author, and year
   a. other supplemental materials
      Lab material:
      • Tiva C Series TM4C123G LaunchPad Evaluation Kit (EK-TM4C123GXL)
      Other references:
      • Tiva TM4C123GH6PM Microcontroller Data Sheet
      • Getting Started with the Tiva TM4C123G LaunchPad Workshop Student Guide and Lab Manual
      • TivaWare Peripheral Driver Library User’s Guide
      • Tiva C Series TM4C123G LaunchPad Evaluation Board User’s Guide.
      • Cortex-M4 Technical Reference Manual
      • Cortex-M4 Devices Generic User Guide
      • Cortex-M3/M4F Instruction Set Technical User’s Manual

5. Specific course information
   a. brief description of the content of the course (catalog description)

   b. prerequisites or co-requisites
      ENGR 356 with a grade of C- or better; ENGR 213 with a grade of C- or better or CSC 210 with a grade of C or better

   c. indicate whether a required, elective, or selected elective course in the program
      Required for Computer and electrical Engineering.

6. Specific goals for the course
a. specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.

Students completing the course successfully will demonstrate

- an in-depth knowledge of a microprocessor/microcontroller.
- an ability to program in assembly and C language
- knowledge of the interactions between software and hardware.
- an ability to integrate software and hardware for microprocessor-based systems.
- an ability to interface microprocessor with other devices through serial and parallel I/O.
- an ability to deal with analog signals in digital systems.
- an ability to use timer and counter functions.
- an ability to design an expanded system by adding external circuits as required.
- an ability to use development tools.
- a skill in troubleshooting a microprocessor-based system.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

Course addresses ABET Student Outcome(s): a, b, c, e, g, j, k.

7. Brief list of topics to be covered

- Introduction to embedded systems
- Introduction to TM4C123GH6PM microcontroller and
- ARM Cortex-M4 architecture and assembly language
- Assembly syntax; Functions; Logic operations
- GPIOs
- Friendly software development in C
- Switch and LED interfacing; IO synchronization
- Interrupt concept and nested vectored interrupt controller
- Edge-triggered interrupt and periodic interrupt
- Analog to digital conversion (ADC)
- Digital to analog conversion (DAC)
- Serial communication
- Serial I/O – SSI vs. UART vs. USB vs. I2C
- Power management
- Advanced Topic in Embedded System Design.