

ECE-GY 6483: Real Time Embedded Systems  
NYU Tandon School of Engineering  
Fall 2023

---

## 1 Course Information

<b>Instructor:</b>	Matthew Campisi <i>mcampisi@nyu.edu</i>
<b>Office hours:</b>	Weekly/TBD
<b>Lectures :</b>	Mon 5:00-7:30PM ET (370 Jay, RM202)
<b>Prerequisites :</b>	Digital Logic/Computer hardware/Basic Programming skills
<b>Teaching assistants:</b>	Nikhil Anand + 5 Total (info TBD)
<b>TA office hours:</b>	TBD
<b>Textbook and Materials:</b>	No required textbook. Optional references: <ol style="list-style-type: none"><li>1. Computers as components: principles of embedded computing system design. Wolf, Marilyn. Elsevier, 2012.</li><li>2. Real-time systems design and analysis: tools for the practitioner. Laplante, Phillip A., and Seppo J. Ovaska. John Wiley and Sons, 2011.</li></ol> STM32F429 DISCOVERY (STM32F429I-DISC1 available through Mouser or Digikey)  Assignments: 30% 2 Exams (Open notes): 30%  Grading: Final Project (Embedded Challenge F2023): 40%

## 2 Course Description

This course provides an overview of the unique concepts and techniques needed to design and implement computer systems having realtime response requirements in an embedded environment. It contrasts the concepts and techniques of real time and embedded systems with those of more traditional computer systems. Topics include: Basic concepts of real time and embedded systems, hardware features, sensors and actuators, programming languages, real time operating systems, synchronization techniques, performance optimization and current trends in real time and embedded systems such as incorporating internet connectivity.

### 3 Outline

The following is a outline of the course topics:

- Week 1: Preliminaries : definitions, examples of embedded systems, computer organization concepts, memory
- Week 2: ARM Cortex M/Fxxx Hardware Overview
- Week 3: Embedded C programming concepts/VS Code IDE/Embed OS
- Week 4: ARM Assembly Language
- Week 5: Ports, Registers, GPIO
- Week 6: Timers , Counters, and PWM
- Week 7: Analog I/O, ADC/DAC/ Embedded DSP
- Week 8: Communications :, USART, SPI, TWI (**Exam 1**)
- Week 9: Interrupts, ISRs and Callbacks
- Week 10: RTOS Characteristics: Scheduling, priorities, reentrancy
- Week 11: RTOS: Shared Resources Management, Mutex, Semaphores and Critical Sections
- Week 12: Reliability and System Modeling (**Exam 2**)
- Week 13: Future of embedded systems : Networking and IOT (Internet of Things)
- Week 14: Project Recap and Prep

### 4 Policies

- Please familiarize yourself with, and follow, the university policies on add/drop deadlines, missing classes for religious observance, accommodations for students with disabilities, and other special circumstances.
- This class has open-notes in class quizzes. “Open notes” means that you may use any printed or handwritten material. However, you may not use electronics, speak to other students, or share written materials with other students.
- More information on the Final project will be provided in class