

Instructor: Dr. Sudeep Pasricha (sudeep@colostate.edu), ENGR B119

Lectures: Tu/Thu 4:00pm – 5:15pm, Eddy 7 (recorded lectures will be available asynchronously via Echo360 on the course Canvas page at or before these times; in-class lectures will begin once CSU gives permission)

Office Hours: 9:30am – 10:30am, Wednesdays via Zoom (link on Canvas page)

Course TA: Pooja Anandathirtha (Pooja.Anandathirtha@colostate.edu)

TA Hours: 2pm-3pm Monday, Thursday via Zoom (link on Canvas page)

Course Description: Embedded systems run the computing devices hidden inside a vast array of everyday products and appliances such as smartphones, tablets, GPS units, cameras, and laptops. Cars are full of them, as are airplanes, satellites, and advanced military and medical equipments. As applications grow increasingly complex, so do the complexities of the embedded computing devices. The goal of this course is to develop a comprehensive understanding of the underlying technologies and design techniques used to build such embedded systems. The course provides an overview of the various building blocks of embedded systems, including processors, memories, peripherals, communication architectures, OS, middleware and embedded software. Additionally, several topics relevant to the design of contemporary and emerging embedded systems are covered, including deep (machine) learning, security, reliability, writing embedded software, system level modeling and specification, design space exploration, hardware-software partitioning, high level synthesis (hardware/software interface), and real time scheduling. Real world examples will be used to demonstrate and explain concepts.

Prerequisites: ECE452 or equivalent computer organization course; basic programming experience in C/C++ and using Linux; basic knowledge of data structures and algorithms

Textbook: None. The course will cover materials from various books and conference/journal articles. Slides will be posted on Canvas. A sample list of reference books is given below:

- P. Marwedel, “Embedded System Design”, Kluwer 2018.
- M. Wolf, “Computers as Components: Principles of Embedded Computing System Design”, MK Pub, 2016.

Syllabus: Here is a tentative outline and syllabus for this course:

Week	Topic
1	Introduction to Embedded Systems
2	Modeling with SystemC
2-3	Specification and Modeling of Embedded Systems

4-6	Software Components in Embedded Systems
7-8	Hardware Components in Embedded Systems
9	Spring Break
10-11	Hardware Components in Embedded Systems
12	HW/SW Partitioning
12	Software Optimizations in Embedded Systems
13	Sensors, Actuators, and Embedded Control
14	Hardware Component Trends
15	Embedded Systems Security
16	Embedded Systems and Ethics
17	Finals (Closed book)

Grading: Grading is based on the following components:

- Homework Assignments: 20%
- Reading Assignments: 15%
- Class Participation: 10%
- Examinations: 25%
- Embedded systems Project: 30%
 - Final presentation: 10%
 - Project report: 20%

Grading Scale:

>95%	90-94%	85-89%	80-84%	75-79%	70-74%	65-69%	55-64%	40-55%	<40%
A+	A	A-	B+	B	B-	C+	C	D	F

Submission Policy: Homework assignments will be assigned throughout the semester. You are allowed late submission up to 3 days on one homework assignment and one reading assignment. Assignments and project deliverables should be submitted before the deadline via Canvas, and ***late submissions will not be graded!***

Re-grading Policy: Re-grading requests should be made within a week from the date of the graded item (homework, exam, or project) becoming available.

Academic Integrity: All submitted work should be your own. Copying of language, structure, images, ideas, or thoughts of another, and representing them as one's own without proper acknowledgement (from github code repos, other web sites, books, papers, other students, etc) and failure to cite sources properly is not acceptable. Sources must always be appropriately referenced, whether the source is printed, electronic, or spoken. Minor first infraction in HWs and presentations will lead to a zero score + one letter level (e.g. A to B) reduction in course grade. Project or Major or repeated infractions in HWs and presentations will result in "F" grade for the course + report to Dean's Office. For more information see CSU's Academic Integrity Policy: <https://tilt.colostate.edu/AcademicHI> (Links to an external site.) and Student Conduct Code: <https://resolutioncenter.colostate.edu/student-conduct-code/> (Links to an external site.)

Attendance: I encourage everyone to attend all the lectures and actively participate in class discussions.

Appointment: I encourage you to make at least one appointment with me during the semester for advice or to discuss research opportunities, independent study, research ideas, course suggestions, concerns, or any other topic you feel is appropriate.