CDA 5636: Embedded Systems

Sections: 22714
Class Periods: Tuesday 3:00 – 4:55 pm and Thursday 4:05 – 4:55 pm
Location: NPB 1002 (Tuesday) and MAEA 0303 (Thursday)
Academic Term: Spring 2025

Instructor:
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Office Hours: Wednesday 3:00 – 5:00 pm in MALA 4002

Teaching Assistants:
Name: Aruna Jayasena
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Name: Abhinav Telukunta
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Office Hours: Monday 3:00 – 4:00 pm in MALA 5200

Course Description
Design of efficient and trustworthy embedded and cyber-physical systems consisting of hardware, software, firmware, sensors, and actuators. It covers fundamental issues related to modeling and specification, design space exploration, hardware-software partitioning, synthesis and compilation, real-time operating systems, and application-specific optimizations targeting area, power, performance, temperature, energy, and security.
3 credits.

Course Pre-Requisites / Co-Requisites
CDA 3101

Course Objectives
Embedded systems run the computing devices hidden inside a vast array of everyday products and appliances such as cell phones, toys, handheld PDAs, cameras, and microwave ovens. 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 technologies behind the embedded systems design. The students develop an appreciation of the existing capabilities and limitations of various steps in overall design methodology including system level specification, design space exploration, hardware-software partitioning, application-specific optimizations, and functional validation of embedded systems.

Materials and Supply Fees: *None*

Required Textbooks and Software: *None*

Recommended Materials:
- Embedded System Design, Peter Marwedel, Springer, 2021, ISBN: 978-3319560434
- **Free Download:** https://link.springer.com/content/pdf/10.1007/978-3-030-60910-8.pdf

Required Computer: UF student computing requirement:
https://news.it.ufl.edu/education/student-computing-requirements-for-uf/

Please bring your computer to the class so that you can login to eLearning and solve the pop quiz. You also need the computer to develop and test your assignments (homework and projects).

Course Schedule

Week	Topics	Assignments and Exams
1	Introduction to Embedded Systems	
2	Modeling and Specification	Homework 1 (Due: Feb 5 at 11:30 pm)
3	Specification (continued)	
4	Embedded Systems Architecture	Project 1 (Due: Feb 19 at 11:30 pm)
5	Architecture (continued)	
6	Compression and Decompression	Homework 2 (Due: Mar 5 at 11:30 pm)
7	Real-time Operating Systems	
8	Hardware-Software Co-Design	
9	Compilation of Embedded Applications	**Midterm** (Mar 11 from 3:00 – 4:55 pm)
10	Spring Break	
11	Control Systems	Project 2 (Due: Apr 2 at 11:30 pm)
12	Design Space Exploration	
13	Energy-aware Computing	Homework 3 (Due: Apr 16 at 11:30 pm)
14	Validation and Verification	
15	Embedded Systems Security	
16		**Final** Exam (Apr 29 from 10:00 am – noon)

Attendance Policy, Class Expectations, and Make-Up Policy

The students are expected to attend the lectures (in person) and actively participate in class discussions. There is a 10% score for class participation and pop quizzes. The pop quiz will be conducted during the lecture based on the materials covered in that lecture. You will not know when the pop quiz will be conducted. You will get the full score (10%) in participation if you get 80% in pop quizzes, prorated otherwise. There is no scope for makeup pop quizzes. Please attend the first lecture and refer to the introduction.pptx in eLearning for further details. For example, if I conduct 20 pop quizzes, and you can

correctly solve 16 of them, you will get full 10% of the overall score. If you get less than 16 points in pop quizzes, your prorated score would be computed as: (10 x total-quiz-points)/16

The students are required to submit their homeworks and projects before the deadline through eLearning. Late submissions are allowed (up to 24 hours) with a 20% penalty. No grades for late submissions after 24 hours from the deadline. The students are required to take the midterm and final exams at the scheduled time. There would be no makeup exams except for medical emergencies with appropriate documentation.

Excused absences must be consistent with university policies in the Graduate Catalog (https://catalog.ufl.edu/graduate/regulations) and require appropriate documentation. Additional information can be found here: https://gradcatalog.ufl.edu/graduate/regulations/

Regrading Policy: A student needs to request for regarding for an assignment (homework or project) or exam within a week of when the grade is posted. The associated announcement will indicate the deadline for that assignment or exam. No regarding is allowed after the deadline has passed. The instructor may add points to each student's midterm such that the highest score in the midterm is 100%. For example, if the highest score is 110 out of 120, the midterm score for each student will increase by 10 points. Note that this increase covers various scenarios, including (but not limited to) minor mistakes in grading, lack of clarity in some questions, or level of difficulty in specific questions. Therefore, during regarding of midterm, a student will not gain any points unless the student gains more than the additional points (e.g., 10 in this example). Due to timing constraints between the final exam and the grade submission deadline, there will be no scope for regrading the final exam. However, we will add points to each student's final such that the highest score in the final is 100%. This increase in points is expected to cover any minor mistakes in grading the final exam.

Zero Tolerance Policy: You are expected to do your assigned activities (homework, project, or exams) on your own without giving any help to anyone or getting any help from anyone (including ChatGPT or other internet sources). Similarly, you are allowed only one crib sheet during the exams with hand-written notes (on one side of a US letter size paper during the midterm, and on both sides of a US letter size paper during the final). Note that the font size of the handwritten notes cannot be less than **14 pts** in Times New Roman (i.e., notes with tiny fonts will not be allowed). Any violation of the course policies will be treated as academic dishonesty and will be reported to the Dean of Student's (DSO). In case of violation, the student will receive a zero score in that assignment, an additional grade penalty, and it will be reported to the DSO.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homeworks (3)	5% each	15%
Pop Quizzes	10%	10%
Projects (2)	10% each	20%
Midterm Exam	25%	25%
Final Exam	30%	30%
		100%

Grading Policy

Percent	Grade	Grade Points
91 - 100	A	4.00
86 – 90.9	A-	3.67
81 – 85.9	B+	3.33
76 – 80.9	B	3.00
72 – 75.9	B-	2.67
68 – 71.9	C+	2.33
64 – 67.9	C	2.00
60 – 63.9	C-	1.67
56 – 59.9	D+	1.33
52 – 55.9	D	1.00
48 – 51.9	D-	0.67
0 – 47.9	E	0.00

More information on UF grading policy may be found at:
UF Graduate Catalog
Grades and Grading Policies

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation,

assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
• Your academic advisor or Graduate Program Coordinator
• HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
• Pamela Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu
• Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the Office of Title IX Compliance, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or
http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*: https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/; https://care.dso.ufl.edu.

On-Line Students Complaints*: https://distance.ufl.edu/getting-help/; https://distance.ufl.edu/state-authorization-status/#student-complaint.*