

CDA 5636: Embedded Systems

Class Periods: Tuesday 10:40 – 11:30 am and Thursday 10:40 am – 12:35 pm

Location: CSE 220 (face-to-face) and via Zoom

Academic Term: Spring 2021

Instructor:

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Office Phone Number: 352 294 6658

Office Hours: Wednesday, 1:00 – 3:00 pm via Zoom

Teaching Assistants: None

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
- 2017
- ISBN: 978-3319560434

Course Schedule

Week	Topics	Assignments and Exams
1	<i>Introduction to Embedded Systems</i>	
2	<i>Modeling and Specification</i>	<i>Homework 1 (Due: Feb 3 at 11:30 pm)</i>
3	<i>Embedded Systems Architecture</i>	<i>Quiz (Feb 9 from 10:40 – 11:30 am)</i>
4	<i>Digital-to-Analog and Analog-to-Digital Converters</i>	
5	<i>Sensors and Actuators</i>	<i>Project 1 (Due: Feb 24 at 11:30 pm)</i>
6	<i>System-level Optimizations</i>	
7	<i>Compression and Decompression</i>	<i>Homework 2 (Due: Mar 10 at 11:30 pm)</i>
8	<i>Real-time Operating Systems</i>	
9	<i>Spring Break</i>	
10	<i>Hardware-Software Co-Design</i>	<i>Midterm (Mar 18 from 10:40 – 12:35 pm)</i>
11	<i>Compilation of Embedded Applications</i>	
12	<i>Control Systems</i>	<i>Project 2 (Due: Mar 31 at 11:30 pm)</i>
13	<i>Design Space Exploration</i>	
14	<i>Energy-aware Computing</i>	<i>Homework 3 (Due: Apr 14 at 11:30 pm)</i>
15	<i>Validation and Verification</i>	
16	<i>Embedded Systems Security</i>	
17		<i>Final Exam (Apr 30 from 10:00 – noon)</i>

Attendance Policy, Class Expectations, and Make-Up Policy

Students are expected to attend the lectures and actively participate in class discussions. Excused absences must be consistent with university policies in the undergraduate catalog and require appropriate documentation (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>).

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homeworks (3)	20 each	15%
Online Quiz (1)	25	5%
Projects (2)	10 each	20%
Midterm Exam	120	25%
Final Exam	120	35%
		100%

Grading Policy

Percent	Grade	Grade Points
91 - 100	A	4.00
86 - 90	A-	3.67
81 - 85	B+	3.33
76 - 80	B	3.00
72 - 75	B-	2.67
68 - 71	C+	2.33
64 - 67	C	2.00
60 - 63	C-	1.67
56 - 59	D+	1.33
52 - 55	D	1.00
48 - 51	D-	0.67
0 - 47	E	0.00

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

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/>.

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://www.dso.ufl.edu/sccr/process/student-conduct-honor-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 broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

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
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.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>

Campus Resources:

Health and Wellness

U Matter, We Care:

If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

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

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 support, 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://www.crc.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://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.