

CSE 332: Cyber-Physical Systems Engineering II

Benjamin Sanda, Ph.D.

Winter 2023

E-mail: bsanda@depaul.edu

Office Hours:
MW 1500–1600

Class Hours:
MW 1330–1500

Office: Daley 200B

Classroom: Daley Room 502

Course Description

CSE 332 is the second in a three-course sequence that provides a comprehensive overview of core CPS topics in an application-driven context and with an emphasis on fundamental engineering design principles of modularity and abstraction. This second course focuses on understanding the interfacing of sensing and actuation technologies of cyber-physical systems. The class consists of lecture sessions, discussions covering the material and methods, and lab exercises to solidify the theory components covered in the class via hands of experiments in the context of designing, analyzing, managing, and testing hardware devices and building cyber-physical system prototypes.

Course Website

This syllabus, as well as the class lecture notes, homework assignments, and other links, are available on D2L. Please check the D2L regularly.

Course Format

For this semester lectures will be virtual and given via Zoom, labs are in person in the classroom. Lab dates will be announced at least one week prior to the lab.

Course Objectives

In this course, students will:

- Experience working in groups.
- Understand digital logic and apply Boolean algebra to derive and simplify a digital system.
- Apply the fundamentals of signals and systems to understand measurement systems.
- Be able to qualitatively and quantitatively assess measurement systems.
- Be familiar with data acquisition technologies.
- Learn state of the art sensing and actuation systems and modeling thereof.

Prerequisites

Students must have taken and passed CSE 331 (or Instructor approval).

Textbook(s) and Required Materials

- *Electronics Fundamentals: Circuits, Devices & Applications* by Thomas L. Floyd and David M. Buchla. You may use the 8th or 9th edition.
 - 8th Edition: ISBN 0135072956
 - 9th Edition: ISBN 013558373X

Course Policies

The course policies are detailed below. Basically, try to learn stuff (which I'll help with), and don't cheat. Remember the 7 P's:

Proper Planning and Preparation Prevents Piss Poor Performance.

Communications

The best way to communicate with me is via email. This is also the primary way I will communicate with the class. When sending emails be sure to include the class name/number, your name, and a full explanation of your question. If you send me a complete email I will send a complete response, if you send a cryptic email I will send a cryptic response. I actually do get emails like the one below:

Subject: question

Don't understand 6

(name blank)

I use regular business hours for answering emails (M–F 0800–1800), If you email me outside those hours do not count on a response until the next day. I do also check my email on weekends but I will not guarantee responses over the weekend.

Meetings

Office hours are as listed. I am an adjunct professor who also works full time so I'm only down on campus the days we have class. If you need to meet outside normal office hours/class we can do so via Zoom. Email me to setup an appointment.

Homework

Homework will be assigned on a regular basis as given in the class schedule. It will be due on the date specified, at the start of class. **Late homework will not be accepted and will result in a zero for that assignment.** Handing in the assignment after the start of class, but still during class, counts as late. It is your responsibility to get the assignments and complete them. Homework assignments and the expected due dates will be posted on D2L and announced in class. Due dates may be altered based on class scheduling and pace of materials. Any alterations will be announced at least one week prior to the new due date.

Homework must be submitted as follows:

- On engineering paper (it doesn't have to be the green stuff, any graph/computation pad) and/or electronically
 - Assignments which have computer (Matlab/LTSpice) and book questions may be submitted in both electronic and paper form (you don't have to type up the book questions, unless you want to)
 - If submitting electronically documents must be in PDF format. Do not send Word docs/other document formats. If submitting multiple items they must be compressed into a single zip file.
 - If submitting in paper form it must be stapled (I will not staple it for you and you will be marked down)
- Each problem must be clearly labeled
- Final answer boxed
- Name on each page
- Class number and HW number on first page
- No title page required
- You do not have to write the problem statement for each problem, just give the solution
- Show all work to receive full credit

Homework Grading

“Try Points” are given for every problem tried. “Try points” are based on effort, not results or correctness, i.e. did you demonstrate in the submission that you attempted to understand and solve the problem? Solutions for homework will be posted after each assignment is collected.

Labs

Labs will be assigned and completed in class during our normal class periods (there is no separate lab section). Each lab will be available on D2L and will contain the lab instructions and required submission. Lab submissions are due one week after the lab is assigned, at the start of class. There will be limited Lab access outside of normal class hours to complete lab assignments as needed.

Late Submissions

Late labs or homework will not be accepted and will result in a zero for that assignment. Handing in the assignment after the start of class, but still during class, counts as late. It is your responsibility to get the assignments and complete them. Assignments and the expected due dates will be posted on D2L and announced in class. Due dates may be altered based on class scheduling and pace of materials. Any alterations will be announced at least one week prior to the new due date.

Exams

There will be two in-class exams. Exams are open book, open notes. All exams are given at the start of the class period. Failure to attend an exam will result in a zero for that exam. There are no make up exams.

- Exam 1: 90 minutes in length, non-cumulative. Administered mid-way through the quarter.
- Exam 2: 90 minutes in length, non-cumulative. Administered during the final exam period.

Quizzes

There will be an in-class quiz every week (no quiz the first week of class and exam weeks). These will consist of 1-3 short problems based on the previous week’s lectures. Quizzes are open book, open notes, and 15 minutes in length. The purpose of the quiz is to give you a quick benchmark for what we learned in the previous week. They are not in-depth or overly difficult and should be able to be completed well within the time allotted. Quizzes will be given at the start of class via D2L. Failure to attend a quiz will result in a zero for that quiz. There are no make up quizzes.

Exam/Quiz Guidelines

- Open book, open notes (you may access D2L and class resources on the computer)
- Any model calculator

- Start Time: 1330
- Be ready to go at the start time. If you are late no additional time will be given.
- Start/end time is set by NIST official US time (not school clock time).
 - <https://www.time.gov/>
 - The official time will be projected on the screen during the examination
- If you fail to stop writing and submit your examination after the designated end time it is considered a breach of the student code of conduct and you will receive a zero on the examination.
- Time warnings will be given at 1-minute remaining.

Respawn Quiz

All students have one extra quiz life with which they may correct and learn from previous glitches in performance. The last week of class there will not be a normal quiz, instead there is an optional respawn quiz. This quiz, if taken, will replace your lowest quiz score from the semester. If you score lower on the respawn quiz than any of your previous quizzes the respawn score will not be used and no score will be replaced (you can't hurt yourself). The respawn quiz will be based on material from the previous week just as with the normal quizzes. If you choose not to take the respawn quiz your grade will not be affected. It is completely optional.

NOTE: This respawn opportunity cannot be used to make up a missed quiz. If you miss a quiz with no valid absence will receive a zero for that quiz no matter what. If you take the respawn it will be applied to your lowest, non-missed, score.

Valid Absences

Permission to miss any due date, exam, or quiz may be granted by the instructor under extreme circumstances. If permission is desired, a request must be made in writing/email before the due date and should include either a signed doctor's explanation or a written explanation signed by an appropriate DePaul officer. Verbal requests are not accepted to grant permission. The request must be written or in email. If an exam or quiz is missed in this manor, an appropriate make up exam/quiz will be administered no latter than one week after the excused absence.

Grading Policy

- Homework – 10%
- Quizzes – 10%
- Labs – 40%
- Exam 1 – 20%
- Exam 2 – 20%

Letter Grades

| Letter Grade | Score Range |
|--------------|-------------|
| A | 95–100 |
| A- | 91–94 |
| B+ | 88–90 |
| B | 85–87 |
| B- | 81–84 |
| C+ | 77–80 |
| C | 73–76 |
| C- | 69–72 |
| D+ | 65–68 |
| D- | 61–64 |
| F | 0–60 |
| I | * |

* **Incomplete:** An incomplete grade is given only for an exceptional reason. See the incomplete grade policy at <http://www.cdm.depaul.edu/Current%20Students/Pages/Grading-Policies.aspx>.

University Codes, Policies, Processes and Procedures

Drop Dates

See the academic calendar for drop dates and details: <https://academics.depaul.edu/calendar/Pages/default.aspx>

Changes to Syllabus

This syllabus is subject to change as necessary during the quarter. If a change occurs, it will be thoroughly addressed during class, posted under Announcements in D2L and sent via email.

COVID-19 Health and Safety Precautions

The health and safety of everyone at DePaul depend on the cooperation of all who come to campus. By taking care of yourself, you protect the entire community. DePaul's COVID-19 response plans are based on the latest guidance from the Centers for Disease Control and Prevention, the Chicago Department of Public Health and the university's medical advisor from AMITA Health.

Mandatory protocols must be followed by DePaul students, faculty and staff at all times on both campuses <https://resources.depaul.edu/coronavirus/guidance/health-safety-practices/Pages/default.aspx>.

Respect for Diversity and Inclusion at DePaul University as aligned with our Vincentian Values

At DePaul, our mission calls us to explore “what must be done” in order to respect the inherent dignity and identity of each human person. We value diversity because it is part of our history, our traditions and our future. We see diversity as an asset and a strength that adds to the richness of classroom learning. In my course, I strive to include diverse authors, perspectives and teaching pedagogies. I also encourage open dialogue and spaces for students to express their unique identities and perspectives. I am open to having difficult conversations and I will strive to create an inclusive classroom that values all perspectives. If at any time, the classroom experience does not live up to this expectation, please feel free to contact me via email or during office hours.

Online Course Evaluations

Evaluations are a way for students to provide valuable feedback regarding their instructor and the course. Detailed feedback will enable the instructor to continuously tailor teaching methods and course content to meet the learning goals of the course and the academic needs of the students. They are a requirement of the course and are key to continue to provide you with the highest quality of teaching. The evaluations are anonymous; the instructor and administration do not track who entered what responses. A program is used to check if the student completed the evaluations, but the evaluation is completely separate from the student’s identity. Since 100% participation is our goal, students are sent periodic reminders over three weeks. Students do not receive reminders once they complete the evaluation. Please see <https://resources.depaul.edu/teaching-commons/teaching/Pages/online-teaching-evaluations.aspx> for additional information.

Academic Integrity and Plagiarism

This course will be subject to the university’s academic integrity policy. All students are expected to abide by the University’s Academic Integrity Policy which prohibits cheating and other misconduct in student coursework. Publicly sharing or posting online any prior or current materials from this course (including exam questions or answers), is considered to be providing unauthorized assistance prohibited by the policy. Both students who share/post and students who access or use such materials are considered to be cheating under the Policy and will be subject to sanctions for violations of Academic Integrity. More information can be found at <https://resources.depaul.edu/teaching-commons/teaching/academic-integrity/Pages/default.aspx>.

Posting work on online sites, such as Hero

All students are expected to abide by the University’s Academic Integrity Policy which prohibits cheating and other misconduct in student coursework. Publicly sharing or posting online any prior or current materials from this course (including exam questions or answers), is considered to be providing unauthorized assistance prohibited by the policy. Both students who share/post and students who access or use such materials are considered to be cheating under the Policy and will be subject to sanctions for violations of Academic Integrity.

Academic Policies

All students are required to manage their class schedules each term in accordance with the deadlines for enrolling and withdrawing as indicated in the University Academic Calendar. Information on enrollment, withdrawal, grading and incompletes can be found at: <http://www.cdm.depaul.edu/Current%20Students/Pages/PoliciesandProcedures.aspx>

Incomplete Grades

An incomplete grade is a special, temporary grade that may be assigned by an instructor when unforeseeable circumstances prevent a student from completing course requirements by the end of the term and when otherwise the student had a record of satisfactory progress in the course. All incomplete requests must be approved by the instructor of the course and a CDM Associate Dean. Only exceptions cases will receive such approval. Information about the Incomplete Grades policy can be found at <http://www.cdm.depaul.edu/Current%20Students/Pages/Grading-Policies.aspx>

Preferred Name & Gender Pronouns

Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the quarter so that I may make appropriate changes to my records. Please also note that students may choose to identify within the University community with a preferred first name that differs from their legal name and may also update their gender. The preferred first name will appear in University related systems and documents except where the use of the legal name is necessitated or required by University business or legal need. For more information and instructions on how to do so, please see the Student Preferred Name and Gender Policy at <http://policies.depaul.edu/policy/policy.aspx?pid=332>

Students with Disabilities

Students seeking disability-related accommodations are required to register with DePaul's Center for Students with Disabilities (CSD) enabling them to access accommodations and support services to assist with their success. There are two office locations:

- Loop Campus (312) 362-8002
- Lincoln Park Campus (773) 325-1677
- Email: csd@depaul.edu

Students who register with the Center for Students with Disabilities are also invited to contact Dr. Gregory Moorhead, Director of the Center, privately to discuss how he may assist in facilitating the accommodations to be used in a course. This is best done early in the term. The conversation will remain confidential to the extent possible. Please see <https://offices.depaul.edu/student-affairs/about/departments/Pages/csd.aspx> for Services and Contact Information.

Class Topics

1. Introduction
2. OpAmps
3. Digital logic
4. Digital representations
5. Combinatorial logic
6. Boolean algebra
7. Signals and systems
8. Data acquisition
9. Signal conditioning
10. Quantizing theory
11. Analog to digital conversion
12. Digital to analog conversion
13. Measurement fundamentals
14. Sensors
15. Actuators