DEPAUL UNIVERSITY
COLLEGE OF COMPUTING AND DIGITAL MEDIA

CSE 332: Cyber-Physical Systems Engineering II - Winter 2021/22 **Instructor: Isuru Godage, Ph.D.**

Instructor

Isuru Godage, PhD.
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Lab Hours

Mo 1:30 – 3:00 PM online via ZOOM (https://depaul.zoom.us/j/95135243164?pwd=akRKMHI2QzQ4SG5CdDlqczBENzdRUT09)
We 1:30 – 4:30 PM, Room 502 in 14 E Jackson

Lab Technician

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Course Web Page

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

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 two weekly lab sessions; 1.5 hours of discussions covering the material and methods and 3 hours of 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 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.
- Master modeling and testing using Matlab Simulink environment
- Learn state of the art sensing and actuation systems and modeling thereof.

Prerequisites

Students must also have taken CSE 331 (or Instructor approval). Also, students must have passed these courses or have been waived out of them. More to the point, students must already know how to solve simultaneous equations, matrix manipulation, and differential equations. Software tools will be used to solve and analyze mathematical relationships governing various cyber-physical systems. If you have any questions, refer to the Instructor.

Important:

- This is both lecture/discussion-based and hands-on class. Students are strongly advised to take part in all the sessions. Students are not permitted to enter 15 minutes after class has started. The use of portable electronic devices is prohibited.
- Labs are group activities. Each group has two/three members. Please find a group member by the end of the first lab. Let the instructor know if you have difficulties getting into a group before the second meeting.
- You can change groups, but it is difficult if you are the only group that needs a change in the class.
- In group submissions, identify (percentage-wise) member contributions if the contribution is not even.
- Homework should be completed individually.
- Please use the electronic components distributed to you for lab assignments and electrical measurement instruments with care.
- The CPSE lab has three workstations and workbenches equipped with the required software and hardware needed to complete homework, lab assignments. The lab will be kept open 20 hrs/week outside class hours.

Course Format

The course provides the material you will need to understand the fundamental concepts covered during course, including:

- Lectures (1.5 hrs/week).
- Weekly lab (3 hrs/week) for hands-on analyzing assembling, testing, and validating physical systems.
- Weekly lab and homework assignments.
- Resources such as videos, notes, and code files via D2L.
- Self-Assessment resources on D2L, including lecture questions/answers, and unit quizzes/solutions, to assess your progress and understanding.
- A final exam to assess the understanding of the material covered in class.

Textbooks

Getting started with MATLAB (https://www.mathworks.com/help/matlab/getting-started-with-matlab.html). Available as a PDF.

Getting started with MATLAB Simulink (https://www.mathworks.com/help/simulink/index.html). Available as a PDF.

Grading

The course grade is apportioned as follows:

- Homework 25%
- Lab assignments and reports 40%
- Final Exam 30%
- Participation 5%

Homework: Homework (PDF version; no hard copies will be provided in class) will be available on D2L. Complete the homework and submit it before the next class meeting. The template for lab reports is available on D2L.

Labs Assignments: Lab exercises (PDF version, no hard copies will be provided in class) will be available on D2L. You will need to complete lab assignments, prepare a lab report based on material covered, and submit (via D2L) the weekly assignment before the next class meeting. The template for lab reports is available on D2L.

Final Exam: Conducted as a virtual exam over ZOOM. More information about the final exam will be posted on D2L.

Participation: Your participation in the quizzes, labs, and the final project will be noted and graded out of 5% assigned for the final grade.

The grading rubric for normalized marks:

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

* Incomplete: An incomplete grade is given only for an exceptional reason such as a death in the family, a severe illness, etc. Any such reason must be documented. Any incomplete request must be made at least two weeks before the final and approved by the Dean of CDM. Any consequences resulting from a poor grade for the course will not be considered valid reasons for such a request.

To do well in this course: To do well in this course, you should come to class regularly, participate in the discussion and lab activities, read the assigned readings each week as indicated in the homework assignments, and talk to the instructor promptly if you have any problems.

Policies

Deadlines for adds drops, and withdraws

See the deadlines in https://www.depaul.edu/university-catalog/academic-handbooks/undergraduate/university-information/Pages/academic-calendar.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.

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. The evaluations are anonymous; the instructor and administration do not track who entered what responses. Students complete the evaluation online in CampusConnect.

Academic Integrity and Plagiarism

This course will be subject to the university's academic integrity policy; the following is an excerpt from the policy. More information is available at http://academicintegrity.depaul.edu/.

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

Students with Disabilities

Students who feel they may need an accommodation based on the impact of a disability should contact me in private as early as possible in the quarter (preferably within the first week of class), to discuss their specific needs, and make sure that you have contacted the Center for Students with Disabilities (CSD). All discussions will remain confidential.

Syllabus

1. Introduction
2. Digital logic
    a. Digital representations
    b. Combinatorial logic
    c. Boolean algebra
3. Signals and systems
4. Data acquisition
    a. Signal conditioning
    b. Quantizing theory
    c. Analog to digital conversion
    d. Digital to analog conversion
5. Measurement fundamentals
6. Sensors
7. Actuators