ECE 720

Electronic System Level & Physical Design

Syllabus

Electronic System Level & Physical Design

ECE 720, sections 301 & 601
Fall 2024
8:30-9:45am Mon, Wed in 1230 EB2
Department of Electrical and Computer Engineering
North Carolina State University
https://moodle-courses2425.wolfware.ncsu.edu/course/view.php?id=3490

Instructor

Professor W. Rhett Davis, 442 MRC
919-515-5857 (wdavis@ncsu.edu)
Office hours: Mon, Wed 10:00-11:00am
Zoom meeting ID: 959 2585 3044   Passcode: 098284
Zoom link: https://ncsu.zoom.us/j/95925853044?pwd=VGdES0VFL3Zudjc2ZHh6ZktaMWxWdz09

Teaching Assistant

TBA

Prerequisites

It is expected that students will have passed ECE 564 ASIC design (or equivalent) and have a basic understanding of register-transfer-level design and synthesis with Verilog. It is also expected that students have an understanding of object-oriented programming with C++, though no formal programming prerequisite is required.

Course Objectives

By the end of this course, you should be able to do the following:

- Capture digital designs at the Transaction-Level and Electronic-System-Level of abstraction using SystemC
- Determine through simulation the performance of a system that includes embedded micro-processors, Dynamic Random Access Memory, Buses, and Direct Memory Access Controllers.
- Identify whether or not a SystemC description successfully models the behavior of a system
- Use behavioral synthesis tools to determine the hardware implied by a portion of C++ code
- Be able to execute a physical design and verification flow through the following steps:
  - Floorplanning
  - Placement
  - Clock-Tree Synthesis
  - Repeater Insertion
  - Routing
  - Static Timing Analysis
  - Power Analysis
  - Signal Integrity Analysis
  - Power Grid Analysis
- Write scripts and build-systems to analyze the output of ESL simulations and automate physical design tasks, using a combination of Python, Tcl, and Make
- Use version-control systems to manage the design of a complex system

Textbook

There is no textbook for the course. Reading materials will be posted on the Resources page of the course web-site. Lecture notes will be be posted to the Schedule and Modules sections of the course web-site, and relevant readings will be highlighted in the lecture notes with each topic.

Course Requirements

Homework: Homework assignments will be issued throughout the semester (approximately one per week) and will be posted on the Homework section of the course website. Source files for assignments will be uploaded to private GitHub repositories for each student (see "Online Resources" below). Students will submit assignments by committing new and modified files to the GitHub repository. These assignments must represent your own work. Giving or receiving assistance on assignments is allowed, but you may not share any paper and/or electronic material (source code, data files, reports, charts, photos, screen-shots, etc.). Offering or receiving these materials is not allowed, and there will be no tolerance for assignments that show signs of sharing these materials. If unusual similarities are noted, an academic integrity violation report will be filed.
(see https://studentconduct.dasa.ncsu.edu/faculty/confronting-academic-misconduct/)

Late Homework: Each will be due at 11:55pm on the due date posted on the course web-site. The submission time & date will be determined by the time-stamp of the latest commit in the assignment directory. Homework turned in late will be assessed a penalty of 5% per day.

Examinations: There will be no examinations for this course.

Project: This course includes a significant design project to demonstrate proficiency in ESL design and physical design. Details will be posted on the Project section of the course website.

Online Resources

- **Message Forums** – available through the "Forums" link on the main course web-page. Different forums will be created for specific topics, but students may always post to the "General" forum. The instructor will answer questions posted to these forums as well as with e-mail, but preferential treatment will be given to forum posts. Students are encouraged to answer questions as well. It is suggested that postings regarding tool-errors refer to a specific log file and run-directory in this workspace.
- **Git Repositories** – Code for Homework Assignments and Projects will be submitted using private Git repositories for each student.
    - Repository URL: https://github.ncsu.edu/engr-ece-720/unityid.git
    - If you are unable to clone your repository, then your NCSU GitHub account may not be active. Please log in to https://github.ncsu.edu using your Unity ID and password to activate your account. Then send an e-mail to wdavis@ncsu.edu with the subject line "GitHub Account Active" from your Unity E-mail account. I will add you as a collaborator to your repository and respond with a message to let you know that you have access.
- **Course Workspace** – 1 GB for each student has been allocated, accessible through the path /mnt/coe/workspace/ece/ece720-fall24/[UnityID]. It is recommended that you use this space for completing all assignments, because it allows the instructor easy access to your files to help with debugging. Otherwise, this space can be used however you like, but it will disappear at the end of the semester, and so archiving your storage in this space during exam week is highly recommended.
- **CAD Tutorials** – Tutorials will be posted under the resources section of the course web-page. Students will be expected to work through these tutorials as part of the homework assignments.
- **Grading and Feedback** – Provided for each assignment in the feedback directories of your Git repositories
- **Anonymous Feedback –** A link for providing anonymous feedback is provided near the top of the course web-page.

Grading Policy

Homework: Approximately one assignment per week (40% total). Each assignment will have equal weight.

Projects: Two projects (30% each), the first project focusing on physical design, and the second project focusing on ESL design.

Grading Scale: All assignments will be graded on a 100-point scale. The average of these assignments (using the weights above) will be used to compute your final score. The following scale will then be used to assign your final grade:

100-97	A+	97-93	A	93-90	A-
90-87	B+	87-83	B	83-80	B-
80-77	C+	77-73	C	73-70	C-
70-60	D				
<60	F				

Gray Areas Between Guaranteed Letter Grades: There will be a gray area of several points below the specified numerical cutoff grades. Two people getting the same weighted average (say, 89) might therefore get different course grades (A- and B+). If you are in one of those gray areas, whether you get the higher or lower grade depends on whether your performance on homework has been improving (it goes up) or declining (it goes down) and whether or not your attendance in class and office hours has been frequent (up) or infrequent (down).

Audit Requirements: Students auditing this course are expected to complete the homework assignments with at least a C- average (above 70). Module quizzes and Projects may be omitted.

Academic Integrity

All assignments must represent individual effort (i.e. your own work). Giving or receiving assistance on assignments is allowed, but you may not share any paper and/or electronic material (source code, data files, reports, charts, photos, screen-shots, etc.). Offering or receiving these materials is not allowed, and there will be no tolerance for assignments that show signs of sharing these materials. If unusual similarities are noted, an academic integrity violation report (https://studentconduct.dasa.ncsu.edu/faculty/confronting-academic-misconduct/) will be filed, which may lead to suspension. See the Resources for Students at the NCSU Office of Student Conduct (https://studentconduct.dasa.ncsu.edu/students/) for details.

Supporting Fellow Students in Distress

Academic life is often more stressful that we would like. Everyone is encouraged to take care of themselves and their peers. If you need additional support, there are many resources on campus to help you:

- Counseling Center (https://counseling.dasa.ncsu.edu/)
- Health Center (https://healthypack.dasa.ncsu.edu/)
- If the personal behavior of a classmate concerns or worries you, either for the classmate's well-being or yours, we encourage you to report this behavior to the NC State CARES team: (https://cm.maxient.com/reportingform.php?NCStateUniv&layout_id=2) Although you can report anonymously, it is preferred that you share your contact information so they can follow-up with you personally.
- If you or someone you know are experiencing food, housing or financial insecurity, please see the Pack Essentials Program (https://dasa.ncsu.edu/pack-essentials/).

Accomodations for Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students at the Student Health Services Building, 2815 Cates Avenue, Suite 2221, 919-515-7653. See http://dso.dasa.ncsu.edu for details.

Changes to Syllabus

Any additions or modifications will be posted to the web-page and announced during lecture.