ECE 485/585 Microprocessor System Design

Winter 2019 - 4 Credits
Mon, Wed, 5:00PM – 6:50PM
Location: Room 310, Willow Creek Center

The Willow Creek Center is located at 241 SW Edgeway Drive in Hillsboro. The center is located adjacent to the Willow Creek/185th MAX Station. Allow at least 50 minutes of travel time if taking the MAX from the PSU Campus

Class Information

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<tr>
<th>Class</th>
<th>Mon/We 5:00PM – 6:50PM</th>
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<tbody>
<tr>
<td>Quarter</td>
<td>Winter 2019</td>
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<tr>
<td>Location</td>
<td>(OFFCAMPUS) WCC 310</td>
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<tr>
<td>Holidays</td>
<td>Monday, Jan 21 (MLK Day)</td>
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<td>Credits</td>
<td>4</td>
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<td>Track(s)</td>
<td>Computer Architecture (core), Embedded Systems (core), Digital IC Design (depth/breadth), <a href="http://www.pdx.edu/ece/graduate-tracks">http://www.pdx.edu/ece/graduate-tracks</a></td>
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Prerequisites

ECE 372 – Microprocessor Interfacing and Embedded Systems. Some of the material may overlap with other ECE courses

Knowledge of an HDL such as Verilog or VHDL would be helpful but is not required.

Contact Information

<table>
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<tr>
<th>Instructor</th>
<th>Zeshan Chishti</th>
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<tbody>
<tr>
<td>E-mail</td>
<td><a href="mailto:zeshan@pdx.edu">zeshan@pdx.edu</a></td>
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<tr>
<th>T/A</th>
<th>Niranjan Anbarasu</th>
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<tr>
<td>E-mail</td>
<td><a href="mailto:anbarasu@pdx.edu">anbarasu@pdx.edu</a></td>
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<tr>
<th>Office hours</th>
<th>Zeshan: Before/after class or by appointment</th>
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<td>Niranjan: TBD</td>
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| Course website  | [https://ece.pdx.edu/~zeshan/ece585.htm](https://ece.pdx.edu/~zeshan/ece585.htm) |

Course Description

Advanced hardware and software design of desktop type microcomputer systems. Topics include large project design management and documentation; DRAM system design, cache organization, connections, and coherency; the memory hierarchy and virtual memory; I/O buses such as AGP, PCI-X, and Infiniband; multithreaded operating system considerations; JTAG(IEEE1149.1) and Design For Test; high frequency signal integrity; and power supply considerations. Team-based, independent design projects are a substantial part of the homework for this class. Also offered for undergraduate-level credit as ECE 485 and may be taken only once for credit.

Who Should Take This Class?

You should take this course if:

- You want to learn about caches, virtual memory, and memory systems
- You want to learn about standard PC-related buses like PCI and USB
- You are interested in computer architecture and plan to complete further courses in computer architecture
- You are interested in computer hardware systems
You should not take this course if:
- You look for an easy class.
- You do not like to model computer systems
- You do not like to read lots of documentation
- You do not want to be part of a team
- You are unable and/or unwilling to attend this class regularly.

Reference Text(s)
- Palnitkar, Samir, *Verilog HDL, 2nd Edition*, Prentice Hall, 2003, ISBN 0-13-259970-8. This is the same textbook used for ECE 351 and should be available at the PSU bookstore. We will be referencing this book but there will be no required reading or assignments from the book
- Patterson, David and Hennessey, John and Patterson, David. *Computer Architecture, Fifth Edition: A Quantitative Approach* (The Morgan Kaufmann Series in Computer Architecture and Design); Morgan Kaufman, 2011, ISBN-13: 978-0123838728. We will be referencing this book but there will be no required reading(s) from the book
- Patterson, David and Hennessey, John, *Computer Organization and Design – Fifth Edition: The Hardware/Software Interface*; Morgan Kaufman, 2013, ISBN-13: 978-0124077263. We will be referencing this book but there will be no required reading(s) from the book

Required Hardware and Software
There is no required hardware or software for this course. Students are expected to complete a major design project using Verilog, System Verilog or C/C++. There are several commercial grade tool chains that can be downloaded to your personal computer and used for no charge and there are suitable tools available in the ECE labs in FAB.

Course Outcomes and Learning Goals
- Understand and be able to design microcomputer-based systems
- Understand and be able to design static, dynamic, and non-volatile memory systems
- Understand and be able to model multilevel cache and virtual memory systems
- Understand the architecture, advantages and disadvantages of common PC buses such as PCI and USB
- Gain experience working as a member of a project team implementing a complex modelling project
- Gain experience making technical presentations

Course Organization
This course will meet for approximately 4 hours a week. Through a mix of lectures, homework, exams and a final project a motivated student will be equipped with the tools and knowledge to design microcomputer-based systems. Focus will be placed on memory systems, caches, virtual memory and standard microcomputer buses such as PCI and USB

Students will complete a number of homework assignments and two exams. During the last few weeks of the course, students will work as part of a team completing a sizeable system modeling exercise. Each team will make a technical presentation on their project during the last week of the term.

Students taking the course as ECE 585 will complete an additional assignment that involves researching a topic and summarizing their findings in a technical brief.

Lecture Recordings
It is our intent to record all of the lectures. We will strive to post a link to the recording on the course web site within 24 hours of the lecture. There are, however, two things to note:
• This is not a perfect system, meaning we cannot guarantee the quality of each and every lecture. There have been cases in the past where a lecture cannot be posted at all. This is our not-so-subtle way of saying that skipping the live lectures figuring you can watch them later is not a good strategy for successfully completing this course. You are responsible for all of the lecture material whether or not the lecture video is posted.
• There may be cases (travel, illness, unavoidable situation) where we will record and post a link to the lecture without doing it live. On those (hopefully) rare occasions, the class meeting for that night will be canceled and you will be expected to view the lecture and complete the assigned work on your own. Unless it is an unplanned emergency we will notify you of the situation via an announcement on the course website at least 24 hours in advance of when the lecture was originally scheduled for.

Class Participation
• You are encouraged to attend every class meeting in person. You will not get much out of this course if you are rarely in the classroom.
• You are expected to be in-class for all exams and for your final project presentation. Please let us know ahead of time if you know you will not be able to one of these required class meetings so that we can work out a way for you to complete the assignment.

Homework
Homework is due by 7:00PM on the dates indicated on the course website. The homework assignments will be posted to the course website in .pdf format. All the homework assignments can be submitted in hardcopy (in class) or electronic form (via email to the course instructor).

We will strive to grade and return the homework within two weeks after the assignment is due. Please check your graded assignment against the homework solutions. Grading mistakes do happen, but it is your responsibility to bring the matter to our attention immediately after discovering it. Do not wait until the end of the quarter.

Besides contributing substantially to your grade, homework has more far-reaching benefits. It encourages you to keep current with the readings and lectures, tests your comprehension of the material, explores some topics in more depth, and generally prepares you for exam questions.

Final Project
This course involves a substantial final project. You will form a team with other students. More details will be available on the class web site as we get closer to assigning the project. The final projects will be presented to the class during the last week of the term.

Paper Summary
If you are a student taking this course as ECE 585 then you are required to complete an additional assignment: You are to choose a topic, then identify three good papers in that field, read them, and summarize each. Each summary should be approximately one page. You will turn in copies of your sources along with your summaries before the final week of class.

The purpose of this assignment is two-fold: to give you an opportunity to explore a relevant and timely topic in some depth, and to acquaint you with a variety of useful sources: textbooks, journal articles, the trade press, and web sites.

Grading and Assignments
The course grade will be based homework, exams, and the final project. A portion of the ECE 585 grade will also be based on your paper summary.
Homeworks: 20%
Midterm exam: 20%
Final exam: 30%
Final project: 30%
Paper Summary: N/A

**Grading Scale**

Portland State University utilizes a grading system that recognizes A=excellent, B=good, C=satisfactory, D=inferior and F=failure. Points to letter grade conversion will be close to what’s shown:

<table>
<thead>
<tr>
<th>Points</th>
<th>Letter grade</th>
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<tbody>
<tr>
<td>≥ 94</td>
<td>A</td>
</tr>
<tr>
<td>90 – 93</td>
<td>A-</td>
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<tr>
<td>87 – 89</td>
<td>B+</td>
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<tr>
<td>84 – 86</td>
<td>B</td>
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<tr>
<td>80 – 83</td>
<td>B-</td>
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<tr>
<td>77 – 79</td>
<td>C+</td>
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<tr>
<td>74 – 76</td>
<td>C</td>
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<tr>
<td>70 – 73</td>
<td>C-</td>
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<tr>
<td>67 – 69</td>
<td>D+</td>
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<tr>
<td>64 – 67</td>
<td>D</td>
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<tr>
<td>60 – 63</td>
<td>D-</td>
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<tr>
<td>&lt; 60</td>
<td>F</td>
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**Letters of Recommendation**

I am happy to write letters of recommendation for students who get A's in this class. I can write a strong letter if you show me you care, stand out in a positive way, show impeccable behavior, are a role model for others, and show leadership skills. Please give me enough advanced notice and provide me with your resume and any other relevant information. I cannot usually accommodate last-minute requests so allow at least two weeks.

**Disability Resources**

If you have a disability and are in need of academic accommodations, please notify me immediately (office hours, email or by phone) to arrange needed support. I will make every effort to accommodate your needs. For more information about the Disability Resource Center, see [https://www.pdx.edu/drc/](https://www.pdx.edu/drc/).

**Center for Student Health & Counseling (SHAC)**

Main SHAC website: [https://www.pdx.edu/shac/](https://www.pdx.edu/shac/)
Suicide prevention: [https://www.pdx.edu/shac/suicide-prevention](https://www.pdx.edu/shac/suicide-prevention)

**Student Conduct and Plagiarism:**

Students are expected to handle themselves in a professional manner, respecting property and treating fellow students and the instructors with respect. If you use any of the equipment in the lab please take care of it and

**IMPORTANT NOTE:** In fairness to everyone, we will not accept late assignments or reschedule exams. If you have an emergency, please see me as soon as possible. This helps to ensure everyone has the same amount of time to complete assignments and prepare for exams and allows me to post solutions to the course web site.
report any problems to the instructor or TA. You are welcome to collaborate with your fellow students, but all of the work you submit must be your own. Plagiarism of any type will not be tolerated and the consequences will be severe. The PSU code of conduct and information about plagiarism can be found at the following links:

Code of Conduct:  
http://www.pdx.edu/dos/codeofconduct

Plagiarism:  
Work resulting from plagiarism or cheating will receive no credit on that entire assignment or exam. If work is copied from another member of the class (either team or individual) with or without permission, the person or team doing the copying and the person or team providing the work will both receive no credit for assignment without regard to who is at fault.

Practically speaking, as soon as you decide to submit work that is not your own you are destroying not only your chance of earning an A in the course, but also that of your partner(s) and the person(s) who you copied from.

It is ECE department policy that any cases of plagiarism or cheating are reported to PSU administration for further action. You really do not want to go there…and neither do I.

Group Projects:  
Group submissions will be treated as a single entity. It is each team member’s responsibility to review the work of his/her colleagues and ensure the quality of the final submission. You may be asked to submit a confidential peer review for the members of your final project team. Outcomes from the peer reviews may be factored into the grade of the individual team members.