ECE 443 / 543 - Computer Architecture

# FALL Spring Syllabus

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Lectures: TR 11:00 am-12:15pm (Kaufman Hall 225)

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# Course Description:

An introduction to computer architectures; analysis and design of computer subsystems including central processing units, memories and input/output subsystems; important concepts include datapaths, computer arithmetic, instruction cycles, pipelining, virtual and cache memories, direct memory access and controller design.

# Prerequisites:

ECE 341, 346

# Corequisites:

ECE 304, 484W

# Textbook Required:

***Computer Organization and Design: The Hardware/Software Interface****, David A. Patterson and John L. Hennessy, Fifth Edition, 2014, Morgan Kaufmann, ISBN: 978-0-12-407726-3.*

***The Designer’s Guide to VHDL****, Peter Ashenden, Third Edition, 2008, Morgan Kaufmann, ISBN: 978-0-12-088785-9 (For Laboratory Assignment).*

# Software required:

Aldec Active HDL for VHDL projects. Aldec Active HDL has been installed in Kaufman 229. Students will primarily use those computers in Kaufman 229 to finish project assignments

I will use ODU Blackboard Learning System to distribute teaching materials, make announcement, and collect student submissions. Students are required to use their ODU email accounts to access Blackboard for this course.

# Course Learning Outcomes:

Upon completion of this course, students should

1. Have an extensive knowledge on design of digital computer architecture.
2. Be able to design of arithmetic/logic units, control units, memory subsystems, and input/output units.
3. Be able to design instructions with different addressing modes.
4. Be able to understand register-transfer-level (RTL) design of control and data path, and use software tools such as Aldec Active HDL to simulate hardware designs captured using hardware description language.
5. Be able to analyze the computer performance such as CPU execution time and average memory access time.
6. Be able to understand the fundamental concepts and techniques in computer architecture, including instruction set architecture, pipelining, memory hierarchy and exploitation of instruction-level parallelism.
7. Be able to work in teams to accomplish a project for design and implementation of a pipeline microprocessor and an application system.
8. Be able to write technical reports on high level architecture design and detailed digital system design.

# Tentative Course Schedule:

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| --- | --- | --- |
| **Topics** | **Chapters** | **Weeks** |
| Topic 1: Introduction and Language of the Computer, and its Performance | 1 and 2 | 1 - 2 |
| Topic 2: The Processor | 4 | 3 - 4 |
| **The First Midterm Exam (one review session prior to the first exam)** | | |
| Topic 3: The Processor | 4 | 6 - 8 |
| **The Second Midterm Exam (one review session prior to the second exam)** | | |
| Topic 3. Arithmetic for Computers | 3 | 10 |
| Topic 4. Memory Hierarchy | 5 | 11 - 12 |
| **The Third Midterm Exam (one review session prior to the third exam)** | | |
| Topic 4. Memory Hierarchy | 5 | 13 - 14 |
| **Final Exam (review sessions prior to the final exam)** | | |

To be noted:

1. **This is just a tentative schedule. The real schedule will depend on the flow of the class.**
2. **The exact date/time for each exam will be announced in advance.**
3. **The exact date/time for each quiz may or may not be announced in advance.**

# ABET Assessment Objectives:

Ability to identify, formulate, and solve engineering problems **(Outcome 5)**

Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice **(Outcome 11)**

# Course Grading:

The grading will be based on four written exams (three midterms, one final), several homework problem sets, quizzes and VHDL projects. The final grade will be determined by weighing each component as follows:

* Final Exam: 22%
* Midterm Exam: 36% (each midterm exam is equally weighted)
* Homework Assignments: 18% (each homework assignment is equally weighted)
* Quiz: 10% (each quiz is equally weighted)
* VHDL Project: 14% (each project is equally weighted)

*Grading Scale:*

|  |  |
| --- | --- |
| For ECE 543 students:   * A [93.5, 100] * A- [90.0, 93.4] * B+ [86.7, 89.9] * B [83.5, 86.6] * B- [80.0, 83.4] * C+ [76.7, 79.9] * C [73.5, 76.6] * C- [70.0, 73.4] * F [0.0, 69.9] | For ECE 443 students:   * A [93.5, 100] * A- [90.0, 93.4] * B+ [86.7, 89.9] * B [83.5, 86.6] * B- [80.0, 83.4] * C+ [76.7, 79.9] * C [73.5, 76.6] * C- [70.0, 73.4] * D+ [66.7, 69.9] * D [63.5, 66.6] * D- [60.0, 63.4] * F [0.0, 59.9] |

# Attendance:

As per university and departmental policy, students are expected to attend classes and missing 20% of class (unexcused) will result in automatic F. Students should notify instructors in advance when a class will be missed with legitimate excuse (i.e., health or family emergency). In the event of an emergency that causes a class to be missed, instructors must be notified as soon as possible. Students who must miss a class are responsible for all information and announcements provided during class. Classes are expected to begin on time, and students will respect the time boundaries established by the professor.

# Use of Blackboard:

All materials, including syllabus, assignment, grades, and announcements will be posted on Blackboard**. It is students’ responsibility to check on it*.***

# Make-up Tests and Late Assignments and Projects Submission:

**Late homework assignments and VHDL projects, as well as make-up tests including exam and quiz will not be permitted**. I will give appropriate consideration to documented emergencies (i.e., health and family emergencies) and official duties (i.e., military, civil, and university-related duties), but such arrangements must be made *prior to the due date (except for emergency, but a legitimate document such as a doctoral note to identify the exact date/time needs to be provided later)* in any situations where the conflict is foreseeable.

# Homework Assignments and VHDL Projects:

**The deadline, requirement, and scope of each homework assignment and VHDL project will be specified when it is announced.** While the students are encouraged to discuss the problems amongst each other, each individual should prepare their own answers. ***All work must be shown for any credits to be awarded.*** There will be one final VHDL project. **The deadline, requirement, and scope of the final project will be specified when it is announced.** The announcement of the final VHDL project will take place in between the first and second midterms. This final project will be an individual project for students who enroll in ECE 543 and a two-people project for students who enroll in ECE 443.

Honor Pledge:   
*"I pledge to support the honor system of Old Dominion University. I will refrain from any form of academic dishonesty or deception, such as cheating or plagiarism. I am aware that as a member if the academic community, it is my responsibility to turn in all suspected violators of the honor system. I will report to Honor Council hearings if summoned."*  By attending Old Dominion University you have accepted the responsibility to abide by this code. This is an institutional policy approved by the Board of Visitors. For more information please visit [Honor Council](http://studentservices.odu.edu/hc/)]   
   
*Special Needs:*

Old Dominion University is committed to achieving equal educational opportunity and full participation for persons with disabilities. It is the university's policy that no qualified person be excluded from participation in any university program or activity, be denied the benefits of any university program or activity, or otherwise be subjected to discrimination with regard to any university program or activity. This policy derives from the university's commitment to non-discrimination for all persons in employment, access to facilities, student programs, activities and services.

Students are encouraged to self-disclose disabilities that have been verified by the Office of Educational Accessibility by providing Accommodation Letters to their instructors early in the semester in order to start receiving accommodations. Accommodations will not be made until the Accommodation Letters are provided to instructors each semester.

*Course Disclaimer:*

Every attempt is made to provide a syllabus that is complete and that provides an accurate overview of the courses. However, circumstances and events may make it necessary for the instructor to modify the syllabus during the semester. This may depend, in part, on the progress, needs, and experiences of the students.

*Honor Code:*

ODU Honor Code must be adhered to. This means that homework assignments and design projects are to be the work of an individual student group only. Evidence such as identical results and/or wording of sections of a report, if strong enough, will be reported to the University Hearing Officer in charge of administrating the ODU Honor Code. If the violation is deemed sufficient, a permanent record of this infraction will be placed on the student's official university transcript for the first offense! Subsequent offenses could result in dismissal from the university.

<http://orgs.odu.edu/hc/pages/Monarch_creed.shtml>

As it applies here, the writing of all reports will be as individuals and the writing must be in your own words with references to any material obtained by outside sources.

*Writing Assistance:*

The Writing Center (WC), formerly known as Writing Tutorial Services (WTS), is located in the Learning Commons on the first floor of the Perry Library on the ODU main campus. The WC provides supplemental instruction to help students improve their writing strategies. The WC offers tutoring sessions that assist students in learning to proofread their own work, in getting projects started, and in developing the writing process for a paper.   
  
The WC offers 45-minute appointments with graduate student tutors who work with individual students or with groups. Most tutoring sessions are by appointment; walk-in appointments are provided when tutors are not in a scheduled session. For distance students, we use Adobe Connect for online appointments. Students have the option of making standing appointments with tutors once per week for up to four weeks at a time.   
  
In addition to tutoring services for undergraduate and graduate students, the WC will visit classrooms to provide writing lessons and group tutorials. The WC will also assist instructors with ways to incorporate writing in their classes, and throughout the semester, the WC will conduct workshops on Thursdays at 2:00.  
  
We have eight computers in our spaces where students are welcome to write papers and receive help from tutors, as well. Please call the WC at 757.683.4013 or stop by in person for an appointment.