

Course Syllabus



Course Information

Course Information

Course Number: CSCE 350

Course Title: Computer Organization and Design

Section: 500, 501, 502, 503

Time: MWF 10:20AM to 11:10AM

Location: ZACH 310

Lab: Tuesday and Thursday 08:25AM - 09:15AM, 09:35AM - 10:25AM, 11:35AM - 12:25PM and 12:45PM - 01:35PM

Location: ZACH 592

Credit Hours: 4

Instructor Details

Instructor: Abdullah Muzahid

Office: Peterson 206

Phone: 979-458-1059

E-Mail: abdullah.muzahid@tamu.edu

Office Hours: MW 9.00 AM to 10 AM online via zoom

<https://tamu.zoom.us/j/96231447885?pwd=K2hKY251SWgzU2crTGtoc2gyN0JIUT09>

Meeting ID: 962 3144 7885

Passcode: 362173

One tap mobile

+13462487799,,96231447885# US (Houston)

TA Details

Name: **Vahid Janfaza**

Email: vahidjanfaza@tamu.edu (<mailto:vahidjanfaza@tamu.edu>)

Course Description

Computer architecture and design; use of register transfer languages and simulation tools to describe and simulate computer operation; central processing unit organization, microprogramming, input/output and memory system architectures. Cross-listed with CSCE 350.

Course Prerequisites

ECEN 248 - Introduction to Digital Systems

Required Book

- David Patterson and John Hennessy, "Computer Organization and Design: The hardware/software interface", ARM EDITION, 2016 or newer. Electronic versions are OK.
(note: it must be the "ARM" edition, no other edition is usable for this class)

Course Learning Outcomes

The goal of this course is to provide the student with a working knowledge of different methods for logic representation, manipulation, and optimization, for both combinational and sequential logic. At the end of the course the student should be able to view the design of digital systems from a new perspective and have an understanding of several fundamental concepts that can be applied to a wide variety of digital design problems. List one or more learning outcomes for the course.

Individual Course Objectives:

At the end of this course, students should:

- Understand the organization of a computer system including the CPU datapath, CPU control, and memory systems
- Understand the impact of semiconductor technology on computer design and architecture.
- Understand the basics and principles of instruction set design.
- Be familiar with programming using an assembly level language.
- Understand the impact of instruction sets on hardware design.
- Be familiar with designing datapaths for a processor.
- Understand the implications of branch instructions on program flow and hardware design.
- Understand the performance implications of various factors such as clock speed, average clock cycles per instruction and number of instructions.

- Understand the role of compilers and high-level languages in programming.
- Be familiar with designing control circuitry for a basic processor.
- Understand the differences in single-cycle/multicycle design of processors.
- Be familiar with processor pipelining.
- Understand the implications of pipelining on memory design, instruction set design, compiling, performance etc.
- Understand the implications of branch instructions on pipelining.
- Understand basics of memory technology, registers, SRAM, DRAM.
- Understand the performance issue of various memory technologies.
- Be familiar with the notion of locality.
- Understand the memory architectures including cache architectures.
- Be familiar with various cache architectures: direct-mapped, set-associative, wide/narrow block size etc.
- Understand the concepts of virtual memory.
- Be familiar with the need for address translation.
- Understand the impact of address translation on cache/memory accesses.
- Be familiar with hardware designs of various cache architectures.
- Understand the basics of Input/Output.
- Understand the principles of instruction-level parallelism (ILP) and processor microarchitectures which exploit it.
- Understand the principles of thread-level parallelisms and processor microarchitecture which exploit it.
- Understand register-transfer level (RTL) system concepts and description methods, including a hardware description language (VERILOG)

Grading Policy

Breakdown:

Exams (2 Exams)	40%
Labs	35%
Quizzes	20%
Attendance	5%

Grading Scale:

A: 90-100%

B: 80-89%

C: 70-79%

D: 60-69%

F: 0-59%

Note: in the event that the average overall grade of all students lies below a 79% there will be a curve on the overall grade. I will not curve the individual exams and assignments.

Attendance:

Students are expected to attend and be active discussion participants during the lectures (answering questions posed, asking questions, commenting etc.). Students who attends less than 50% lectures will receive a 0 for this part of their grade.

Exams:

There will be two exams. The second exam will be comprehensive, but with an emphasis on the material covered since the first exam.

Tentative Test schedule:

Exam 1 – **March 04, 2022**

Exam 2 – **May-09-2022**

Assignments/Quizzes:

Rather than traditional homework, this course will rely upon a series of on-line quiz assessments. The goal of these quizzes will be to test your knowledge of the lecture material and pinpoint which lectures you should go back and review on-line. There will be one quiz for each lecture, this quiz must be completed prior to the next lecture.

Students may retake the quiz as many times as desired between its release and the next lecture. **-If the quiz is submitted in the same day as the due time, it will be graded with full credit. If it is delayed by few days (up to a week), you will get 50% grade. Otherwise, you will get 0.**

The TAMU Canvas system will be used for all quiz submissions.

Labs:

The course will have nine prelabs and nine labs (tentative). Prelabs are expected to be completed **before** attending the associated lab session. Late prelabs will have 50% of the points deducted for being one working day late, more than 2 days late will not be accepted.

Generally, post-labs and demos must be completed the week following the lab's introduction (the exception being a couple labs that take two weeks). Late post-labs will have 20% of the points deducted for being late up to 1-week. If a post-lab and/or demo is late for more than a week then, a grade of 0 will be assigned.

Lectures:

Lectures will be in person in the classroom. All students are expected to be active participants during lecture.

Course Topics/Schedule:

Hours: Topic

3 hours: Overview of Computer Architecture

3 hours: Instruction Set Architectures (ISA), Representing instructions on the computer, Arithmetical and logical instructions, Memory access instructions

3 hours: Instruction Set Architectures (ISA), Control flow instructions, Function calls instructions, Input-output instructions SPIM- instruction set simulator

3 hours: Computer Arithmetic, Signed and unsigned numbers, Addition and subtraction, Multiplication, Division, Floating point operations

3 hours: Translating and starting a program, Compilers, compiler optimization, Object code generation, assemblers, linking, Run-time execution environment

3 hours: Performance evaluation, CPU performance and its factors, performance metrics, performance factors, comparing performance, SPEC benchmarks

2 hours: Hardware Description Languages, Verilog hardware description language, Design-Simulation Process, Structural Designs in Verilog Behavioral HDL Description of Systems

3 hours: Datapath and Control, and ALU design

3 hours: Single-cycle implementation

3 hours: Microprogramming, catchup

3 hours: Pipelining, Pipelined datapath

4 hours: Pipelined control, Pipeline hazards: structural, control, data hazard detection and resolution, exception handling

4 hours: Memory Hierarchy, Overview of SRAM and DRAM design, Basic of caches, Framework for memory hierarchy, Measuring memory performance

Late Work Policy

See above for late policy on Quizzes, Prelabs and Labs. Work submitted by a student as makeup work for an excused absence is not considered late work and is exempted from the late work policy.

University Policies

This section outlines the university level policies. The TAMU Faculty Senate established the wording of these policies.

Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments.

Please refer to **Student Rule 7** (<https://student-rules.tamu.edu/rule07/>) in its entirety for information about excused absences, including definitions, and related documentation and timelines.

Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in Student Rule 7, or other reason deemed appropriate by the instructor.

Please refer to **Student Rule 7** (<https://student-rules.tamu.edu/rule07/>) in its entirety for information about makeup work, including definitions, and related documentation and timelines.

Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor" (**Student Rule 7, Section 7.4.1** (<https://student-rules.tamu.edu/rule07/>)).

"The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence" (**Student Rule 7, Section 7.4.2** (<https://student-rules.tamu.edu/rule07/>)).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (**See Student Rule 24** (<https://student-rules.tamu.edu/rule24/>)).

Academic Integrity Statement and Policy

"An Aggie does not lie, cheat or steal, or tolerate those who do."

"Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one's work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case" (**Section 20.1.2.3, Student Rule 20** (<https://aggiehonor.tamu.edu/Rules-and-Procedures/Rules/Honor-System-Rules/>)).

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at aggiehonor.tamu.edu (<https://aggiehonor.tamu.edu/>).

[NOTE: Faculty associated with the main campus in College Station should use this Academic Integrity Statement and Policy. Faculty not on the main campus should use the appropriate language and location at their site.]

Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact Disability Resources in the Student Services Building or at (979) 845-1637 or visit disability.tamu.edu **(<https://disability.tamu.edu/>)**. Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

[NOTE: Faculty associated with the main campus in College Station should use this Americans with Disabilities Act Policy statement. Faculty not on the main campus should use the appropriate language and location at their site.]

Title IX and Statement on Limits to Confidentiality

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking.

With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and must report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions (see [University Rule 08.01.01.M1](https://rules-saps.tamu.edu/PDFs/08.01.01.M1.pdf) **(<https://rules-saps.tamu.edu/PDFs/08.01.01.M1.pdf>)**):

- The incident is reasonably believed to be discrimination or harassment.
- The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention – including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most instances, you will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University's goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need.

Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with **Counseling and Psychological Services** [\(https://caps.tamu.edu/\)](https://caps.tamu.edu/) (CAPS).

Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University's **Title IX webpage** [\(https://titleix.tamu.edu/\)](https://titleix.tamu.edu/).

[NOTE: Faculty associated with the main campus in College Station should use this Title IX and Statement on Limits of Liability. Faculty not on the main campus should use the appropriate language and location at their site.]

Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors that influence a student's academic success and overall wellbeing. Students are encouraged to engage in proper self-care by utilizing the resources and services available from Counseling & Psychological Services (CAPS). Students who need someone to talk to can call the TAMU Helpline (979-845-2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends. 24-hour emergency help is also available through the National Suicide Prevention Hotline

COVID-19 Guidance

Please follow the university guidance for COVID-19. The latest guidance is here

COVID 19 Guidance [\(https://covid.tamu.edu/\)](https://covid.tamu.edu/)
