

Course Information

Course Number: CSCE 312

Course Title: COMPUTER ORGANIZATION

Section: 501-504

Time: TR 05:00 pm - 06:15 pm for Lectures (all sections)

Location: ZACH 350 (face-to-face) and ZOOM (remote) for Lectures

Credit Hours: 4

Lab Details

| SECTION | Lab Time | Lab Venue |
|---------|------------------------|--------------------------|
| 501 | TR 11:30 am - 12:20 pm | ETB 1034 |
| 502 | TR 01:30 pm - 02:20 pm | ZACH 441 |
| 503 | MW 04:15 pm - 05:05 pm | HEB 118 |
| 504 | MW 05:35 pm - 06:25 pm | ARCC 207 |

Instructor Details

Instructor: JYOTIKRISHNA "JD" DASS

E-Mail: dass.jyotikrishna@tamu.edu (HIGHLY recommend to contact on [CANVAS Inbox](#))

Office Hours: Schedule 1:1 ZOOM appointment on CANVAS Inbox. Also willing to spend some time after Lectures (ZACH 350 or on ZOOM)

Web: <http://people.tamu.edu/~jyoti1991/>

Course Description

This is an introductory hands-on course on computer systems from a programmer's perspective comprising elements of simple digital logic design, data representation, processor architecture, programming of processors, computer memory, control flow, input/output, and performance measurements

Course Prerequisites

All the computer science knowledge necessary for completing this course is given in the course lectures, lab projects, and the textbook. Some lab projects will require basic computer programming skills. Some basic background in data structures and algorithms will be helpful.

Special Course Designation

This is a Face to Face course (Sections 501-504) which will also be synchronously streamed remotely via ZOOM from the classroom/labs. Refer to [Section 3.1 Face-to-Face Courses](#)

Course Learning Outcomes

Students upon completion of this course will be able

1. To integrate key notions from Algorithms + Computer Architecture + Operating System + Compilers + Software Engineering
2. To explore various ideas and techniques to answer how a computer works, and how are they designed
3. To actively apply new concepts learned in the class lectures through fascinating hands-on lab projects
4. To incrementally build a modern virtual general-purpose computer system from the ground up via tightly integrated lab projects
5. To gain cross-section views of the computing field from the bare-bone details of switching circuits to the high-level abstraction of object-based software design
6. To simulate digital logic circuits by writing a simple Verilog-like Hardware Description Language and testing on Hardware simulator

Textbook and Resource Materials

Textbook

The Elements of Computing Systems: Building a Modern Computer from First Principles, Noam Nisan, Shimon Schocken, MIT Press, 2005 ([LINK](#))

- Chapters 1-6 for most of our course content are available FREE online [HERE](#)
- The complete eBook is available FREE on [TAMU Libraries](#)

Reference

Digital Design. 2nd Ed, Frank Vahid, Wiley Publication, 2010

- Will be referenced in a limited capacity. Purchasing not required.

Simulator Software

Download and Install from [HERE](#)

- [Nand2Tetris](#) is the official website and MOOC accompanying the Textbook. This course is heavily inspired by this MOOC and our lab projects will use the software suite comprising simulators to run and test the chips designed in the lab projects.

Course Contents

CANVAS

- All course materials (Lecture slides, Lab projects, Practice questions, Quizzes, Exams, any additional materials) will be posted on CANVAS as a common repository.
- Lecture related materials will be organized under *Modules* on CANVAS
- Lab Projects will be organized under *Assignments* on CANVAS
- Lecture slides and Lab projects have been modified with the instructor's own thoughts and inputs as deemed necessary
- Quizzes and Exams will be designed to be taken on CANVAS directly. We might explore the option to upload your answer sheet on CANVAS
- All submissions and grades will be made on CANVAS

Course Communication

- Announcements will be made on CANVAS and students are responsible to keep themselves updated of course developments and progress on CANVAS
- [ZOOM](#) will be used for synchronous streaming during class and lab hours
- Discussion forums for Q&A will be enabled on CANVAS for both Lectures and Labs. Make sure all correspondence is done through these forums for benefit of everyone and to build our community
- Contact the Teaching Staff on CANVAS Inbox and avoid emails

Devices and Technology

- Students **MUST** carry their devices ([BYOD](#)) to both classrooms and labs to engage in class discussions and to perform lab projects
- We **MAY** require students to turn on cameras during class/labs/virtual office hours if required
- The university's new [Bring Your Own Device](#) policy requires that students have access to a webcam
- Those willing to attend this course remotely, please ensure you have a suitable internet plan at your place to attend our lectures, labs, quizzes, exams, etc. Please note it is possible for us to require video streaming if needed

Grading Policy

Letter Grade received for the percentage of total points earned by the end of the course

| % Total | 90-100 | 80-89 | 70-79 | 60-69 | < 60 |
|--------------|--------|-------|-------|-------|------|
| Letter Grade | A | B | C | D | F |

There are **5 graded activities** which need to be carried out **INDIVIDUALLY** (unless mentioned otherwise) based on which you will earn your overall points in this course

1. Lab Projects: 45%

- There will be **6** graded lab projects which are tightly-integrated with the class lectures to help reinforce the learning in lectures and vice-versa
- All these projects will be inter-related to incrementally build a modern virtual general-purpose computer system from the ground up
- Projects P1-P5 comprise **35%** and carry equal weight (**7%**) unless specified otherwise
- Project P6 accounts for **10%**
- Projects P1-P5 will be based on writing Hardware Description Language (HDL) code and in some cases writing (or completing) the test scripts and compare files for various hardware chips in the project.
- Each of these projects (P1-P5) will carry *100 Points* and be accompanied by
 - **Project handout** with project design details,
 - **Chips collateral [60 points]** zip file comprising HDL file (.hdl) to be completed for all chips which will then need to be tested on hardware simulator tool with Test script (.tst file if provided, or write your own), and compared with Compare script (.cmp file if provided or write your own)
 - **Project report [40 Points]** to document your design philosophy, methodology, circuit diagrams, implementation techniques and answer some additional conceptual questions related to project
- Project P6 will be a software programming project and will be hosted as a private [HackerRank](#) contest for our class on the Assembler topic
 - HackerRank platform will also have a Leaderboard to help you track your performance on hidden test cases with respect to others and students will have (may be limited) chances to resubmit to improve and move up the leaderboard.
 - This experience will also help build competitive programming skills and equip you to explore HackerRank and similar platforms in the future to practice and prepare for coding job/internship interviews, etc.

2. Take-Home Quizzes: 10%

- There will be a bunch of short take-home quizzes aligned with the lecture content. These are key opportunities to build and apply fundamental concepts to problem-solving
- Quizzes will be announced during certain class lectures and made available on CANVAS after that lecture.
- Students will then have a fixed deadline (for example, 24 hours) to attempt and submit the quiz directly on CANVAS
- It is possible that *two attempts* within any quiz deadline can be allowed and then *higher* points will automatically be considered
- Quizzes on lecture topics covered until Assembler design (**BASIC**) will have a combined weight of **0.4** whereas, for advanced topics (**ADVANCED**) taught thereafter, the combined weight of their quizzes will be **0.6**
 - For example: Suppose, a student earns **E_b points** on all quizzes in the **BASIC** set worth **T_b points** and earns **E_a points** on all quizzes in the **ADVANCED** set worth **T_a points**, then,

$$\text{Take-Home Quiz points, } Q = \frac{(E_b \times 0.4) + (E_a \times 0.6)}{(T_b \times 0.4) + (T_a \times 0.6)} \times 10$$

3. Midterm Exam: 20%

- The midterm exam will test your understanding of the materials from class lectures, discussions, quizzes, practice questions, and related lab projects
- The exam will be held during regular lecture timings on **Tuesday, September 29th**
- The exam will be **online** on CANVAS with **proctoring** (we will explore other online options too based on how CANVAS quiz experience has been)
- Students are welcome to take the online exam in the classroom and ask queries to the instructor in person. Remember to carry your laptop with you
- For those willing to take the online exam remotely, we will have some live chat option to ask queries to the instructor

4. Final Exam / Project X: 20%

- We will be exploring the option for Final exam or software programming-based Project X based on overall class strengths and students' feedback and experience with the CANVAS quizzes and midterm proctoring
- If we go with the Final Exam (**remote ONLY**), it will comprise topics (lectures and labs) covered post-midterm
- If we go with Project X (which I am more excited about), we will share and discuss the project statements beforehand which students will complete over 3 weeks starting November first week
- Final Exam (if we decide to) will be held REMOTELY (online) on **Friday, December 4, 2:00 pm - 4:30 pm** as per [university final calendar](#). If we decide to go for Project X, the due date for submission will be **Friday, December 4, 4:30 pm**

5. Participation: 5%

- We expect students to attend and participate in lectures and labs regularly. Attendance will be recorded on Zoom or in-class/lab. **Note:** Logging into an online class without active participation is NOT defined as academic attendance. See [Slide 6 HERE](#) for details
- We look forward to rewarding students who help us build an engaging course by initiating discussions in classrooms/labs/ZOOM and on CANVAS, actively participating in CANVAS discussion forums to help peers with their queries, selflessly contributing to the knowledge and learning of peers with insightful comments and discussions (sometimes going beyond the scope of topics covered in class materials), and creating an inclusive community of CSCE 312
- Please be mindful of the [Aggie Honor Code](#) and [Student Conduct Code](#) while posting and answering peer queries. DO NOT share your actual solution or code with peers but it is acceptable to share and discuss general approaches, directions, solving practice questions together, and so on

Late Work Policy

- It is your responsibility to keep up with the class and the lab, even when unexpected events interfere
- Technology issues not limited to lack of or sudden unavailability/breakdown of technological support (device, internet plan, electricity, etc.) are not an excuse for missing any graded activity – make sure your computer is configured correctly and address any technical issues well in advance of deadlines and exam dates
- Late work is defined when submission time for any graded activity, determined by the timestamp recorded on CANVAS, exceeds the announced due date and time for that graded activity
- Late work will be accepted **ONLY** for **Lab Projects (P1-P6)**
 - The number of minutes late the work is turned in (**m**) will be used to compute the late penalty
 - Your points for the graded lab project submitted late will be $\times (0.9998)^m$ to determine your final points for that lab project
 - See how turning in a late lab project affects your points for that project

| Minutes (m) Late | Max Points you can earn |
|------------------|-------------------------|
| 0 | 100 |
| 5 | 99.9 |
| 60 | 98.8 |
| 1440 (24 hours) | 75 |
| 2880 (48 hours) | 56.2 |
| 4320 (72 hours) | 42.1 |

- **Take-Home Quizzes** will have STRICT deadlines and late submissions will be awarded **ZERO Points**. However, since there will be a bunch of quizzes, you must try to be on time and do better in subsequent quizzes.

- 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. (See Student Rule 7 in Makeup Work Policy under University Policies section below)
- **Missed exams (Midterm Exam and Final Exam/Project X)** will only be rescheduled (as makeup) for university excused absences. To be considered for an excused absence the student must notify the instructor in writing (CANVAS inbox/e-mail is acceptable) **prior to the day of absence**. Note that if advanced notice is not feasible, you have 2 business days to provide written notification (CANVAS inbox/ email) to the instructor. This notification must include an explanation of why notice could not be sent. See [student rules 7.1](#). **ZERO POINTS will be assigned for exams due to an unexcused absence.**

Course Schedule

- *Master Plan (Subject to Change)*

| WEEK | LECTURE | | LAB PROJECT |
|------|--|--------------------|---|
| | ID: Topic | Date (Day) | ID Deploy/Due: Date (Day) |
| 1 | L0: Course Overview and Logistics | Aug 20 (R) | P0 Deploy: Aug 21 (F) |
| | L0: Background and Motivation | Pre-Recorded | |
| 2 | L1: Boolean Algebra and Expressions | Aug 25 (T) | P0 Due: Aug 25 (T) P1 Deploy: Aug 26 (W) |
| | L2: Switch and Logic gate Implementation | Aug 27 (R) | |
| 3 | L3: Number System and Conversions | Sept 1 (T) | P2 Deploy: Sept 4 (F) P1 Due: Sept 6 (Su) |
| | L4: Boolean Addition | Sept 3 (R) | |
| 4 | L5: Multi-bit and Multi-input Adders | Sept 8 (T) | |
| | L6: Boolean Subtraction and ALU Design | Sept 10 (R) | |
| 5 | L7: Time and Memory Elements | Sept 15 (T) | P2 Due: Sept 15 (T) P3 Deploy: Sept 16 (W) |
| | L8: Registers and RAMs | Sept 17 (R) | |
| 6 | L9: State Machine Design & Program Counter | Sept 22 (T) | |
| | Midterm Review | Sept 24 (R) | |
| 7 | MIDTERM EXAM | Sept 29 (T) | <i>No labs on Sept 28 (M) & Sept 29 (T)</i> |
| | L10: Machine Language - Introduction | Oct 1 (R) | |

| | | | |
|----|--|-----------------------------------|--|
| 8 | L11: HACK computer machine language | Oct 6 (T) | P3 Due: Oct 6 (T) P4 Deploy: Oct 7 (W) |
| | L12: HACK Assembly Programming - I | Oct 8 (R) | |
| 9 | L13: HACK Assembly Programming - II | Oct 13 (T) | P5 Deploy: Oct 16 (F) P4 Due: Oct 18 (Su) |
| | L14: Computer Architecture - I | Oct 15 (R) | |
| 10 | L15: Computer Architecture - II | Oct 20 (T) | |
| | L16: HACK Assembler Design - I | Oct 22 (R) | |
| 11 | L17: HACK Assembler Design - II | Oct 27 (T) | P5 Due: Oct 27 (T) P6 Deploy: Oct 28 (W) |
| | L18: JACK programming Language/ BUFFER | Oct 29 (R) | |
| 12 | L19: Memory Introduction | Nov 3 (T) | Project X (if decided) Deploy*: Nov 6 (F) |
| | L20: Virtual Memory | Nov 5 (R) | |
| 13 | L21: Cache memory - I | Nov 10 (T) | P6 Due: Nov 15 (Su) |
| | L22: Cache memory - II | Nov 12 (R) | |
| 14 | L23: Pipelining - I | Nov 17 (T) | |
| | L24: Pipelining - II | Nov 19 (R) | |
| 15 | BUFFER | Nov 24 (T) | |
| | | | |
| 16 | FINAL EXAM or *PROJECT X (TBD) | Dec 4 (F) 2:00-4:30 pm | Project X Due: Dec 4 (F) by 4:30 pm |

University Policies

This section outlines the university level policies that must be included in each course syllabus. 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](#) 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](#) 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](#)).

"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](#)).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (See [Student Rule 24](#).)

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](#)).

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at aggiehonor.tamu.edu.

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. 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.

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](#)):

- 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](#) (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](#).

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 (800-273-8255) or at suicidepreventionlifeline.org.

COVID-19 Temporary Amendment to Minimum Syllabus Requirements

The Faculty Senate temporarily added the following statements to the minimum syllabus requirements in Fall 2020 as part of the university's COVID-19 response.

Campus Safety Measures

To promote public safety and protect students, faculty, and staff during the coronavirus pandemic, Texas A&M University has adopted policies and practices for the Fall 2020 academic term to limit virus transmission. Students must observe the following practices while participating in face-to-face courses and course-related activities (office hours, help sessions, transitioning to and between classes, study spaces, academic services, etc.):

- Self-monitoring—Students should follow CDC recommendations for self-monitoring. **Students who have a fever or exhibit symptoms of COVID-19 should participate in class remotely and should not participate in face-to-face instruction.**
- Face Coverings—[Face coverings](#) (cloth face covering, surgical mask, etc.) must be properly worn in all non-private spaces including classrooms, teaching laboratories, common spaces such as lobbies and hallways, public study spaces, libraries, academic resource and support offices, and outdoor spaces where 6 feet of physical distancing is difficult to reliably maintain. Description of face coverings and additional guidance are provided in the [Face Covering policy](#) and [Frequently Asked Questions \(FAQ\)](#) available on the [Provost website](#).
- Physical Distancing—Physical distancing must be maintained between students, instructors, and others in course and course-related activities.
- Classroom Ingress/Egress—Students must follow marked pathways for entering and exiting classrooms and other teaching spaces. Leave classrooms promptly after course activities have concluded. Do not congregate in hallways and maintain 6-foot physical distancing when waiting to enter classrooms and other instructional spaces.
- To attend a face-to-face class, students must wear a face covering (or a face shield if they have an exemption letter). If a student refuses to wear a face covering, the instructor should ask the student to leave and join the class remotely. If the student does not leave the class, the faculty member should report that student to the [Student Conduct office](#) for sanctions. Additionally, the faculty member may choose to teach that day's class remotely for all students.
- For the safety of our campus community, eating and drinking in university teaching classrooms are not allowed. Eating and drinking should be limited to designated dining areas, one's dorm room, or outside while maintaining physical distancing of 6 feet or greater from others. Please hydrate well before class. If someone needs to hydrate for health reasons, they can briefly leave the class, hydrate, and return. Good hand hygiene should be used after touching the face covering.

Personal Illness and Quarantine

Students required to quarantine must participate in courses and course-related activities remotely and **must not attend face-to-face course activities**. Students should notify their instructors of the quarantine

requirement. Students under quarantine are expected to participate in courses and complete graded work unless they have symptoms that are too severe to participate in course activities.

Students experiencing personal injury or illness that is too severe for the student to attend class qualify for an excused absence (See [Student Rule 7, Section 7.2.2.](#)) To receive an excused absence, students must comply with the documentation and notification guidelines outlined in Student Rule 7. While Student Rule 7, Section 7.3.2.1, indicates a medical confirmation note from the student's medical provider is preferred, **for Fall 2020 only, students may use the Explanatory Statement for Absence from Class form in lieu of a medical confirmation. Students must submit the Explanatory Statement for Absence from Class within two business days after the last date of absence.**

Operational Details for Fall 2020 Courses

For additional information, please review the [FAQ](#) on Fall 2020 courses at Texas A&M University.