

# COMP 3410: Computer Organization & Architecture – Fall 2021

## COVID-19 INFORMATION

(Please refer to the following link [covidpolicy.pdf \(memphis.edu\)](#) (GE2040) for the policies on COVID-19 Health and Safety)

### Class Format

- In-person/on-ground.
- If you are experiencing symptoms such as sneezing, coughing, or a higher than normal temperature, please get in touch with your health care provider or the Student Health Center at <https://www.memphis.edu/health/>
- Do not attend class in person if you're showing symptoms of illness. However, I will make every effort to have class materials available online for those who cannot attend in person.
- Please be reminded that the University currently requires that all persons, regardless of vaccination status, wear masks indoors and in places where appropriate social distancing is not possible
- The policy does permit faculty members to take action for non-compliance with mask use. Additionally, if students have concerns about faculty or staff mask use, contact Human Resources at [hr@memphis.edu](mailto:hr@memphis.edu) or 901.678.3573.
- Faculty who are delivering on-campus instruction may remove their face mask to teach, provided they are located within a delineated teaching area that is no less than 6 feet from students.

University's COVID19 website ; [Coronavirus Updates - Coronavirus Updates - The University of Memphis](#)

### Student Resources

Additional resources can be found on the Dean of Students website at <https://www.memphis.edu/deanofstudents/crisis/index.php>

## Contact Information:

**Office:** Dunn Hall 320

**Department Office:** Dunn Hall 375

**Office Phone:** 678-3712

**Department Phone:** 901.678.5465

**Email:** [jyu8@memphis.edu](mailto:jyu8@memphis.edu)

**Class:** DH 351 TR 3:10pm to 5:10pm

The best way to get in touch with me is through email – I will try to respond within 24 hours.

## Office Hours:

Mon, Tues, Thurs 9:30 am – 12:00 pm Dunn Hall 320  
(Just drop by or email me ahead to confirm)

**Teaching Assistant:** *(to be finalized)*

TBD

## Lecture Meeting Times/Locations:

82741 - COMP 3410 – 001 MW 2:20 - 4:20 pm Dunn Hall 233

## Catalog Description:

**COMP 3410** – Basic concepts in assembly language programming, including logic, comparing and branching, interrupts, macros, procedures, arrays, program design, testing, debugging, loading, and linking; combinational, arithmetic and logical circuits ALU; memory circuits, latches, flip-flops, registers; computer structure; fetch-execute cycles, clocks and timing; microprogramming and microarchitecture; data path, timing, sequencing; cache memory organization; RISC architectures.

PREREQUISITE: COMP 2150

## Course Website:

<https://elearn.memphis.edu>

You will find all the course material (lecture slides, handout notes, assignments, codes, grades, etc.) in this site.

## Topics Include:

1. Introduction
  - Computer systems and computer organization;
2. Number systems and arithmetic for Computer;
  - Number conversion, arithmetic overflow handling,
  - Floating points
3. MIPS instruction set architecture and operations;
4. Digital logic and processor design;
  - Logic gates and modular ALU design
  - Combinational and sequential logic and control
5. Performance and pipelining
  - Building a datapath
  - Pipelined datapath and control
  - Handling of data hazards
  - Parallelism via Instruction
6. Memory hierarchy and cache organization
  - Memory technologies
  - Basics of Caches and performance improvement
  - Cache mapping and memory hierarchy

## Course outcome for COMP3410 (Computer Organization and Design)

- (1) Understand the keys components within a computer system and organization.
- (2) Understand number systems and implement binary arithmetic with overflow handling and floating-point numbers.
- (3) Implement assembly language for MIPS processor ISA and operations.
- (4) Implement digital logic and processor data path and control using logic gates, combinational and sequential components
- (5) Analyze instructions, data path, and control complexity for performance assessment
- (6) Analyze the cause of pipelines hazards and implement ways to overcome them.
- (7) Understand memory hierarchy and apply the principle of locality in caches design.

## Required Text:

- zyBook: Computer Organization and Design, 5th Edition by David Patterson and John Hennessy
- Sign in or create an account at [zybooks.com](https://zybooks.com)
- Enter zyBook code  
MEMPHISCOMP3410YuFall2021
- Click Subscribe

## Evaluation:

1. Assignments: 40 %: (zyBook exercises, (MIPS) programming, and written assignments)  
(zBook in-class (10%), MIPS programming / Written Assignments (HWxx..) (30%);
2. Three quizzes: 15% (5% each)
3. One Midterm: 20%
4. Final exam: 25%

**Grading Scale:** Letter grades will be determined as follows:

**A+:** 96% and above; **A:** 90-95%  
**B+:** 87-89%; **B:** 81-86%; **B-:** 79-80%  
**C+:** 77-78%; **C:** 71-76%; **C-:** 69-70%  
**D+:** 67-68%; **D:** 60-66%  
**F:** Below 60%

### **Assignments: (40%)**

The assignments include in-class zyBook exercises, MIPS assembly language programming, and other questions to enforce the concepts and understanding of the material discussed in class. There is no Lab session for this course. Instead, some portions of lecture time (usually during the latter part of the lecture) are allocated to start the assignments. The due date for each assignment is posted in the write-up and is usually one week after the published time. You are responsible for checking the due date of the assignments regularly posted on the eLearn course site. Some of the zyBook exercises consist of in-class and take-home portions. You have to submit the in-class portion to get the overall (in-class + take-home) grade of that assignment. Missing the in-class part will result in a zero for that zyBook exercise assignment

### **Participation/Attendance: (zyBooks exercises):**

You must attend class regularly. The class will keep building on itself and moves briskly, so you need to get a good handle on each concept soon after discussing it. You can accomplish that by completing the assigned zyBook exercises after almost every lecture. You are required to bring your laptop loaded with the necessary zyBooks textbook installed for this course. You will need to submit a time-limited (closed to the end of the lecture) zyBook question to show your presence in class. If you are missing from the class, you will receive no marks for the zyBooks exercise of that lecture. Please be sure you have loaded your laptop with the subscribed zyBook and MIPS simulator (MARS4\_5.jar) for MIPS programming. We have eleven zyBooks exercises altogether. You can select the top nine grades for the overall zyBooks exercises grades.

### **Late/Makeup Policy:**

All assignments are expected to be completed and turned in on schedule. Due dates are usually one week after the posted date for each assignment. Your TA/GA will not accept Late assignments except in extreme circumstances. Likewise, makeup quizzes and exams will be given only under extreme circumstances. If you feel that your circumstances warrant a late work submission or a makeup quiz/exam, get in touch with me as soon as possible to show documented proof of your situation.

### **Plagiarism/Cheating Policy:**

An essential part of learning is getting plenty of practice with it yourself. As such, all assignments (unless specifically indicated otherwise) are expected to be done in individual effort. If I determine that you have copied something directly from a book, the Internet, or some other source, you will receive a failing grade on the assignment and (at my discretion) a failing grade in the course. If I determine that you have copied another student's assignment, this will happen to both you and the person from whom you copied. The first-time offender will receive a warning in the form of face-to-face meeting and an email. For the 2<sup>nd</sup> occurrence, you will be asked to see the department chairperson. The Office of Student Conduct will also receive a copy of this incident for further disciplinary action. Please don't put me in this situation.

### **Getting Help:**

Although I expect you to do your work individually, I encourage you to seek help if you get stuck:

- Talk to me! I'm very willing to sit down and try to provide hints without giving away the solution.
- Contact your lab TA.
- The Computer Science Learning Center (Dunn Hall 208) will be open throughout the semester. Hours will be posted on the door. The hours for this semester should also be posted online soon. You can find them by going to [memphis.edu/cs/](http://memphis.edu/cs/) and click on "Current Students" and then click on "Computer Science

Learning Center.” The lab will be staffed by friendly, knowledgeable computer science students whom you can ask for help.

### Student Disabilities:

If you have a disability that may require assistance or accommodations, or if you have any questions related to any room for testing, note taking, reading, etc., please speak with me as soon as possible. You must contact the Student Disability Services Office (678-2880) to request such accommodations/services officially.

### Course Schedule: (subject to change):

Date	Lecture Material	Text	Test	Assignments
8/23	Introduction, Computer Abstr and technology, course outline	Ch 1		Z1 (1.0 - 1.4)
8/25	Inside the CPU, Semi tech, performance			
8/30	Language for the computer: Instructions/Numbers	Ch 2 (2.1 - 2.8)		Z2 (1.5 -1.8) HW1 - Computer (Exec 1 zyBook) Technology and numbers
9/1	Binary data	Ch 2; Ch 19(Bits)		Z3:(2.1 - 2.8) Z4: (19.1 - 19.7)
9/6	labor day NO Class			
9/8	Logics, MIPS instruction Set and operation		Q1	Z5: (2.9, - 2.13)
9/13	MIPS programming	Notes		HW2 - Arith, C to MIPS
9/15	MIPS programming			
9/20	MIPS programming (Functions / Subroutine)	Ch 3		
9/22	Arithmetics for Computers	3.1 - 3.5		Z6: (3.1 - 3.5)
9/27	Add, Multiply and overflow			HW3 - MIPS programming
9/29	Floating points and divisions ** (TBD)			
10/4	Review MidTerm 1 reviews			
10/6	MidTerm		MT	
10/11	Fall Break (9 - 12) (No Class)			
10/13	The Processors , ALU, logic circuits	Ch 4.1- 4..5		HW4 - ALU, and datapath control
10/18	Sequential logic and controls	Ch 8 (B)		Z7:(8.1 - 8.7)
10/20	MIPS datapath Control	4.3	Q2	
10/25	Single Cycle Datapath	4.4		Z8:(4.1 - 4.5)
10/27	MultipleCycle DataPath/control signal	4.5		HW5: Control and Data harzards,
11/1	Pipeline and Data harzards	4.8		Z9(4.6- 4-9)
11/3	Control Harzards abd exception handling	4.9		
11/8	More on Pipeline and harzards control			
11/10	Memory Hierarchy / Cache Organization	Ch5		HW6 - Memory / cache organization
11/15	Memory/Quiz 3 (TBD)		Q3	Z10(5.1 - 5.2)
11/17	Cache performance			
11/22	Cache Mapping	5.8-5.10		Z11(5.3- 5.4)
11/24	Thanksgiving (24 - 28) (No Class)			
11/29	memory hierarchy (Dependable)	5.5		
12/1	Review for Final Exam/Study day			
12/3	Final Exam (Dec 3 - 9)		Final	

Final Exam: December 7 – 13. Exact details (date, time, location) will be announced when it is available

#### Tentative Quiz and Exam Topics:

- Quiz 1: Computer Organization, Key components, performance, Number conversion, Arithmetic (Ch 1. 19)
- Midterm1: MIPS programming (ch 3)
- Quiz 2: ALU, sequential logic, and controls Ch 4, 8
- Quiz 3: Datapath (single and multiple cycles), Memory Hierarchy Ch 4, 5
- Final Exam: (Comprehensive, some MIPS prog, with focus on Ch 4 – 5 )