ECE 4713/6713 – COMPUTER ARCHITECTURE (FALL 2024)

Instructor: Samee U. Khan | skhan@ece.msstate.edu | Simrall 306

Office Hours: 1 PM-3:30 PM (Tuesdays | Simrall 306 | via Webex) or request via email
Lecture Time: 9:30 AM-10:45 AM (**Simrall 106**) and **Asynchronous**
Distance Section: Asynchronous (recordings will be available on Canvas)

Prerequisite: Grade of C or better in ECE 3724 (Microprocessors)

Textbook: D. Patterson and J. Hennessy, *Computer Organization and Design: The Hardware/Software Interface*, Sixth Edition, Morgan Kaufmann and Elsevier Publishers, 2022, ISBN-13: 978-0128201091.

Catalog Description and Objectives
Detailed design and implementation of a stored-program digital computer system. Designs for the CPU, I/O subsystems, and memory organizations. ALU design and computer arithmetic

Objectives
After successfully completing this course, the students will be able to:
- Demonstrate an understanding of and the ability to evaluate computer design
- Explain the design philosophy behind the computer architecture being presented and examine the consequences of various design alternatives
- Demonstrate basic capability to analyze and evaluate the performance of a computer system with CPU for various design alternatives
- Demonstrate a developing appreciation for various technical and economic issues that impact engineering design choices
- Demonstrate the capability to design a pipelined processor

Methods of Evaluation and Standards of Achievement
Types of graded assignments include:
(a) Homework – assigned and submitted through Canvas
(b) Tests – conducted during lecture times; the distance section students will have a 36-hour window to take their tests using Honorlock.
(b) Final – conducted on Dec 12 (8:00 AM-11:00 AM | Simrall 106); the distance section students will have a 72-hour window (start Dec 12 (8:00 AM)–end Dec 15 (7:59 AM) to take their tests using Honorlock. (The time allotted for tests and Final will be the same for all students regardless of their enrollment status unless university-approved accommodations are mandated.)

Graduate Student Requirements: Graduate students will be required to answer additional questions of greater complexity than undergraduate students on homework, tests, and the final.

Grading Breakdown		Grading Scale			
Assignment Type	**Percentage**	**Grade**	**Average**	**Grade**	**Average**
Homework	45% (= 5×9%)	A	90.0-100	D	60.0-69.9
Tests	30% (= 2×15%)	B	80.0-89.9	F	<60
Final Examination	25%	C	70.0-79.9		

The Final Examination will be comprehensive (covers all course content). If beneficial, the final exam grade may replace the lowest test grade for students who take both tests.

Course Topics

Only major topics are listed below. The textbook lists all topics and subtopics. We will cover Chapters 1 through 5 of the book for this course.

Chapter 1: Computer Abstraction and Technology
- Performance
- Power
- Uniprocessor to Multiprocessors
- Arithmetic

Homework I

Chapter 2: Instructions
- Operations and Operands
- Logical Operations
- The MIPS instruction set (arithmetic, logical, branch, memory access)
- Arrays versus Pointers
- Matrix Multiply in C

Homework II

Test I (Chapter 1 and Chapter 2)

Chapter 3: Arithmetic for Computers
- Additional, Subtraction, Multiplication and Division
- Floating Point
- Subworld Parallelism and Matrix Multiply

Homework III

Chapter 4: Processor
- Logic Design Conventions
- Datapath
- Pipelining
- Data Hazards
- Controls Hazards
- Exceptions
- Advanced Pipelining

Homework IV

Test II (Chapter 3 and Chapter 4)

Chapter 5: Memory Hierarchy
- Memory Technology
- Caches
- Virtual Machines and Virtual Memory
- Parellesim and Memory Hierarchy
- Cache Blocking and Matrix Multiply

Homework V

Final Examination (Comprehensive)

Course Materials
Course materials will be accessed through Canvas.

Expectations for the Classroom and Communication

The following policies for course communication apply to ALL students:
▪ You are required to check your MSU email account regularly.
▪ The course materials will be accessed through Canvas.
▪ Homework submissions will utilize Canvas unless otherwise specified by the instructor.
▪ You must have access to a computer that connects to the internet.
▪ Students should direct correspondence related to the class to the instructor's MSU e-mail address.

The following policies for course communication apply to students enrolled in the Distance section:
▪ Faculty office hours will be hosted in Webex. Students can join using a computer or smartphone app.
▪ Students should expect to log in to Canvas no less than thrice weekly to access course content.

Minimum Technology Requirements
The following minimum technology requirements are necessary for all students to complete the course: a computer with a web browser, Microsoft Office, Adobe Reader, and Internet access.

All five homework will be administered online via Canvas. There are no time extensions available. Distance students must also ensure they are prepared to undertake tests and final examinations via honor lock (**described below**).

Technical Assistance
If you have questions about this course, please contact the instructor via Canvas messaging. For technical support (e.g., computer support, Canvas issues), please contact help@ece.msstate.edu or engr-dist-support@lists.msstated.edu or www.bagley.msstate.edu/distance.

Attendance Policy for Face-to-Face Instruction
Students registered in face-to-face sections are expected to attend all class meetings. Please refer Academic Operating policy 12.09 (http://www.policies.msstate.edu/policypdfs/1209.pdf) regarding attendance expectations and accommodations.

Attendance Policy for Distance Instruction
Distance students are expected to regularly watch the recordings of the lectures and regularly check Canvas for updates.

MSU Syllabus via Canvas
The Mississippi State University Syllabus contains all policies and procedures that are applicable to every course on campus and online. The policies in the University Syllabus describe the official policies of the University and will take precedence over those found elsewhere. It is the student's responsibility to read and be familiar with every policy. The University Syllabus may be accessed at any time on the Provost website under Faculty and Student Resources and at https://www.provost.msstate.edu/faculty-student-resources/university-syllabus.

Honorlock (Distance Sections)

We will use Honorlock, to proctor your online tests and final examination. Please refer to the Honorlock Resources for Students guide for detailed instructions. To use Honorlock, you will need:

- A computer with a webcam
- A photo ID
- A stable internet connection
- Google Chrome and the Honorlock Chrome Extension, which you can download here.

Important Points:

- Honorlock support is available 24/7/365. If you encounter any issues, you can contact them via live chat within the Honorlock session.
- No resources are allowed while taking exams. All exams, including the final Exam, are individual assignments. Sharing examination questions, copying another student's work, or allowing another student to copy your work constitutes academic dishonesty. Unauthorized resources, such as Chegg, are prohibited during exams.
- The course schedule is subject to change based on class needs; announcements will be made during the class period and on Canvas.
- Ensure adequate internet access and power before starting a test or the final examination, as you can only start once, and no time extensions are available.
- For any technical issues, visit Honorlock Support. https://online.msstate.edu/honorlock/.