

ECE 394, Introduction to Computer Architecture, Fall, 2024

(Computer Organization and Design: The Hardware Software Interface)

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- Preferred Method of Contact: In person during office hours or e-mail
- Classroom, Day/Time: 202-EB, Tuesday & Thursday 9:30-10:45 AM
- Student/Office Hours: Tuesday 11:00-12:30 & Wednesday 10:00-11:30 AM
- Prerequisites: ECE 194 and CS 211
- Teaching Assistant (TA): Grading – Md “Raihan” Uddin
- TA Contacts: Grading – mxuddin11@shockers.wichita.edu

How to use this syllabus

This syllabus provides you with information specific to this course, and it also provides information about important university policies. This document should be viewed as a course overview; it is not a contract and is subject to change as the semester evolves. Any changes should be shared via lecture and/or Blackboard.

University Policies and Procedures

The Wichita State University Policies and Procedures Manual can be found at:
<https://www.wichita.edu/about/policy/>.

Academic Integrity

Students at Wichita State University are expected to uphold high academic standards. WSU will not tolerate a lack of academic integrity. Students are responsible for knowing and following the Student Code of Conduct http://webs.wichita.edu/inaudit/ch8_05.htm and the Student Academic Honesty policy http://webs.wichita.edu/inaudit/ch2_17.htm. When the faculty member determines sanctions are warranted for violations of academic integrity, regardless of severity, the faculty member must report the infraction to the Office of Student Conduct and Community Standards. If you need more information about the process or wish to appeal a decision, please visit https://www.wichita.edu/about/student_conduct/ai.php

If there are homework (HW) assignments in this course, each HW will be an individual assignment (unless otherwise stated). Students can discuss with others, but they should not write the solution together; one submission (wording/coding) should be reasonably different from other submissions. "Collaboration is good, cheating is not!" There will be severe consequences for academic dishonesty. Cheating (such as copying word-for-word from other sources) in any test will automatically result a 'Fail' grade in this course; this grading policy applies to all parties involved (including the ones who help/show).

Course Description

This course aims to provide a strong foundation to understand computer architecture and computer design principles. It introduces computer organization using multilevel and quantitative approaches, with a focus on processors, memory hierarchy, and parallel processing. Students will learn to assess design decisions considering historical, current, and future requirements and technological constraints.

Measurable Student Learning Outcomes

After passing this course, students should be able to:

- (SO: EAC 1) identify, formulate, and solve computer system problems by applying principles of engineering, science, and mathematics (*Note: SO is Student Outcome and EAC is Engineering Accreditation Commission*)
- (SO: EAC 2) apply computer design to produce solutions that meet specified needs with consideration of public welfare and economic factors

Required Texts/Readings Textbook

Please talk to the instructor before buying books for this course.

Textbook: zyBooks: ECE 394: Introduction to Computer Architecture ["Computer Organization and Design: The Hardware / Software Interface, ARM Edition," by David A. Patterson and John L. Hennessy, Morgan Kaufmann, 2017 edition.]

Students will access zyBooks directly. Instructions for students:

- 1) Sign in or create an account at learn.zybooks.com
- 2) Enter zyBook code: WICHITAECE394AsaduzzamanFall2024
- 3) Subscribe

Other Readings/Materials

Book: "Structured Computer Organization," Andrew S. Tanenbaum and Todd Austin, Pearson, sixth edition, 2016.

Handouts on evolution of multilevel machines, milestones in computer architecture, and related materials will be made available via WSU Blackboard. PowerPoint slides of class lectures will be made available via WSU Blackboard.

More information will be provided during class lectures as may require.

Class Protocol

There are points on class performance. It is expected that students join the instructor and/or TA before classes start. Students are always encouraged to ask questions, especially if they find ambiguity in assignments and materials covered.

Contact Policy

Although you may attempt to reach me in-person or by phone, email communication is always preferred. Feel free to email me any questions and/or concerns following these guidelines:

- **Always** email me from your WSU email address and/or through Blackboard.
- Always use the course name in the subject line of the email.
- Remember to sign your name.
- If you have a problem with accessing or uploading assignments, you should let me know as soon as possible before the assignment is due. You will also have to accompany this notification with the file in question, so I can verify that it is completed by the due date/time.
- I offer a Discussion Forum on Blackboard which allows common questions to be seen and responded to publicly.
- You **should NOT** contact me for tech support.
 - Any technical problems involving your computer, or issues regarding file uploading or sharing, should go through the OneStop. You can contact them at 316-978-3909. You can also fill out a request for help form at their [website](https://wichita.edusupportcenter.com/sims/helpcenter/common/layout/SelectHelpHome.seam?inst_name=wichita):
https://wichita.edusupportcenter.com/sims/helpcenter/common/layout/SelectHelpHome.seam?inst_name=wichita

Response Time

To Email and Discussion Forum Questions:

I answer your questions as soon as possible within 24 hours. If you do not receive reply to your email within 24 hours, please re-send me the email, probably the email did not arrive to my Inbox.

Feedback on Assignments:

As soon as possible after the due date including the late submission date/time. Answer key will be discussed in lecture sessions and/or shared via Blackboard.

Grading Scale

WSU uses a +/- grading scale for final grades and to calculate grade point averages. In this class, grades are assigned according to the following chart. (Other classes might assign grades differently; therefore, be sure to understand the different grading scales in all of your classes.)

Points/Percentage	Letter Grade	Grade Points	Interpretation
93 and up	A	4.00	A range denotes excellent performance
90 – less than 93	A-	3.70	
87 – less than 90	B+	3.30	
83 – less than 87	B	3.00	B range denotes good performance
80 – less than 83	B-	2.70	
77 – less than 80	C+	2.30	
73 – less than 76	C	2.00	C range denotes satisfactory performance
70 – less than 73	C-	1.70	
67 – less than 70	D+	1.30	
63 – less than 67	D	1.00	D range denotes unsatisfactory performance
60 – less than 63	D-	0.70	
0 – less than 60	F	0.00	

Assignments

List of grading assignments/components and values toward final grades are shown below. The dates for homework, quizzes, and exams will be announced in class and/or made available via Blackboard.

<u>Grading Assignments/Components</u>	<u>Values (%)</u>
Readings (as assigned on zyBooks.com)	10%
Homework (five of six, take home via Blackboard)	15%
Quiz (two of three, 30-minute during class-time)	10%
Exam-1 (~ Week 5, 65-minute during class-time)	20%
Exam-2 (~ Week 10, 65-minute during class-time)	20%
Exam-3 (cumulative, 65-minute during class-time)	25%

Extra Credit

Extra credits are possible depending on class performance. If required, extra credit assignments and their due dates will be determined around Week 10.

Late Assignments

For homework assignments, late submissions will not be accepted after five days from the original due date/time. Homework scores will not be considered for letter grades. Exceptions include documented emergency situations and prior consents.

Missed Tests

Makeup for missed tests (Quiz and Exam) will be given only when there is a genuine reason, with clear proof. It is students' responsibility to provide the proof; if the reason for missing a test is illness, a doctor's note will be required. Students should contact the instructor before any makeup test.

Teaching Assistants

Grading TA:

Md "Raihan" Uddin <mxuddin11@shockers.wichita.edu>

Office Hours: TBD

Office Room: TBD

The Grading TA (if any) is not allowed to solve student problems (any problem). The TA should grade test papers and provide feedback to students for any missing points. If students have any questions regarding the course materials or assignments, they should immediately contact the course instructor.

Syllabus Policies and Student Resources

All students should familiarize themselves with the course-related policies and student resources that can be found at: www.wichita.edu/syllabuspolicies

These include, but may not be limited to:

- Academic Integrity
- CARE Team
- Concealed Carry Policy
- Counseling and Prevention Services
- COVID-19 Conditions
- Definition of a credit hour
- Disability Services
- First Generation Students
- Heskett Center and Campus Recreation
- Important Academic Dates

- Inclusive Excellence and Respect for Diversity
- Intellectual Property
- Names and Pronouns
- Shocker Alert System
- Student Health Services
- Title IX
- Video and Audio recording

Students with Disabilities

A disability is something that affects a major life activity. These life activities include, but are not limited to, learning, walking, breathing, hearing, and seeing, in addition to many other physical, sensory functions, and psychological disabilities.

If you are a student with a disability, or believe you might have a disability, which requires accommodations, please contact the Office of Disability Services (ODS) www.wichita.edu/ods to discuss reasonable and appropriate accommodations and eligibility requirements. It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability ODS will review your concerns and determine, with you, what academic accommodations are necessary and appropriate for you. For example, adaptations of teaching methods, class materials or testing may be made on a case-by-case basis if warranted, as required by the Americans with Disabilities Act (ADA). All information and documentation of your disability is confidential and will not be released by ODS without your written permission.

Respect for Diversity

Wichita State University is committed to being an inclusive campus that reflects the evolving diversity of society. To further that goal, Wichita State University does not discriminate in its employment practices, educational programs or activities on the basis of age (40 years or older), ancestry, color, disability, gender, gender expression, gender identity, genetic information, marital status, national origin, political affiliation, pregnancy, race, religion, sex, sexual orientation, or status as a veteran. Retaliation against an individual filing or cooperating in a complaint process is also prohibited.

Students from all diverse backgrounds and perspectives are welcome in this Course and the diversity that students bring to this course should be viewed as a resource, strength and benefit. All materials and activities are presented with the intent to be respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

Laboratory Information

Programming in Python is a must for coding in this course. Students in this course will need access to Beoshock, the HPC cluster at WSU, for their programming needs. There is no teaching/research lab associated to this course; however, we will provide supports so that you can perform the programming assignments. Information about Beoshock (such as how to log in and how to run TensorFlow code) will be provided via lectures. The main purpose of Beoshock is to provide students a machine learning platform so that they can write/debug/run programs for assignments and projects. The Computer Architecture and Parallel Programming Laboratory (CAPPLab) in 312 Wallace Hall may provide additional help.

Brief List of Topics to Cover

Chapter 1: Introduction

- Eight great ideas in computer architecture
- Technologies for building processors and memory
- Performance
- From uniprocessors to multiprocessors

Handout: Multilevel Computers

- Evolution of multilevel machines
- Milestones in computer architecture
- The Computer Zoo

Chapter 4: The Processor

- Building a datapath
- Parallelism: Pipelining
- Data hazards, Control hazards

Chapter 5: Memory Hierarchy

- Memory, Caches
- Virtual memory

Chapter 6: Parallel Processors

- Parallel processing
- SISD, MIMD, SIMD, SPMD, and vector
- Hardware multithreading
- Multicore and other shared memory multiprocessors

Tentative Schedule

Week Tue	Note	Important topics/readings, assignments, due dates, and reminders are listed here so that you can organize your time and academic work.
1 08/20		ECE 394: Intro to Computer Architecture, Syllabus; K-probe; zyBook 1.1 (Intro to Computers); Homework, Quiz, and Exam;
2 08/27	HW-1	HW-1 Discussion; zyBook 1.2-1.5 (eight ideas, processors); HW-1 (due on Blackboard); zyBook 1.6 (performance);
3 09/03	HW-2	9/02 (Labor Day) No Class/Lab; HW-2 (Bb); zyBook 1.7-1.9 (... uni- and multiprocessors, Core i7);
4 09/10	Quiz-1	Quiz-1 Discussion; Handout: Multilevel Computers; Quiz-1 (class test, 30-min / 30-pts, closed book);
5 09/17	Exam-1	Exam-1 Discussion; Handout: Computer Generations; Exam-1 (class test, 65-min / 65-pts, closed book);
6 09/24	Update	zyBook: 3.1 (The Processor: Introduction); zyBook: 3.2-3.3 (The Processor: Datapath, Pipelining);
7 10/01	HW-3	zyBook 3.4-3.5 (Data hazards: Forwarding versus stalling); HW-3 (Bb); zyBook 3.6 (Data hazards and Control hazards);
8 10/08	Mid-Pt HW-4	zyBook 3.7 (Parallelism via instructions); HW-4 (Bb); zyBook 3.8 (Going faster: ILP and matrix multiply);
9 10/15	Fal-Brk Quiz-2	10/12 (Sat) to 10/15 (Tue) (Fall Break) No Class; Quiz-2 (class test, 30-min / 30-pts, closed book);
10 10/22	Exam-2	Exam-2 Discussion; zyBook 4.1 (Memory Hierarchy: Introduction); Exam-2 (class test, 65-min / 65-pts, closed book);
11 10/29	Update	zyBook 4.2-4.3 (Memory Hierarchy: Caches); zyBook 4.4-4.5 (Memory Hierarchy: Virtual memory);
12 11/05	HW-5	zyBook 5.1 (Parallel Processors: Introduction); HW-5 (Bb); zyBook 5.2 (Difficulty of Parallel Processing);
13 11/12	HW-6	zyBook 5.3 (SISD, MIMD, SIMD, SPMD, and vector); HW-6 (Bb); zyBook 5.4 (Hardware multithreading);
14 11/19	Quiz-3	zyBook 5.5-5.6 (Multicore processors, graphics processing units); Quiz-3 (class test, 30-min / 30-pts, closed book);
15 11/26	Thx-Brk	Future of Computers (selected materials); 11/27 (Wed) to 12/01 (Sun) (Thanksgiving Break) No Class;
16 12/03	Exam-3	Exam-3 Discussion; Exam-3 (class test, 65-min / 65-pts, closed book);
Finals		None!

Note: A date in Column 1 indicates the Tuesday of that week. Here, 12/03 is Tuesday of Week 16.

1) July 24, 2024; prepared for fall 2024 term; DRZ

Definition of a Credit Hour

Example for 3 credit hour class: Success in this 3 credit-hour course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction and preparation/studying or course related activities for a total of 135 hours.

Go to 4.08 / Definition and Assignment of Credit Hours for the policy and examples for different types of courses and credit hour offerings.