COVID-19 and Wichita State University

Wichita State will follow federal, state, and county public health recommendations and mandates related to university operations. The COVID-19 pandemic is a complex, challenging, and fluid situation, which continues to evolve rapidly. Students consistently should review https://www.wichita.edu/about/COVID-19/index.php for the Wichita State COVID-19 Response for information throughout the semester.

ECE 394, Introduction to Computer Architecture, Spring, 2021

- Instructor: Abu Asaduzzaman
- Department: Electrical Engineering and Computer Science (EECS)
- Office Location: 253 Jabara Hall (JB) building
- Telephone: +1-316-978-5261
- Email: Abu.Asaduzzaman@wichita.edu

- Preferred Method of Contact: Zoom/phone during student/office hours or via email
- Student/Office Hours: Tuesday and Thursday 3:20–3:50PM & 5:30–6:15PM
- Classroom, Day/Time: HYB, Tuesday and Thursday 4:05–5:20 PM
- Prerequisites: CS 194, CS 211
- Teaching Assistant (TA): Grading TA – Hui Li
- TA Contact: Email – hxli4@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 (see

https://www.wichita.edu/about/policy/ch_08/ch8_05.php) and the Student Academic Honesty policy (see https://www.wichita.edu/about/policy/ch_02/ch2_17.php). 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/AcademicDishonesty.php.

All homework (HW) assignments in this course are individual assignments (unless otherwise stated). Students can discuss with others, but they should not write the solution together; one's submission (wording/coding) should be substantially different from others' 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 in an F grade for the course; this applies to all the parties involved (including the ones who help/show).

Course Description

This course is to introduce computer organizations using multilevel approach with an emphasis on processors (single-core and multicore). The history of computer systems is briefly discussed. Other important topics covered include performance, parallelism, and memory hierarchy. In addition, the graphics processing unit (GPU) is introduced if time permits. Prerequisite(s): ECE 194, CS 211.

Definition of a Credit Hour

This is a 3 credit-hour course. 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. [Note: one unit of credit means one credit-hour.]

Measurable Student Learning Outcomes

After passing this course, undergraduate students will be able to:

- (EAC 1) an ability to identify and solve computer system problems by applying principles of engineering, science, and mathematics
- (EAC 2) an ability to apply computer system design to produce solutions that meet specified needs with consideration of public welfare and economic factors

Required Texts/Readings Textbook

You may talk to the instructor before buying books for this course.

Textbook: zyBooks: Computer Organization & Design (1e) – ARM ["Computer Organization and Design ARM Edition: The Hardware Software Interface," David A. Patterson and John L. Hennessy, Morgan Kaufmann, 1st edition, 2016.]

Students will access zyBooks directly. Instructions for students:

1) Sign in or create an account at learn.zybooks.com
2) Enter zyBook code: WICHITACS394AsaduzzamanSpring2021
3) Subscribe

Other Readings

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.

Class Protocol

There are points on class performance. It is expected that students arrive to the assigned room before class starts. Students are always encouraged to ask questions, especially if they find ambiguity in assignments and materials covered.

Contact Policy

Use zoom/telephone during student/office hours. Email communication is also preferred. Feel free to email me any questions or concerns following these guidelines:

- **Always** email me from your WSU email address. Email sent from personal email servers like Gmail, Yahoo, etc., have a tendency to end up in my spam folder, and I never see them. You may also email me through Blackboard via the Email My Instructor tab. I also offer a Discussion Forum on Blackboard which allows common questions to be seen and responded to publicly.
- 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.
- 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/SelfHelpHome.seam?inst_name=wichita

Response Time

To Email and Discussion Forum 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, usually grades are assigned according to the following chart. However, the grading scale may change as/if needed. (Other classes might assign grades differently: 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.

Grading Assignments/Components	Values (%)
Readings (as assigned on zyBooks.com)	12%
Homework (four of five, take home via Blackboard)	8%
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)	30%

Extra Credit

Extra credits are possible as/if needed. Depending on class performance around Week 10, if required, extra credit assignments and their due dates will be determined.

Late Assignments

For homework assignments, late submissions will not be accepted after five days from the original due date/time. It should be noted that up to 50% points may be subtracted for any late submission. 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 Assistant (TA)

Grading TA:

Hui Li (email: hxli4@shockers.wichita.edu)

Office Hours/Room: Tue & Thu 5:30–6:15 PM via Zoom (TBD)

The Grading TA (if any) should grade test papers (homework, quiz, etc.). However, the TA is not allowed to solve problems (any problem) for students. If students have any questions regarding test questions and/or course materials, they should immediately contact the course instructor.

Laboratory Information

Although there is no laboratory activity in this course, you are welcome to visit my Computer Architecture and Parallel Programming Laboratory (CAPPLab) in room 256 Jabara Hall and/or online at http://www.cs.wichita.edu/~capplab/. CAPPLab was an NVIDIA GPU Research Center in 2015-2017. CAPPLab is used for research in computer architecture, high performance computing, embedded systems, and related fields. Currently available resources in CAPPLab include: GPU/CUDA technology, embedded systems development boards/software, etc.

Tentative Brief List of Topics to Cover

Chapter 1: Introduction

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

Handout: Multilevel Computers

- Evolution of multilevel machines
- Milestones in computer architecture

Chapter 4: The Processor

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

Chapter 5: Memory Hierarchy

- Caches, memory hierarchy
- Virtual memory

Chapter 6: Parallel Processors

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

Tentative Schedule for 15-week class

Zoom Meeting Days / Times: Tue & Thu / 4:05-5:20 PM (Feb. 01 – May 13)

In-Person Meeting: To be determined and shared via lecture/Blackboard

Week	Class	Note	Important topics/readings, assignments, due dates, and reminders are listed here so that you can organize your time and academic work.
1 02/01-02/07	02/02 02/04	Read-01 (cont'd)	CS 394: Intro to Comp Arch, Syllabus; K-probe; zyBk 1.1 & 1.2 (Eight ideas in computer architecture);
2 02/08-02/14	02/09 02/11	Read-01 HW-1	zyBk 1.1 through 1.5 (processors and memory); HW-1 (due 2/11 before class);
3 02/15-02/21	02/16 02/18	Read-02 HW-2	zyBk 1.6, 1.7, and 1.8 (uni- to multiprocessors); HW-2 (due 2/18 before class);
4 02/22-02/28	02/23 02/25	Read-03 Quiz-1	zyBk 1.9 (Core i7); Handout: Multilevel Machines; Quiz-1 (30-min, 30 pts, Closed book);
5 03/01-03/07	03/02 03/04	Read-04 Exam-1	Handout: Milestones in Comp Arch; zyBk 3.1; Exam-1 (65-min, 65 pts, Closed book);
6 03/08-03/14	03/09 03/11	Read-05 Update	zyBk 3.2 (Building a datapath); zyBk 3.4 and 3.5 (Pipelined datapath and control);
7 03/15-03/21	03/16 03/18	Read-06 HW-3	zyBk 3.6 and 3.7 (Data hazards and Control hazards); HW-3 (due 3/18 before class);
8 03/22-03/28	03/23 03/25	Read-07 Mid-Pt HW-4	zyBk 3.8 (Parallelism via instructions); zyBk 3.9 (ILP and matrix multiply); HW-4 (due 3/25 before class);

Week	Class	Note	Important topics/readings, assignments, due dates, and reminders are listed here so that you can organize your time and academic work.
9 03/29-04/04	03/30 04/01	Read-08 Quiz-2	zyBk 4.1, 4.2, and 4.3 (The basics of caches); Quiz-2 (30-min, 30 pts, Closed book);
10 04/05-04/11	04/06 04/08	Read-09 Exam-2	zyBk 4.4 and 4.5 (Virtual memory); Exam-2 (65-min, 65 pts, Closed book);
11 04/12-04/18	04/13 04/15	Read-10 Update	zyBk 4.6 (Measuring and improving performance); zyBk 5.1 (Introduction) and 5.2 (parallel processing);
12 04/19-04/25	04/20 04/22	Read-11 HW-5	zyBk 5.3 (SISD, SIMD, MIMD, and vector) and 5.4; HW-5 (due 4/22 before class);
13 04/26-05/02	04/27 04/29	Read-12 Quiz-3	zyBk 5.5 and 5.6 (Intro to GPUs); Quiz-3 (30-min, 30 pts, Closed book);
14 05/03-05/09	05/04 05/06	Exam-3	Overview; What's Next? Exam-3 (cumulative, 65-min, 65 pts, Closed book);
~~15~~	~~Finals~~	~~N/A~~	~~None~~

[_v5) Updated on Feb. 26, 2021; corrected assignment dates; DRZ]

[_v4) Updated on Jan. 27, 2021; added reading assignments, etc.; DRZ]

[_v3) Updated on Jan. 19, 2021; added date information; DRZ]

[_v2) Updated on Jan. 6, 2021; added zyBooks information/topics; DRZ]

[_v1) Updated on Dec. 20, 2020; from spring 2020; DRZ]