



ECE 394, Introduction to Computer Architecture, Fall, 2024

(Computer Organization and Design: The Hardware Software Interface)

- Instructor: Abu Asaduzzaman (DRZ)
- Department: Electrical and Computer Engineering (ECE)
- Office Location: 303 Wallace Hall (303-WH) building
- Telephone: +1-316-978-5261
- Email: abu.asaduzzaman@wichita.edu
- 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

ছাত্রদের গান

- কাজী নজরুল ইসলাম

We are energy, we are force
We are students.
[Google translate]

আমরা শক্তি আমরা বল
আমরা ছাত্রদল।

মোদের পায়ে তলায় মূর্ছে তুফান
উর্ধ্বে বিমান বাড়-বাদল।
আমরা ছাত্রদল।।

সবাই যখন বুদ্ধি যোগায়
আমরা করি ভুল!
সাবধানীরা বাঁধ বাঁধে সব,



NEWS » News Best Countries Best States Healthiest Communities Ideas & Opinions Elections

<https://www.usnews.com/news/world/articles/2024-08-14/students-who-ousted-hasina-are-helping-lead-bangladesh-from-the-streets-to-the-ministries>
Home / News / World News / Students Who Ousted Hasina ...

Students Who Ousted Hasina Are Helping Lead Bangladesh, From the Streets to the Ministries

Within a week of unseating Bangladesh's longest-serving prime minister, the students who drove out former Prime Minister Sheikh Hasina were directing Dhaka's traffic

By Associated Press | Aug. 14, 2024, at 12:13 a.m.

আমরা পশি নীল অতল!
আমরা ছাত্রদল।।

আমরা ধরি মৃত্যু রাজার
যজ্ঞ-ঘোড়ার রাশ,
মোদের মৃত্যু লেখে মোদের
জীবন--ইতিহাস!
হাসির দেশে আমরা আনি
সর্বনাশী চোখের জল
আমরা ছাত্রদল।।

মোরা বিংশ শতাব্দীর!
গৌরবেরি কান্না দিয়ে
ভরেছি মা'র শ্যাম-আঁচল।
আমরা ছাত্রদল।

আমরা রচি ভালোবাসার
আশার ভবিষ্যৎ,
মোদের স্বর্গ-পথের অভাস দেখায়
আকাশ-ছায়াপথ!
মোদের চোখে বিশ্ববাসীর
স্বপ্ন দেখা হোক সফল।
আমরা ছাত্রদল।।

Learning Points:

Students are the future of any nation!
Student-centered education (be proactive)

Natural Languages → Computer Languages
Translation or Interpretation? (Handout 2)

Welcome!

Introduction to Computer Architecture **(Computer Organization and Design: ARM Edition)**

Instructor:

Abu Asaduzzaman (Zaman)

+1-316-978-5261

Abu.Asaduzzaman@wichita.edu

ECE 394 – Introduction to Computer Architecture

(Computer Organization and Design: ARM Edition)

Course Coordinator/Instructor:

A S MD Asaduzzaman → **Abu Asaduzzaman** → **Dr. Zaman** → **DRZ**
Professor of Computer Engineering
Undergraduate Program Director





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UNIVERSITY

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Abu Asaduzzaman (Zaman) is a [professor](#) of computer engineering and the [Undergraduate Program](#) Director in the [Department of Electrical and Computer Engineering](#). Asaduzzaman received his [PhD](#) and [MS](#) degrees, both in computer engineering, from Florida Atlantic University (FAU). He received his BS degree in electrical and electronic engineering from Bangladesh University of Engineering and Technology (BUET). Link to his [curriculum vitae](#).

Asaduzzaman's [research](#) interests include computer systems, data analysis, and machine learning. He is a recipient of research grants from various organizations including [Kansas NSF EPSCoR](#), DoE [Argonne National Laboratory](#), [NetApp](#), [Nvidia](#), and State of Kansas-URCA. His research lab ([CAPPLab](#)) [earned top research designation](#) as it was named a GPU Research Center by Nvidia. His [solar energy project](#) was well recognized by the Green Group at WSU. Link to his [research statement](#).

Asaduzzaman's [teaching](#) courses include Introduction to Computer Architecture ([ECE 394](#)), Modeling, Simulation, and Analysis ([ECE 475-475L](#)), Microprocessor-Based System Design ([ECE 594-594L](#)), High Performance Computer Systems ([ECE 694](#)), Hardware-Based Cybersecurity ([ECE 696](#)), Applied Parallel Computing ([CS 697AP](#) - A satellite course from [UCB](#) and [XSEDE](#)), Machine Learning Essentials and Applications ([ECE 707](#)), Parallel Computing ([ECE 794](#)), and Computer Systems in Data Analytics ([ECE 875](#)). Link to his statement of [teaching philosophy](#).

Asaduzzaman's [services](#) include the R5 Program Chair for the 2025 [IEEE Region 5](#) Annual GreenTech Conference and Business Meeting and the [Technical Program Chair](#) of 2019 [ASEE](#) Midwest Section Conference at Wichita State ([see photos](#)). He serves as reviewer for peer-reviewed journals and as program committee member for conferences. He serves as panel reviewer for [NSF](#) programs.

Visit  **CAPPLab**
capplab@wichita.edu

WSU Links: [myWSU](#) | [Blackboard](#) | [E-mail](#) | [Schedule](#) | [Course Plan](#) | [Zoom](#) | [MRC](#)

CoE Links: [Departments](#) | [Student Success](#)

ECE Links: [BS-CE](#) | [Svc-Tkt](#) | [Videos](#)

DRZ Links: [Blue Card](#), [BC Writeup](#) | [LinkedIn](#)

Contact:

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Student/Office Hours:

Please email to set up appointments

BeoShock HPC Cluster at WSU:

[HPC Wiki](#) | [HPC New User Signup](#)

YouTube Links:

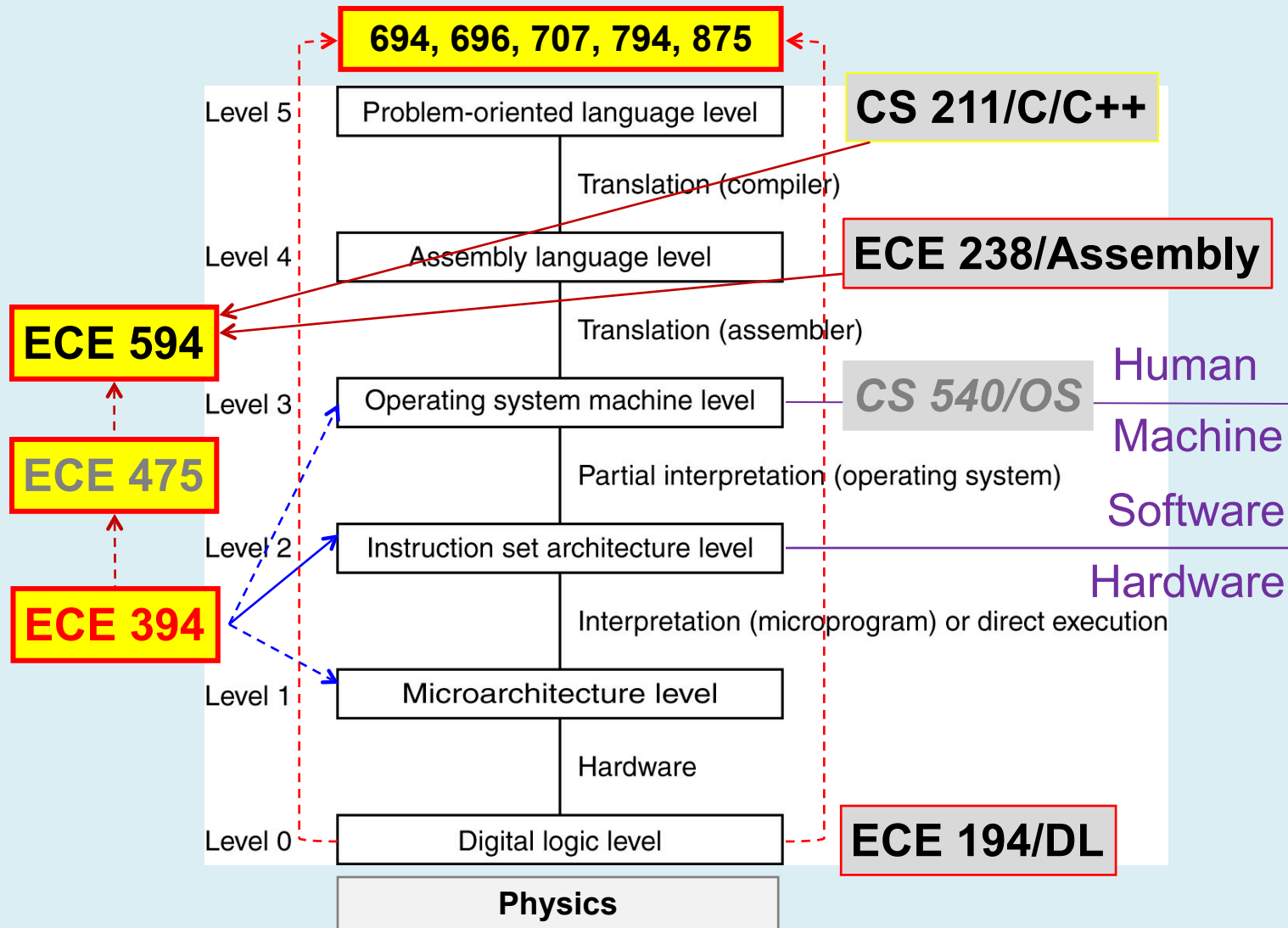
Posters: [1](#), [2](#), | [Scanner](#) | [Solar-Car](#)

Other Links:

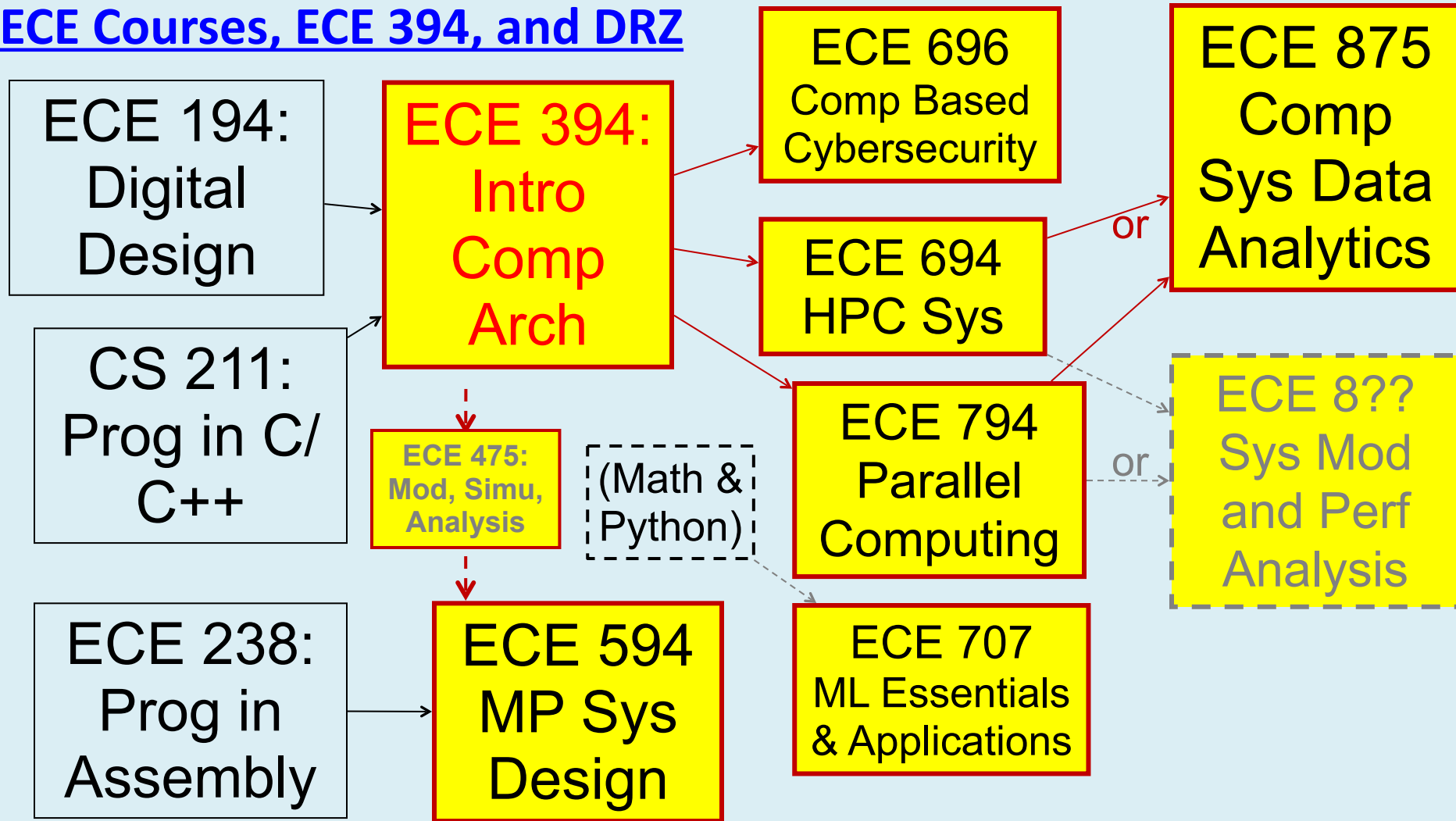
[Graduate Forms](#) | [Weather](#) | Pictures: [1](#), [2](#),

Computer Systems: A Multilevel Approach

(From Handout 2)



ECE Courses, ECE 394, and DRZ



Introduction to Computer Architecture



Do you have any questions?

12:07 PM

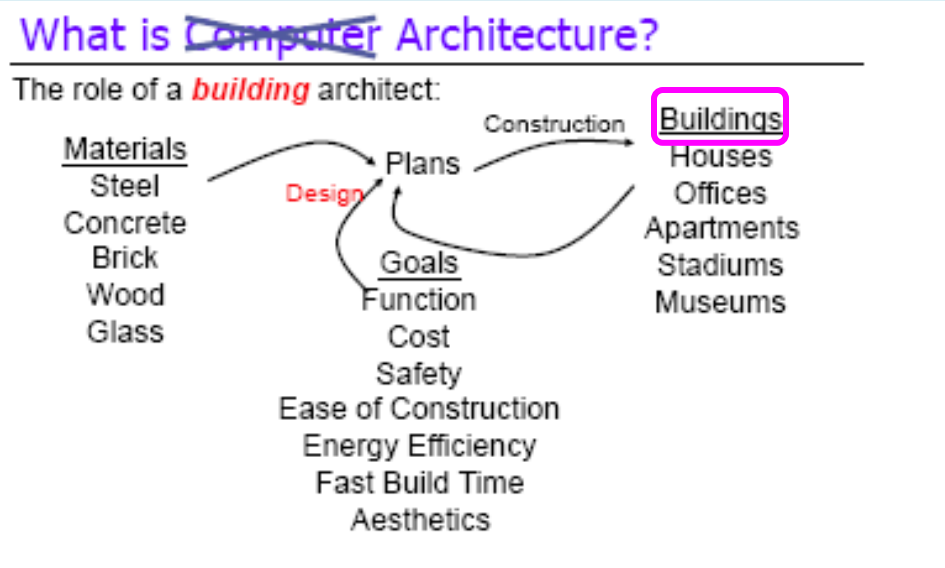
Let's talk about 'it'!

Computer Architecture

- Okay, what is a **computer**?
 - Duh! (You know it!)
- What is **architecture**?
 - You know it!
- What is **computer architecture**?
 - **You know it? (i.e., Do you know it?)**

Let's talk about 'it'!

(Building) Architecture vs Computer Architecture



Let's talk about 'it'!

(Building) Architecture vs Computer Architecture

What is ~~Computer~~ Architecture?

The role of a **building** architect:



What is Computer Architecture?

The role of a **computer** architect:



Important differences: age (~60 years vs thousands), rate of change, automated mass production (magnifies design)

Slides developed by Milo Martin & Amir Roth at the University of Pennsylvania
with sources that included University of Wisconsin slides
by Mark Hill, Guri Sohi, Jim Smith, and David Wood.

Computer architecture!

Computer

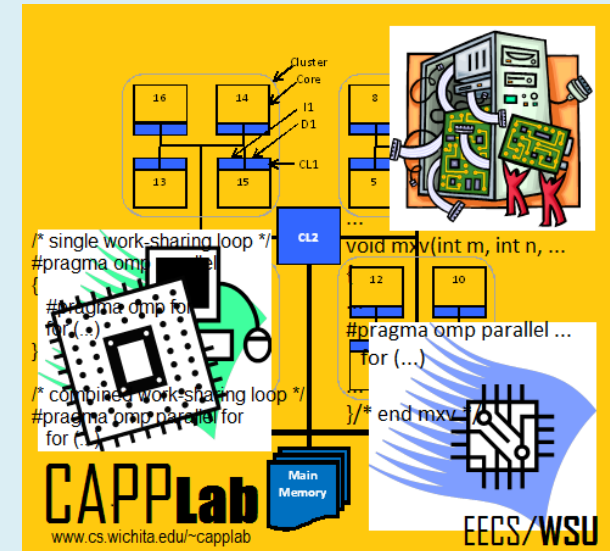
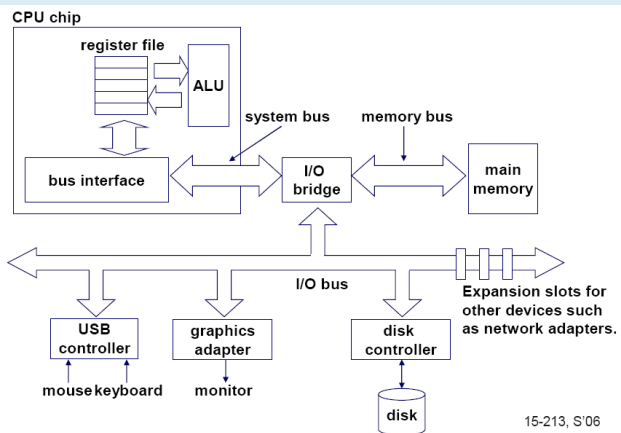
Computer is a machine that receives inputs; manipulates and/or stores data; and provides useful outputs.



Computer architecture!

Computer Architecture

Computer Architecture (Digital Computer Organization): The conceptual design and fundamental operational structure of a computer system.



Computer architecture!

Computer Architecture

■ What is computer architecture?

- Is it hardware? Is it software? Or, both?
- Computer architecture is a set of rules and methods that describe the functionality, organization, and implementation of computer systems. Computer organization helps optimize performance-based products.

■ Why do we care?

- We cannot live without computers. **We need BETTER Computers (i.e., Computer Architecture)!!!**

Let's talk about ECE 394

Introduction to Computer Architecture

Digital Design (ECE 194), Programming (CS 211) ... (pre-requisite)

■ Why do we care?

- Computers are everywhere; we cannot live without computers. **Need BETTER Computer Architecture!!!**

■ Why ECE 394?

- ECE 394 introduces computer architecture.
- We learn *what* make a computer and how computers execute programs! (How does it sound? Simple?)
- **Here, things will be complicated. How?**
- Processors, Memory Hierarchy, Parallel Processors, ...

Introduction to Computer Architecture



Do you have any questions?

12:07 PM

Intro to Computer Architecture

Lecture 1

Reading: See Syllabus

Test: See Syllabus

■ Introduction: ECE Courses, ECE 394, and DRZ

■ ECE 394 Syllabus

- Textbook, Important Topics, Grading Policy, Etc.
- zyBooks Information

■ Course Evaluations | Knowledge Probe

■ Computers: An Introduction (from zyBooks)

- Eight great ideas in computer architecture
- Technologies for building processors and memory



■ Student/Office Hours

- Tue 11:00AM-12:30PM & Wed 10:00-11:30 AM in 303-WH
- Email: abu.asaduzzaman@wichita.edu

■ No In-Person Classes

- Tue (Sept. 10), Thu (Sept. 12)

■ Grading TA: Md “Raihan” Uddin


- Wed 10:00-11:00 AM in 312-WH (CAPPLab)
- Email: mxuddin11@shockers.wichita.edu

Intro to Computer Architecture

Blackboard (Bb)

- **Content > Information, Course Materials, Tests, etc.**
 - Information > Syllabus, K-Probe, Evaluations, etc.
 - Course Materials > Lecture Notes, Reading Materials, Video Clips, etc.
 - Tests > Homework, Quiz, and Exam
- **Announcements > Important messages, etc.**
- **Gradebook > Individual scores, etc.**

ECE-394-14691-202510

 Course Settings

Intro Computer Architecture tr 09:30:00 (ECE-394-14691-Fall 2024)

[Content](#) [Calendar](#) [Announcements](#) [Discussions](#) [Gradebook](#) [Messages](#) [Analytics](#) [Groups](#)

 Student Preview



ECE-394 | DRZ



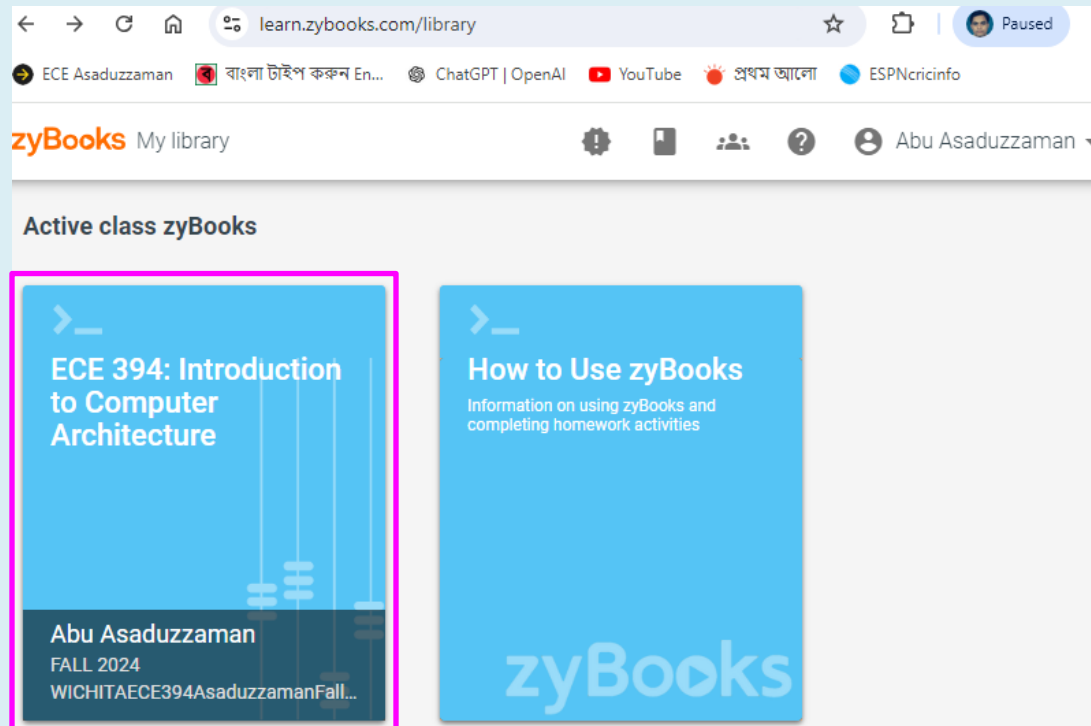
Intro to Computer Architecture

Syllabus

■ Syllabus on Blackboard

➤ Course Content > Information > ECE394fall24_Syllabus_

■ Textbook on learn.zybooks.com



Intro to Computer Architecture

From Syllabus

Grading Assignments/Components and Values

Grading Assignments/Components	Values (%)
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%

*** Important ***
Please read the syllabus!

Intro to Computer Architecture

Class Activities/Performance

■ Discussion

- Questions / Answers

■ Practice and Feedback (random)

- Discuss with your peers as a small group
- (One side, feedback) 3-2-1 (learned, interesting, repeat), more
- (Other side, practice) Make sure to write: Your Name and Date

■ Attendance

- Very important (no need to mention)!

Introduction to Computer Architecture



Do you have any questions?

12:07 PM

Course Evaluations

Four Major Evaluations

■ Knowledge Probe (for ABET purpose) ← Week 1

- Week-1; between you and me.
- Mainly to determine prerequisite materials.

■ Early Evaluation

- After couple of HW/Quiz; you and me; to improve current learning.

■ ABET Evaluation (for ABET purpose)

- Before the end of the semester; your feedback goes to ABET via me.
- To assess and improve current programs and/or progress.

■ Course Evaluation & Surveys

- Before the end of the semester; your feedback directly goes to WSU.
- To assess the instructor's performance. Directly impacts instructor!

ECE 394

Introduction to Computer Architecture

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.		