CPE/EE 517-A Digital & Computer System Architecture

The Schaefer School of Engineering and Science
Spring 2025

Instructor: Md Abu Sayeed
Canvas Course Address: https://sit.instructure.com/courses/78050
Course Schedule: Monday, 6:30 PM - 9:00 PM
Classroom: Library B15
Contact Info: msayeed1@stevens.edu
Office: Burchard 307B
Phone: (409) 998-2301
Office Hours: Tuesday- 4:00 pm-6:15 pm,
Thursday- 9:45 am-10:50 am, 12:30 pm-2:10 pm
Virtual Office Hours: Thursday 12:30 pm-2:10 pm (zoom)
Virtual session URL: https://stevens.zoom.us/j/5376037524
Prerequisite(s): C/C++, Assembly Programming

COURSE DESCRIPTION

This course introduces students to computer architecture and the design of efficient computing and memory systems. The key topics of this course include efficiency metrics (performance, power, energy, and cost), Instruction set choices for C++ code, organization of a simple processor (data path, control path, and 5-stage pipelining), hardware/software interface (Instruction, data and thread level parallelism), memory hierarchy and the performance of cache organizations.

STUDENT LEARNING OUTCOMES

After successful completion of this course, students will be able to

- Understand the quantitative approach for computer architecture design and be able to apply metrics to evaluate performance of a computer system.
- Comprehend the essentials of digital systems and organization of an ARM processor.
- Understand the basic Instruction Set Architecture (ISA) and able to design a five-stage pipeline.
- Analyze computer memory systems using cache protocols, paging mechanism, and memory access time formula.
- Able to use instruction, thread and data level parallelisms.
- Comprehend advancements in computer systems architecture from technical papers, and effectively communicate insights through presentations.
- The students will be able to recognize and achieve high levels of professionalism in work and understand ethical systems in a social context.

COURSE FORMAT AND STRUCTURE

To access the course, please visit stevens.edu/canvas . For more information about course access or support, contact the Technology Resource and Assistance Center (TRAC) by calling 201-216-5500.

Course Logistics

- When assignments are due, they are due by 11:59 pm EST on the due date listed in the course schedule.
- Deadlines are an unavoidable part of being a professional, and this course is no exception. Course requirements must be completed and posted or submitted on or before the specified due date and delivery time deadline. Due dates and delivery time deadlines are in Eastern Time (as used in Hoboken, NJ). Please note that students living in distant time zones or overseas must comply with this course time and due date deadline policy. Avoid any inclination to procrastinate. Due dates have been established for each assignment to encourage you to stay on schedule. Assignments received 1-6 days late will have 20% of the total points deducted; assignments received more than one week late will receive 0 points.
- An assignment file should be appended by your username, such as "assignment1_kim53.doc". This makes it easier for me to manage assignment files you download to my computer.

Communication Policy

Email is the best way to get in touch with me during the semester, and my email address is (msayeed1@stevens.edu). Monday-Friday you can expect a response within 24 hours. Saturday and Sunday you can expect a response within 48 hours. For synchronous meetings, we can either meet during my office hours, or you can email me and we can schedule a meeting. When emailing me, please place in the subject line the course number/section and the topic of the email (i.e., XXX 240 – Assignment 2 Question). This will help me tremendously in locating your emails quicker when I scan the hundreds of emails that seem to make it into my box each day.

TENTATIVE COURSE SCHEDULE

The following is a tentative course schedule. Any changes to this schedule will be communicated to students via Email/Canvas.

Week	Date	Topic	Note
Week 1	1/20	Labor day – No class	
Week 2	1/27	Introduction, Course Syllabus, and Introduction to computer architecture	
Week 3	2/3	Quantitative Approaches	Homework 1
Week 4	2/10	Review of Digital System	

Week 5	2/18 (Monday Class Schedule)	Instruction Set	
Week 6	2/24	Instruction Set Architecture (ISA)	Homework 2
Week 7	3/3	Computer Arithmetic & 5 -stage pipelining	
Week 8	3/10	Midterm	
Week 9	3/17	Spring break	
Week 10	3/24	Datapath and 5-stage pipelining	Lab
Week 11	3/31	Instruction Level Parallelism (ILP)	
Week 12	4/7	Data Level Parallelism (DLP) and Thread Level Parallelism (TLP)	Finalize paper selection
Week 13	4/14	Parallelism/Memory Hierarchy	Homework 3
Week 14	4/21	Paper Presentation	
Week 15	4/28	Memory Hierarchy and advanced topics	Homework 4
Week 16	5/5	Exam Review	
The data and time of the final exam will be announced a week before the final exam			

COURSE MATERIALS

Textbook(s):

1. Sign in or create an account at learn.zybooks.com
2. Enter zyBook code
   STEVENSCPE517EE517SayeedSpring2025
3. Subscribe

References:

- Computer Organization and Design: The Hardware Software Interface: ARM Edition by Patterson and Hennessy, Morgan Kaufmann, 2016, ISBN-13: 978-0128017333

- Computer Architecture: A Quantitative Approach, John L. Hennessy and David A. Patterson, Morgan Kaufmann, 6th edition, 2017.

COURSE REQUIREMENTS

Attendance. Students are required to attend all lectures. Random attendance signoffs will be performed. Each student is permitted one absence per semester without penalty. Excused absences (religious or medical, noted in via email to the professor prior to the absence occurring) accompanied by proper documentation will not lead to point deductions.

Quiz/Class activities. Students are expected to participate in class activities and quizzes based on the weekly lecture. It does not necessarily have class activities every week.

Homework and Labs. There will be four (4) homework assignments and one (1) lab for this semester. The due time of each assignment is 11:59PM of the due date. Assignments received 1-6 days late will have 20% of the total points deducted; assignments received more than one week late will receive 0 points.

Presentations: Two students form a group and present a research article using Microsoft Power Point. You can select any topic from this course content. You can select articles from IEEE explore: https://ieeexplore.ieee.org/Xplore/home.jsp. If you select a conference paper, then the venue of the paper should be US or Canada. I will provide the rubric for the presentation and detailed instructions later.

Exams. There will be one mid-term exam and a final exam for this course. Note, there is no makeup exam. Excused absence from any exam shall seek consent from the instructor before the exam day; rearrangement can be scheduled only if a student has a physical problem evidenced by the Doctor's prescription.

TECHNOLOGY REQUIREMENTS

Baseline technical skills necessary for online courses

- Basic computer and web-browsing skills
- Navigating Canvas

Required Equipment

- Computer: current Mac (OS X) or PC (Windows 7+) with high-speed internet connection

Required Software

- Microsoft Word
- Microsoft PowerPoint

GRADING PROCEDURES

Grades will be based on:

Attendance	10 %
Quiz / Class activities	20%
Presentation	5%
Homework and Lab Assignment	20%
Mid-term Exam	20 %
Final Exam	25%

Grade breakdown:

A	>=94%
A-	90 – 93.9%

B+	85 – 89.9%
B	80 – 84.9%
B-	75 – 79.9%
C+	70 – 74.9%
C	65 – 69.9%
F	<65%

Late Policy

Assignments received 1-6 days late will have 20% of the total points deducted; assignments received more than one week late will receive 0 points.

Academic Integrity

Graduate students in 500-level courses are bound by the Graduate Student Code of Academic Integrity, while undergraduate students in those courses have special provisions that have been agreed upon by the Senior Vice Provost for Graduate Education and the Honor Board.

Undergraduate Honor System

Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the Honor System Constitution. More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at http://web.stevens.edu/honor/

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

"I pledge my honor that I have abided by the Stevens Honor System."

Reporting Honor System Violations

Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at www.stevens.edu/honor.

Graduate Student Code of Academic Integrity

All Stevens graduate students promise to be fully truthful and avoid dishonesty, fraud, misrepresentation, and deceit of any type in relation to their academic work. A student's submission of work for academic credit indicates that the work is the student's own. All outside assistance must be acknowledged. Any student who violates this code or who knowingly assists another student in violating this code shall be subject to discipline.

All graduate students are bound to the Graduate Student Code of Academic Integrity by enrollment in graduate coursework at Stevens. It is the responsibility of each graduate student to understand and adhere to the Graduate Student Code of Academic Integrity. More information

including types of violations, the process for handling perceived violations, and types of sanctions can be found on the Office of Graduate Academics web page.

Special Provisions for Undergraduate Students in 500-level Courses

The general provisions of the Stevens Honor System do not apply fully to graduate courses, 500 level or otherwise. Any student who wishes to report an undergraduate for a violation in a 500-level course shall submit the report to the Honor Board following the protocol for undergraduate courses, and an investigation will be conducted following the same process for an appeal on false accusation described in Section 8.04 of the Bylaws of the Honor System. Any student who wishes to report a graduate student may submit the report to the Senior Vice Provost for Graduate Education or to the Honor Board, who will refer the report to the senior vice provost. The Honor Board Chairman will give the Senior Vice Provost for Graduate Education weekly updates on the progress of any casework relating to 500-level courses. For more information about the scope, penalties, and procedures pertaining to undergraduate students in 500-level courses, see Section 9 of the Bylaws of the Honor System document, located on the Honor Board website.

EXAM CONDITIONS

The following procedures apply to quizzes and exams for this course. As the instructor, I reserve the right to modify any conditions set forth below by printing revised Exam Conditions on the quiz or exam.

- Students are/are not allowed to work with or talk to other students during quizzes and/or exams.

LEARNING ACCOMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

For more information about Disability Services and the process to receive accommodations, visit https://www.stevens.edu/student-diversity-and-inclusion/disability-services. If you have any questions please contact: Phillip Gehman, the Director of Disability Services Coordinator at Stevens Institute of Technology at pgehman@stevens.edu or by phone: 201.216.3748.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

INCLUSIVITY

Name and Pronoun Usage

As this course includes group work and class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your name and/or pronouns, please inform the instructor of the necessary changes.

Inclusion Statement

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). Appointments are can be made by phone (201-216-5177).

EMERGENCY INFORMATION

In the event of an urgent or emergent concern about the safety of yourself or someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year round. For students who do not reside near the campus and require emergency support, please contact your local emergency response providers at 911 or via your local police precinct. Other 24/7 national resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text “Home” to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at care@stevens.edu. A member of the CARE Team will respond to your concern as soon as possible.