Department of Physics and Engineering

EGR/CSC 4054 Computer Architecture and Assembly Language

4 Units

Spring 2025✪

MWF 1:30 pm – 2:35 pm

Meeting location: Rohr Science Hall (RS) 295

Final Exam: Wednesday, 5/7, 1:30 – 4:00 pm

INFORMATION	SPECIFICS FOR THE COURSE
Instructor title and name:	Dr. José Manjarrés
Phone:	619-849-2451
Email:	josemanjarres@pointloma.edu
Office location and hours:	RS276, MWF 9 AM – 12 PM, 3:00 PM – 4:00 PM / T 1:00 pm – 2:00 PM

PLNU Mission

To Teach ~ To Shape ~ To Send

Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service is an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

Department Mission

The Physics and Engineering Department at PLNU provides strong programs of study in the fields of Physics and Engineering. Our students are well prepared for graduate studies and careers in scientific and engineering fields. We emphasize a collaborative learning environment which allows students to thrive academically, build personal confidence, and develop interpersonal skills. We provide a Christian environment for students to learn values and judgment, and pursue integration of modern scientific knowledge and Christian faith.

Course Description

This course covers the fundamentals of current pipelined computer designs. Experience with assembly language programming and digital logic and circuit design will be used to motivate the need for certain facets of the more general instruction set architecture. Throughout the course, performance issues, hardware constraints, and memory hierarchy will be shown to inform processor design. Additional topics include integer and floating point arithmetic, I/O and considerations surrounding multi-core architectures.

Prerequisite(s): CSC 1054 with a grade of C- or higher or EGR 1054 with a grade of C- or higher and Junior or Senior standing**.**

Program and Course Learning Outcomes

Course Learning Outcomes:

- Design and implement digital logic circuits using hardware description language
- Build a basic computer system from foundational components (gates, ALU, memory, CPU) in a simulated environment
- Analyze computer architectures including memory hierarchies, instruction sets, and CPU organization
- Compare performance characteristics of different computer system components and architectures
- Develop programs in both high-level and assembly languages
- Implement basic operating system services and understand their interaction with hardware
- Evaluate historical and contemporary developments in computer systems

Program Outcomes:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (LO1)
- An ability to communicate effectively with a range of audiences. (LO3)
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. (LO5)

Required Texts and Recommended Study Resources

Students are responsible for having the required course textbooks prior to the first day of class.

1. Nisan, N. and Schocken, S. The Elements of Computing Systems: Building a Modern Computer from First Principles, 2nd ed. MIT Press. ISBN: 9780262539807.
2. Ledin, J. Modern Computer Architecture and Organization, 2nd ed. Packt. ISBN: 9781803234519.

Course Credit Hour Information⊛

In the interest of providing sufficient time to accomplish the stated Course Learning Outcomes, this class meets the PLNU credit hour policy for a 4-unit class delivered over 15 weeks. It is anticipated that students will spend a minimum of 37.5 participation hours per credit hour on their coursework. For this course, students will spend an estimated 150 total hours meeting the course learning outcomes.

Assessment and Grading

This course will have four ways to assess knowledge and learning, described as follows.

1. Homework Checks: Short 5-minute quiz related to a pre-class reading.
2. Presentations: In-class student-led presentations on a prescribed topic related to the course content.
3. Exit Tickets: Brief, one-page handwritten summaries that groups of students in the audience craft summarizing their main takeaways from their peer's presentation.
4. Projects: Group coding projects addressing the contents of each unit. Each project is presented through a video walkthrough of the code and its testing. Peer evaluation is weighted in as a multiplier to each group member's grade.
5. Final Project: A design problem encompassing topics from the beginning to the end of the course. It includes a report and a presentation to the general public during the time designated for the final exam.

The table below outlines the assessment criteria for this course.

Activity	Points Per Activity	Quantity	Total Points
Homework Checks	20	17	340
Presentations	150	1	150
Exit Tickets	20	11	220
Projects	50	8	400
Final Project	200	1	200
Total			**1310**

Grades will be based on the following:

Sample Standard Grade Scale Based on Percentages

A	B	C	D	F
A [92.5-100]	B+ [87.5-90)	C+ [77.5-80)	D+ [67.5-70)	F [0-60)
A- [90-92.5)	B [82.5-87.5)	C [72.5-77.5)	D [62.5-67.5)	
	B- [80-82.5)	C- [70-72.5)	D- [60-62.5)	

Final Examination Policy

Successful completion of this class requires taking the final examination on its scheduled day. The final examination schedule is posted on the Traditional Undergraduate Records: Final Exam Schedules site. If you find yourself scheduled for three (3) or more final examinations on the same day, you are authorized to contact each professor to arrange a different time for one of those exams. However, unless you have three (3) or more exams on the same day, no requests for alternative final examinations will be granted.

Incompletes and Late Assignments

All assignments are to be submitted/turned in by when they are due—including assignments posted in Canvas. Late assignments are deducted 20% of its grade. Incompletes will only be assigned in extremely unusual circumstances. No assignments will be received via email nor outside their available time posted in Canvas.

Missed Exams

No examination shall be missed without prior consent or a well-documented emergency beyond the student's control. A score of zero will be assigned for an examination that is missed without prior consent or a well-documented emergency beyond the student's control. If a student misses an online test, any attempt to complete it outside of the classroom will be considered an act of academic dishonesty and will nullify the test score as well as disciplinary actions.

Artificial Intelligence (AI) Policy

You are allowed to use Artificial Intelligence (AI) tools (e.g., ChatGPT, Gemini Pro 1.5, GrammarlyGo, Perplexity, etc) to generate ideas, but you are not allowed to use AI tools to generate content (code, text, video, audio, images) that will end up in any work submitted to be graded for this course; if you do so, it'll be considered a case of academic dishonesty and prompt disciplinary action. If you have any doubts about using AI, please gain permission from the instructor.

PLNU Academic Accommodations Policy

PLNU is committed to providing equal opportunity for participation in all its programs, services, and activities in accordance with the Americans with Disabilities Act (ADA). Students with disabilities may request course-related accommodations by contacting the Educational Access Center (EAC), located in the Bond Academic Center (EAC@pointloma.edu or 619-849-2486). Once a student's eligibility for an accommodation has been determined, the EAC will work with the student to create an Accommodation Plan (AP) that outlines allowed accommodations. The EAC makes accommodations available to professors at the student's request.

PLNU highly recommends that students speak with their professors during the first two weeks of each semester/term about the implementation of their AP in that particular course. Accommodations are not retroactive so clarifying with the professor at the outset is one of the best ways to promote positive academic outcomes.

Students who need accommodations for a disability should contact the EAC as early as possible (i.e., ideally before the beginning of the semester) to assure appropriate accommodations can be provided. It is the student's responsibility to make the first contact with the EAC. Students cannot assume that because they had accommodations in the past, their eligibility at PLNU is automatic. All determinations at PLNU must go through the EAC process. This is to protect the privacy of students with disabilities who may not want to disclose this information and are not asking for any special accommodations.

Additional Course Information:

Additional PLNU policies and practices that apply to this course can be found at the following link: https://docs.google.com/document/d/18i1pUoY0iCfB8w7JKxVvACQW309X-JRB/edit?usp=sharing&ouid=116164865489739533893&rtpof=true&sd=true

Tentative Teaching Schedule

Date	Topic
13-Jan	Welcome
15-Jan	Boolean Algebra
17-Jan	Logic Gates
20-Jan	MLK Day
22-Jan	Hardware Construction
24-Jan	Project 1 Specification
27-Jan	History Byte 1: Alan Turing and the Turing Machine
29-Jan	Binary Numbers
31-Jan	The ALU
3-Feb	Project 2 Specification
5-Feb	History Byte 2: Real-Time Computation and DSPs
7-Feb	Registers
10-Feb	RAM and ROM
12-Feb	Memory Devices
14-Feb	Project 3 Specification
17-Feb	History Byte 3: The Evolution of Memory and Storage
19-Feb	Hack Machine Language
21-Feb	Project 4 Specification
24-Feb	Computer System Components
26-Feb	Custom PC Pitch Contest
28-Feb	History Byte 4: GPUs and TPUs
3-Mar	Computer Architectures
5-Mar	The Hack Platform
7-Mar	Project 5 Specification
10-Mar	Spring Break
12-Mar	Spring Break

14-Mar	Spring Break
17-Mar	History Byte 5: Intel Processors
19-Mar	Assembler
21-Mar	Project 6 Specification
24-Mar	Project 6 Time
26-Mar	x86 Processor and Addressing Modes
28-Mar	x86 Assembly Language
31-Mar	Project 7 Specification
2-Apr	History Byte 6: AMD Processors
4-Apr	The Jack Language
7-Apr	The Jack OS
9-Apr	Project 8 Specification
11-Apr	Project 8 Time
14-Apr	History Byte 7: ARM Processors
16-Apr	Easter Break
18-Apr	Easter Break
21-Apr	Final Project Specification
23-Apr	History Byte 8: Linux OS
25-Apr	History Byte 9: Single-Board Computers
28-Apr	History Byte 10: Windows OS
30-Apr	History Byte 11: Android OS
2-May	History Byte 12: Mac OSX and iOS
7-May	Final Project Presentations