

# (CS 330) Microcomputer Architecture Syllabus

Winter 2025, 4 Credits

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Office Hours: See EduCat  
Lecture/Lab Location: TSB 2506/2508

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Web page: See EduCat  
Lecture Time: 12:00-12:50 MWF  
Laboratory Time: T 12 - 2:50

**Required Materials:** ZyBook: Online resource and homework

- (1) Sign in or create an account at learn.zybooks.com
- (2) Enter zyBook code: NMUCS330TiremanSpring2025
- (3) Subscribe

**Other Requirements:** NMU issued laptop computer or suitable substitute. All necessary programs are provided. Arduino manuals are provided.

**Course Description:** *Study of how computer hardware responds to stored instructions. Construction projects with logic circuits lead to the conceptual designs of microprocessors. Assembly language programming is introduced in the context of the logic circuitry being controlled. Projects emphasize the software needed in common interfacing tasks. Prerequisite: CS 122 or instructor's permission.* - Undergraduate Course Catalog.

**Course Objectives:** The following are the course objectives. By the end of the semester, the successful student will be proficient at each one of the following objectives.

1. Through the successful completion of laboratory exercises students will demonstrate they can construct electronic circuits which employ Boolean logic concepts.
2. Through the successful completion of exams and laboratory exercises students will demonstrate their ability to represent a logical expression as a truth table, a logical equation, or a circuit.
3. Through the successful completion of exams and laboratory exercises students will explain and illustrate how components of a system work together to produce a more complex device.
4. Through the successful documentation of assembly language, students will demonstrate their understanding of how the assembly language commands operate and how their proper use produces a working assembly programs.

**Grading:** The final course grade will be determined using the following breakdown.

Category	% of class grade
ZyBook Assignments	10
Online Quizzes	10
Laboratory summaries	20
Midsemester Project	10
Final Project	10
Exam 1	12.5
Exam 2	12.5
Final Exam	15
Total	100

The final grade is a weighted calculation of the total points earned under each category. You must pass both the laboratory portion and the lecture portion of this course. If you receive a failing grade in either portion you fail the entire course regardless of you grade in the other portion.

Grade Range (%)	Letter Grade
93 - 100	A
90 - 92	A-
87 - 89	B+
83 - 86	B
80 - 82	B-
77 - 79	C+
73 - 76	C
70 - 72	C-
67 - 69	D+
63 - 66	D
60 - 62	D-
0 - 59	F

**Homework Assignments:** Homework assignments are assigned via the ZyBook and completed via ZyBook. Due dates will be posted within the ZyBook system. Complete the assignments ON TIME. The homework assignments are worth 10% of the total course grade.

**Quizzes:** There will be periodic online quizzes via EduCat. The quizzes account for 10% of the total grade.

**Exams:** There will be two regular exams and a final exam in this course. The tentative schedule for exams is as follows: Exam 1 is February 14, 2025, Exam 2 is March 28, 2025, and the Final Exam is Thursday, May 1, 2025 from 12 PM to 1:50 PM. The final exam is comprehensive. Exams are closed notes, closed book, and no calculators are allowed. Exams 1 and 2 are each worth 12.5% of the course grade while the final exam is 15%.

**Missed Exams:** If a student must miss an exam and knows before hand they are to approach the Professor before the exam day to arrange for a make-up exam date. If a serious illness or emergency comes up on the exam date then the student is responsible for contacting the Professor as soon as possible to make arrangements for a make-up exam. Note that ALL changes in the exam date and make-up exams are subject to approval of the Professor and are handled on an as-need basis. The Professor reserves the right to refuse the administration of a make-up exam if they feel the reason given is unacceptable.

**Laboratory:** Laboratory meets once a week for three hours. Attendance in laboratory **IS** taken and points may be deducted for being late to laboratory or missing a laboratory all together. **Labs cannot be made up without special approval.** The Professor retains the right to determine if your excuse is reasonable or not. Wanting to leave early for holidays or family gatherings is NOT a reasonable excuse. Laboratory is worth 20% of the final course grade.

**Semester Project:** Each lab group (1 table) will pick 1 of 4 possible semester projects. The projects are the serial port, analog-to-digital converter, pulse width modulated fan control, and the hex keypad. Each project utilizes a different part of the hardware (and later software) topics covered in CS 330. **Midsemester Project:** The Midsemester project requires the following: wiring up the hardware, testing the circuit for proper operation, creation of appropriate diagrams (circuit and timing), and writing of a mid-semester report. More details to be announced later. The total weight on the final grade for the mid-semester project is 10%. A good faith effort must be put into the completion of the mid-semester project or a

failing grade will be assigned. **Final Project:** The final project takes the mid-semester hardware project and interfaces it with the Arduino 2560 microcontroller. The students then write an Arduino program, including significant parts in AVR assembly language, which interfaces with the hardware in ways specific to each project. More details will be announced later. The following items are submitted as part of the final project: a final written report, project code with inline comments, circuit diagram, and timing diagram (or similar). The total weight on the final grade for the final project is 10%. A good faith effort must be put into the completion of the final project or a failing grade will be assigned.

**Extra Credit:** There is no extra credit given in this course.

**Calculators:** Calculators are not allowed on exams or quizzes. This includes laptops, PDA's, cell phones, and any other device capable of storing data and manipulating numbers.

**Laptop Computers:** The use of laptop computers will be governed by the following policy:

- Computers are to be used during lecture and laboratory for course work only.
- Use of computers during exams is prohibited except as allowed/agreed upon for a documented disability.
- Displaying offensive or obscene material viewable by the Professor or other students during class on a computer will receive sharp discipline.
- The University is **NOT** responsible for your laptop or files/programs on the laptop. Backup your system! We do work with part of the system later and damage to the core operating systems is possible!!
- Do not utilize software in violation of licensing agreements. Beware of copyright laws and licenses on all programs and files you download or install on a computer.
- You must not use your computer for any malicious act of software or data stealing, copying, harassment, or other misuse.

**All Other Electronic Devices:** The use of electronic devices other than a calculator in the class room is prohibited except (1) if the device is necessary for an approved documented disability or (2) if the device does not interfere with the learning environment and is being used for coursework. The use of all other electronic devices during class is prohibited at all times and strictly enforced during exams.

**Classroom Behavior:** The environment of the college classroom is to be one of exploration and learning. Although various levels of success are achieved at different times, it is still expected that the students conduct themselves in a manner of respect to both the professor and the fellow students.

**Class Cancellation:** The university does not often cancel classes but if it does local television and radio stations are informed and information is posted on the NMU website. In the unlikely event that the Professor will be absent at the last minute a sign will be posted at the entrances to the classroom. Also, information concerning make up of the missed time and/or laboratory will be sent by email to all.

**Academic Integrity:** Northern Michigan University puts a very high value on academic integrity, and violations are not tolerated. Any violation of academic integrity will receive academic and possibly disciplinary sanctions in accordance with NMU policy. See your student handbook for more information.

While it is encouraged for students to work together, there are situations where work is expected to be the student's whose name appears on the work. Using the same code and documentation (even if you change your name and modify some words), is also considered cheating. Each student is expected to learn

how to create their own work. If you have questions on what is considered appropriate, ask your professor.

**Use of Generative AI NOT Permitted:** AI writing aids such as ChatGPT are categorically not permitted at any stage of coursework in this class. Use of these tools will be treated as academic dishonesty, constituting a clear violation of NMU's Academic Dishonesty Policy. If a student is found to have used any generative AI tools for any of their work in this class, the student will be given a grade of 'F' for the course and will be referred to the Dean of Students office for discipline.

**Veterans Services:** If you are a veteran and need assistance with your benefits or are experiencing complications with your education due to military service connected issues, contact the Veteran Resource Representative in 2101 Hedgcock (227-1402 or [mrutledg@nmu.edu](mailto:mrutledg@nmu.edu)). The Veteran Resource Representative can advocate for you before the Veterans Administration and can also help you solve any veteran specific issues you may have.

**Students with Disabilities: Students with Disabilities:** If you have a need for disability-related accommodations or services, please inform the Coordinators of Disability Services in the Dean of Students Office at 2001 C. B. Hedgcock Building (906-227-1737 or [disability@nmu.edu](mailto:disability@nmu.edu)). Reasonable and effective accommodations and services will be provided to students if requests are made in a timely manner, with appropriate documentation, in accordance with federal, state, and university guidelines.

**Equal Opportunity:** Northern Michigan University does not unlawfully discriminate on the basis of race, color, religion, sex, national origin, age, height, weight, marital status, familial status, handicap/disability, sexual orientation or veteran status in employment or the provision of services, and provides, upon request, reasonable accommodation including auxiliary aids and services necessary to afford individuals with disabilities an equal opportunity to participate in all programs and activities.

**Religious and Spiritual Observance syllabus statement:** Faculty, staff, and students practice a variety of religious and spiritual traditions, which enhance the diversity of our campus community. NMU acknowledges that scheduling conflicts between required academic activities and religious and spiritual obligations are inevitable. Additionally, we recognize that some religious and spiritual obligations extend for multiple days and/or start at sundown of one day and extend through sundown of another day. In the event of conflicts, I will make every effort to help students avoid any negative academic consequences of observing religious and spiritual obligations. Students should consider the implications of missing class due to religious and spiritual obligations and should take into consideration these impacts when making decisions regarding any other absences during the term. When an exam, assignment, or class conflicts with a religious or spiritual obligation, students are responsible for notifying me a **minimum** of 7 days in advance of the date(s). You are not exempt from meeting course requirements or completing assignments in a timely manner as determined by this instructor.

## CS 330 Tentative Topics and Reading List

All Lecture days are estimates

Topic	Description and Reading material	Duration
Introduction	Introduction to the course	no class
Information as Bits	Digital Systems, Number Systems and number system conversions	2-3 lectures
Combinational Logic	Gates, boolean algebra equations, timing diagrams, circuits, truth tables	3-4 lectures
Combinational Logic II	Logic equation simplification, K-maps, DeMorgans laws	3 lectures
Binary Arithmetic and Circuits	Adders, subtractors, Unsigned and signed binary math, two's compliment math along with circuits	2 lectures
Exam I	First exam on all topics above	
Sequential Logic	SR latches, clocks, D-type flip flops, registers JK and T flip flops, non-ideal behavior	3 lectures
Datapath Components	Comparators, load registers, shifters, counters and timers	3 lectures
Datapath Components II	Register files, multifunction registers ALUs, ROM, RAM, SRAM vs. DRAM	3 lectures
Atmel 2560 Mega Architecture	Cover 2560 architecture, fetch & instruction cycles, timing diagrams, onboard memory, I/O ports	3-4 lectures
Exam II	Second exam on all topics covered since Exam I	
Assembly language Programming	Data transfer, addressing modes, laboratory examples, arithmetic and logic ops., review flags	5 lectures
Branching in programs	unconditional branching, conditional branching, relative addressing, subroutines and stack ops., utility program	5 lectures
Interfacing Topics	Handshaking, parallel data transfer, serial data transfer 1650/8250 UART, analog to digital conversion	7 lectures