CS 330 **Microcomputer Architecture** **Winter 2002**

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Office Hours: M T W F 10:00 - 11:00 AM
M W 3:00 - 4:00 PM
Other times by Appointment

Text: Digital Computer Electronics{3rd edition), by Albert Paul Malvino

This class is an introduction to the hardware and software interaction of microcomputer operation and application. The topics have been selected so that the student will acquire the basic knowledge necessary to pursue, on her/his own, any aspect of hardware or software application later desired.

Basic principles which underlie electronic computer operation, organization and programming will be studied. These include:

- Binary numbers; arithmetic and information coding - Boolean Algebra
- Digital logic circuits
- Machine and assembly language programming
- Interfacing including hardware and software aspects

Digital electronic circuitry and the accompanying binary arithmetic and digital logic will be introduced. Using digital logic circuits as building blocks complex register circuits and memory devices will be studied. The synchronized operation of combinations of these circuits on a bus structure forming a microcomputer architecture will be developed. The programmed operation of the microcomputer architecture will serve as a model for the study of machine language programming. The courses will conclude with an introduction to interfacing topics.

Grade Breakdown:

	Quizzes (Lowest I Dropped)	30%
	Labs	30%
Friday, Mar 1, 12 - 12:50 PM	Midterm Exam	20%
Thursday, May 2, 12 - 1:50 PM	Final Exam	20%

All quizzes and exams are closed book and no calculators are permitted to be used during the taking of the quizzes or exams. **Quizzes are given every Friday of the semester**. The Midterm will also most likely be on a Friday as well.

Attendance at all labs is mandatory. Make ups for quizzes and labs will only be provided for at the discretion of the instructor. This will occur only for reasonable excuses. Desire to go home for the weekend or to go hunting are not considered reasonable excuses. Informing the instructor **BEFORE** an absence is more likely to result in a make-up than informing the instructor after the absence.

Food of any kind (including snack food) is not allowed in the lab or classroom. Please do not bring it in. Drinks will be permitted as long as care is taken not to have spills occur. If excessive spillage occurs, drinks may be restricted as well.

Lab partners will be provided with toolkits for doing lab work. These kits will be checked both before and after a lab. IF your kit is found to be missing any tools, **you and your partner will be charged for the replacement** of the missing item(s). Please be sure your tools do not walk out of lab.

The instructor will make every effort to respond to all email questions received by 5 PM Monday through Friday, with a response by 10 PM Monday through Friday. The instructor will also make every effort to have all handouts available on his web site for download if you should lose your copy.

If you have a need for disability-related accommodations or services, please inform the Coordinator of Disability Services in the Disability Services Office at 1104 University Center (227-1737). 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.

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. Persons having civil rights inquiries may contact the Affirmative Action Office at 204 Cohodas (27-2420).

Course Content

I Introduction and overview

II Numbers for computers
1. Number system bases
   decimal, binary, octal, hexadecimal
2. Binary numbers as codes
   ASCII codes
3. Binary arithmetic
   addition, subtraction
   1 's compliment subtraction
   signed number codes, 2's compliment numbers

III Binary logic
1. Basic logic functions
   AND, OR, EXOR, NAND, NOR
2. Introduction to Boolean algebra
   Algebraic properties
   DeMorgan's rules
   Karnaugh Maps

IV Electrical devices to perform logic
1. The basic logic gates
2. The logic *of* arithmetic
3. The flip-flop circuit
   construction and basic operation
   flip-flop types and application
   memory and counters
4. Laboratory experiments with logic devices

V Registers
1. Buffers, counters and shift registers
2. Synchronized operation
3. The tri-state concept
4. Examples *of* registers
5. Memory devices
   addressing
   memory types
6. Laboratory examples of register and memory operations in the computer.

VI Computer architecture
1. Bus organization
2. Sequential operation *of* registers
3. Programmed instructions
   instruction fetch cycle
   instruction operation cycles

VII Assembly language programming: basic instruction types
1. Data transfer
2. Addressing modes
3. Laboratory examples
4. Arithmetic and logic operation
5. Review of flags
6. Laboratory examples

VIII Branching of the program operation sequence

1. Unconditional branching
2. Conditional branching
3. Relative addressing
4. Laboratory examples
5. Subroutines and stack operation
6. Utility program examples
7. Laboratory examples

IX Interfacing topics

1. Handshaking
2. Parallel data transfer
3. Laboratory examples
4. Serial data transfer, the A Y3-l0l5 UART
5. Optional laboratory example
6. Digital to analog and analog to digital conversion
7. Laboratory examples