CSE 241 Digital Systems

Fall 2018

Course Description

A course in digital principles which includes the following topics: fundamentals of digital logic, number systems, codes, computer arithmetic, Boolean algebra, minimization techniques, basic components of digital circuits such as logic gates and flip-flops, design of combinational and sequential circuits, memory devices, and programming logic. Recommended for sophomore-level students.

Learning Outcomes

- Understand and apply Boolean Algebra
- Understand logic gates and their operation
- Understand Karnaugh maps and apply them to simplify logic expressions
- Understand signed and unsigned integer representation and arithmetic
- MSI circuit decoders, multiplexers and design of combinational circuits
- Flip-flops and sequential circuit synthesis
- Verilog hardware description language, synthesis and simulation

Course Prerequisites

None, however familiarity with using a computer is necessary. If you do not feel comfortable with word processors, web browsers, or general computing this course may not be appropriate at this time for you and you should speak with the instructor immediately.

Textbook and Materials

Required:
Textbook: The required textbook for this course is "Digital Design: Principles and Practice" 5th Edition, by John F. Wakerly. Pearson, 2017. ISBN-13: 978-0134460093, ISBN-10: 013446009X

Lab Kit: You will also buy a lab-kit of components customized for the course, there are two options. Do not by both. If you choose not to buy a kit, the list of components is below and you are expected to have them, and can purchase them from sources of your choice.

Option 1: You can buy at Jameco using one collective part number: 2244818
It costs $22.49 + shipping and handling.

Option 2: The second part that we will use is an Arduino Uno. This is a very versatile and highly useful microcontroller board. This is often used in prototyping small circuits. You can buy both this option at Jameco using one collective part number: 2244800. If you purchase this kit you do not need to purchase the one above.
It costs $44.65 + shipping and handling.

Materials list:

Part No.	Qty.	Description
2134993	1	830-Point Breadboard with 70-Piece Jumper Wire Kit Super Combo
46252	1	QUAD 2-INPUT POSITIVE NAND GATE DIP-14
46316	1	HEX INVERTER DIP-14
46375	1	QUAD 2-INPUT POSITIVE AND GATE DIP-14
48098	1	QUAD 2-INPUT EXCLUSIVE OR GATE DIP-14
47992	1	DUAL J-K NEGATIVE-EDGE-TRIGGERED FLIP-FLOP DIP-14
46607	1	3-TO-8 DECODER/DEMULTIPLEXER DIP-16
47466	1	QUAD 2-INPUT POSITIVE OR GATE DIP-14
333973	10	LED Uni-Color Red 660nm 2-Pin T-1 3/4 Box
34761	10	LED Uni-Color Green 565nm 2-Pin T-1 3/4
1586074	1	Pushbutton Tactile Switch SPST
2258831	1	3-Pin SPDT Slide Switch
690620	20	0.25 Watt 100 Ohm Resistor Carbon Film 5%

Schedule

Lecture:
9 am - 9:50 am, MWF, Davis 101

Recitation:
R1: R 8 pm - 8:50 am
R2: R 5 pm - 5:50 pm
R3: R 4 pm - 4:50 pm
R4: W 5 pm - 5:50 pm
R5: R 9 am - 9:50 am
R6: T 10 am - 10:50 am
R7: F 1 pm - 1:50 pm
R8: R 6 pm - 6:50 pm
R9: M 5 pm - 5:50 pm

Attendance

Lectures:

Students are required to attend lectures. The absence will risk missing of important content and information. In lecture quizzes may not be announced ahead of time. If you do not show up for an exam or quiz without previous arrangements barring extreme unforeseeable circumstances, then you will not be allowed to make up the assignment.

Recitations/Labs:
If you complete your lab earlier than the full time assigned, attendance in the recitation is not required. When labs are assigned it is mandatory that you attend your assigned recitation section to perform your lab. Prelabs (if applicable) can only be signed off during your assigned lab section during the first of the recitations assigned for that specific lab. If you must miss your section, speak with your TA as soon as possible. Sections are full so attending other sections is not allowed without express permission. You are to use this time to work on your lab assignments however you may need to spend additional time outside of the recitation to complete the work. You may also use this time to work on other course related assignments.

Instructor Contact Information

Dr. Jennifer Winikus
Email: jwinikus@buffalo.edu
Website: www.cse.buffalo.edu/~jwinikus
Office Phone: 716-645-4757
Office: Davis 351

Office Hours

Unless instructed that they have changed.
Mondays 10-Noon and Thursdays 2-4pm, Davis 351
By appointment, email to arrange.

TAs will provide additional office hours which will be announced.

Academic Content

This is a tentative list of topics:
- Number Systems
- Signed Arithmetic
- Boolean Arithmetic
- Karnaugh Maps
- Combinational Logic
- Logic Gates
- Sequential Logic
- Verilog Design

Program Outcome Support:

Program Outcome Support

0: Not Supported, 1: Minimally Supported, 2: Supported, 3: Strongly Supported

CEN Program Outcome	1	2	3	4	5	6	7
Support Level		3	3	0	0	0	0	0

Grading Policies

Your grade will be comprised of:
20 % Exam 1
30 % Exam 2
15 % Homework, Quizzes, and other assignments
35 % Laboratory Assignments*
Extra credit opportunities may be offered.

Your final score for the course will be converted into a letter grade as follows:

- A: 100–94
- A-: 93–90
- B+: 89–87
- B: 86–84
- B-: 83–80
- C+: 79–77
- C: 76–74
- C-: 73–70
- D: 69–60
- F: 59–0

The instructor reserves the right to curve grades if appropriate and as they choose.

*If you score less that 60% for the lab score for the term, you will fail the course independent of overall grade.

Incompletes (I/IU): The course follows the university undergraduate incomplete policy. A grade of incomplete ("I") indicates that additional coursework is required to fulfill the requirements of a given course. Students may only be given an "I" grade if they have a passing average in coursework that has been completed and have well-defined parameters to complete the course requirements that could result in a grade better than the default grade. An "I" grade may not be assigned to a student who did not attend the course.

Prior to the end of the semester, students must initiate the request for an "I" grade and receive the instructor's approval. Assignment of an "I" grade is at the discretion of the instructor. Upon assigning an "I" grade, the instructor shall provide the student specification, in writing or by electronic mail, of the requirements to be fulfilled, and shall file a copy with the appropriate departmental office. Students must not re-register for courses for which they have received an "I" grade

Failure for Non-Attendance (FX): Students who have earned a failing grade due to lack of attendance (or participation where attendance is no applicable) will be awarded an "FX".

Collaboration Policies

Unless explicitly told, all work is to be done independently with only the assistance of TAs and the instructor. You may discuss the general concepts of assignments and what the question asks for with other students but you must not discuss answers.

Unauthorized collaboration will result in an "F" in the course as a violation of academic integrity.

Exam Policy

There will be 2 exams.
- The first exam will have three parts: practice exam, traditional exam, and correction session.
  - Practice exam: is part of your assignment grade and is done in class the lecture prior to the traditional exam.
  - Traditional exam: Wednesday, October 10th, 7pm (room TBD), all accommodation requests must be made a minimum of 1 week ahead of time. Lecture on the day of the traditional exam will be canceled. Seat assignments will go out a week ahead of time.
  - Correction session: Friday, October 12th, 7pm (room TBD), and is optional. All accommodation requests for the correction session must be made a minimum of a week ahead of time. If you have accessibility resources accommodations for exams, please consult the instructor concerning what would be appropriate for your situation for the corrections session. Seat assignments will go out a week ahead of time.
- The second exam will have two parts: the practice exam and the traditional exam.
  - Practice exam is part of your assignment grade and is done in class on the last class of the term.
  - Traditional part of the exam is scheduled by the registrar during finals week. Wednesday, December 12th, 8-11am, Davis 101 and Knox 110. Room/Seat assignments will go out a week ahead of time.

You must have a valid ID with you at the time of the exam (UB Card will suffice) and your own writing tools. You can not borrow pens or pencils during the exam. During the exam there is to be no talking or looking at your phone, doing so may result in an automatic "F" on the exam; and potentially in the course.

Any accommodations must be made in advanced barring extraordinary circumstances.

Due Dates

All submissions will be made on UBLearns in PDF form unless otherwise instructed.

Late work:
No late work will be accepted. You have a 24 hour grace period after the due date where you can submit still at no penalty, after that close out, work will not be accepted.

No work will be accepted after midnight on Friday of the last week of classes barring extraordinary circumstances.

If a review of your assignment grading is desired, you have 1 week from the time the grade is released to request a review. Corrections are not allowed, with the exception of the special

policies for exam 1 (these will be detailed further prior to the exam).

Email Policy

Students are responsible for email sent to their official University at Buffalo email address. Communication will not be done with non-university email addresses. A level of professionalism is expected with all communications.

Accessibility Resources

If you have any disability which requires reasonable accommodations to enable you to participate in this course, please contact the [Office of Accessibility Resources](#), 60 Capen Hall, 716-645-2608, and also the instructor of this course. The office will provide you with information and review appropriate arrangements for reasonable accommodations.

University Policies

You are expected to adhere to all university policies, including those listed below and not listed.

Academic Integrity Policy:
https://catalog.buffalo.edu/policies/integrity.html

Policy on Accommodations:
https://www.buffalo.edu/administrative-services/policy1/ub-policy-lib/reasonable-accommodation.html

The Office of Equity, Diversity and Inclusion provides many resources including the following policies to be followed:

Discrimination and Harassment:
http://www.buffalo.edu/administrative-services/policy1/ub-policy-lib/discrimination-harassment.html

Religious Accommodation and Expression:
http://www.buffalo.edu/administrative-services/policy1/ub-policy-lib/religious-accommodation-expression.html

Departmental Academic Integrity Policy:
https://engineering.buffalo.edu/computer-science-engineering/undergraduate/resources-for-current-students/academic-integrity-students.html

Student Code of Conduct:
http://www.buffalo.edu/content/dam/www/studentlife/units/uls/student-conduct/ub-student-code-of-conduct.pdf

Classroom Behavior Expectations:
https://catalog.buffalo.edu/policies/obstruction.html

Explanation of Grades:
https://catalog.buffalo.edu/policies/explanation.html

Departmental Statement on Academic Integrity in Coding Assignments and Projects

All academic work must be your own. Plagiarism, defined as copying or receiving materials from a source or sources and submitting this material as one's own without acknowledging the particular debts to the source (quotations, paraphrases, basic ideas), or otherwise representing the work of another as one's own, is never allowed. Collaboration, usually evidenced by unjustifiable similarity, is never permitted in individual assignments. Any submitted academic work may be subject to screening by software programs designed to detect evidence of plagiarism or collaboration.

It is your responsibility to maintain the security of your computer accounts and your written work. Do not share passwords with anyone, nor write your password down where it may be seen by others. Do not change permissions to allow others to read your course directories and files. Do not walk away from a workstation without logging out. These are your responsibilities. In groups that collaborate inappropriately, it may be impossible to determine who has offered work to others in the group, who has received work, and who may have inadvertently made their work available to the others by failure to maintain adequate personal security. In such cases, all will be held equally liable.

Departmental Policy on Violations of Academic Integrity

The CSE Department has a zero-tolerance policy for AI violation.
All AI violation cases will be reported to the department, school and university, and recorded.
Even the 1st offense will receive "F" for the course, unless the instructor deems it appropriate to reduce the penalty.
Subsequent violation of AI in any form and in any other course will automatically result in a "F" grade, with no exception.

Copyright Policy

Materials used in connection with this course may be subject to copyright protection under Title 17 of the United States Code. Under certain Fair Use circumstances specified by law, copies may be made for private study, scholarship, or research. Electronic copies should not be shared with unauthorized users. If a user fails to comply with Fair Use restrictions, he/she may be liable for copyright infringement.

For more information on the SUNY policy of copyright ownership regarding materials in courses: http://system.suny.edu/academic-affairs/faculty/faculty-ownership/

Tentative Schedule

The schedule and content is subject to change. Please pay attention to announcements for details about important dates.

Week	Date	Material
1	M- 8/27	Introduction
1	W- 8/29	Introduction to Number Systems
1	F- 8/31	Arithmetic
2	M- 9/3	Labor Day- No Class
2	W- 9/5	Signed numbers and arithmetic
2	F- 9/7	Other number systems
3	M- 9/10	Switching Algebra
3	W- 9/12	Switching Algebra
3	F- 9/14	Switching Algebra
4	M- 9/17	Logic Gates and Combinational Logic
4	W- 9/19	Minimization
4	F- 9/21	K-Maps
5	M- 9/24	More Gates
5	W- 9/26	Documentation
5	F- 9/28	Combinational Logic - Arithmetic
6	M- 10/1	Combinational Logic - Arithmetic and MSI devices
6	W- 10/3	Combinational Logic - MSI
6	F- 10/5	Review Session
7	M- 10/8	Practice Exam in Lecture
7	W- 10/10	Exam- 7pm - No Lecture
7	F- 10/12	Lecture: Verilog intro Corrections Session for Exam - 7pm

8	M- 10/15	**Verilog with combinational logic**
8	W- 10/17	**Verilog with combinational logic**
8	F- 10/19	**Verilog with combinational logic**
9	M- 10/22	**Shifting and Rotating**
9	W- 10/24	**Timing**
9	F- 10/26	**Sequential logic intro, Latches**
10	M- 10/29	**Sequential logic, triggers and D Flipflops**
10	W- 10/31	**Sequential logic, T and JK**
10	F- 11/2	**Sequential logic, Counters and Verilog**
11	M- 11/5	**Sequential logic, Shift Registers and FSM intro**
11	W- 11/7	**FSM intro**
11	F- 11/9	**FSM structure and analysis**
12	M- 11/12	**FSM design**
12	W- 11/14	**More FSM Design- ASM**
12	F- 11/16	**FSM and Verilog**
13	M- 11/19	**FSM and Verilog**
13	W- 11/21	**Thanksgiving Break- No Class**
13	F- 11/23	**Thanksgiving Break- No Class**
14	M- 11/26	**FSM Wrap Up**
14	W- 11/28	**Memory and storage**
14	F- 11/30	**Memory and Storage**
15	M- 12/3	**Component level concepts**
15	W- 12/5	**Component level concepts**
15	F- 12/7	**Last day of classes- Final exam review**
16	M- 12/10	**Final Exam Week- No Class**

16	W- 12/12	Final Exam: 8-11am
16	F- 12/14	Final Exam Week- No Class

Final exam is TBA- Wednesday, December 12th, 8-11am in Davis 101 and Knox 110- Room/seat assignments will go out a week ahead of time.

Tentative Schedule for Assignments:
These are the weeks the assignments are planned to be released, not when they are due. All assignments and due dates are tentative and may change. In general you may assume that the due date is one week from the assigned date. Points per assignment may vary.

      Week 1: Homework 1 and 2, Lab 0
      Week 3: Homework 3, Lab 1
      Week 4: Homework 4, Lab 2
      Week 5: Homework 5, Lab 3
      Week 6: Lab 4
      Week 7: Exam Week, Homework 6, Lab 5
      Week 8: Lab 6
      Week 9: Homework 7, Lab 7
      Week 10: Homework 8, Lab 8
      Week 11: Homework 9, Lab 9
      Week 12: Homework 10, Lab 10
      Week 13: Thanksgiving Break, Homework 11
      Week 14: Homework 12, Lab 11
      Week 15: Last week of classes, Homework 13, Lab Practical
      Week 16: Final Exam Week

Important Dates

First Day of Classes: Monday August 27
Last Day to Drop/Add: Tuesday September 4
Last Day to Resign: Friday November 9
Last Day of Classes: Friday December 7

All content in the syllabus is subject to change based on the needs of the class and the discretion of the instructor