ECE 212: Fundamentals of Logic Design
Syllabus - Fall 2018

Section 001: Room 1025, EB2, Mon/Wed 11:45am – 1:00pm

Instructor: Dr. Robert Evans, Teaching Associate Professor, ECE
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Office Hours: Monday 10:00-11:00 AM, Thursday 3:00-4:00 PM, or by appointment

Teaching Assistants:

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TA Office Hours will be by appointment.

Course Content
The following topics will be covered in this course (All chapter numbers refer to chapters in the required course textbook:

- Review of number systems and binary arithmetic (Chapter 2)
- Switching Algebra, Combinational Circuit Analysis, Combinational Circuit Synthesis,
- Logic Minimization (Chapter 4)
- Introduction to Hardware Description Languages (HDL) (structural and dataflow
- styles of Verilog HDL) (Chapter 5)
- Combinational Logic Building Blocks (Chapter 6)
- Sequential Logic, State Machine Analysis, and State Machine Design (Chapter 7)
- Sequential Logic Building Blocks and Synchronous Design Methodology (Chapter 8)
- Memory, Caches, and Memory Hierarchies (Chapter 9 and notes)

Student Learning Outcomes
By the end of this course, the student is expected to be able to:

- Simplify Boolean algebraic expressions by applying Boolean algebra theorems.
- Express functions in canonical sum-of-product and canonical product-of-sum forms.
- Determine the function performed by a combinational- or sequential-logic circuit through analysis.
- Design and synthesize a combinational or a sequential logic circuit to perform a desired function.
- Minimize the cost, complexity, power, and latency of a combinational or a sequential logic circuit by applying various logic minimization approaches, including Boolean simplification, and Karnaugh Maps.
- Describe and simulate a combinational or a sequential logic circuit using the Verilog hardware description language.
- Implement a combinational or a sequential logic circuit using a programmable logic device.

- Design combinational logic building blocks including decoders, encoders, multiplexers, comparators, adders, subtractors, ALUs, and parity generators/checkers.
- Design sequential logic building blocks including latches, flip-flops, counters, and registers.
- Construct complex digital subsystems using meaningful arrangements of decoders, encoders, multiplexers, comparators, adders, subtractors, ALUs, parity generators/checkers, counters, and/or registers.
- Design a datapath and the control logic to orchestrate the datapath.
- Determine the most appropriate memory technology for a particular memory application, by matching technology attributes to requirements.
- Design a cache.
- Simulate the operation of cache given a memory address trace.
- Determine the average memory access time given a memory address trace and a memory hierarchy.

Prerequisites

C- or better in ECE 109 or in ECE 206. EE or ECE Majors Only

GER Information

This course is not designated as a General Education Requirement.

Textbook and Fees

There is one **required** textbook for this course:

- Digital Design: Principles and Practices, **Fourth or Fifth** Edition. John F. Wakerly. Prentice Hall, Upper Saddle River, NJ, 2006. Note: The 3rd edition is not acceptable!

Hardware

- Students in this course will be required to purchase the following hardware components: breadboard, wire cutters/strippers, and batteries (4 D Cells).
- The components may be purchased through the NCSU bookstores or online (Amazon, etc.). (See Extra Expenses below).
- The following hardware components will be provided by the department parts shop: electronic components (switches, LEDs, resistors, capacitors, TTL chips, wire, etc.)

Computing Environment

- All computer simulation tools used in the course are available on the EOS system. All students should have an EOS account. Personal computers may also be used.

Course Web Pages

- Materials (handouts, assignments, message boards, etc.) will be accessible through the course Moodle Web site (www.wolfware.ncsu.edu). Only registered students will have access to these materials. Grades for homework exercises and exams will be posted on the Moodle site as well.

Course Organization and Schedules

- The separate schedule spreadsheet provides the projected schedule for the lectures and the associated reading assignments, and due dates for homework, electronic homework and exams.
- The schedule is flexible and subject to change due to inclement weather, etc..
- Changes to the schedule will be communicated in class and/or on the Moodle web site.

Assignments and Grading

The overall class grade will be a weighted average of the following components:

- Homework exercises - 20 points
    - (Each of the 9 homework exercises will have a weight of 2.22 points each for a total of 20 toward the final grade.
- Electronic Homework (eHW) - 20 points
    - eHW 1 - 5 points
    - eHW 2 - 5 points
    - eHW 3 - 10 points
- Exam 1 - 15 points
- Exam 2 - 15 points
- Exam 3 – 15 points
- Final Exam - 15 points

Homework

All homework is to be done *individually*. Though you can discuss concepts with other students, the instructor, and the TA's, it is crucial that you know how to do every homework assignment on your own. This is the same material that will be on the exams. Evidence of copying or other unauthorized collaboration will be investigated as a potential academic integrity violation. **The minimum penalty for cheating on homework is a grade of -100 on the assignment.** If you are tempted to copy because you're running late, you will be better off missing the assignment and taking a zero.

Late Assignment Policy

- Homework assignments are due at the beginning of the class period on the due date. Homework papers must be stapled WITH A SIGNED COVER SHEET.
- Homework assignments turned in after the scheduled class period will be penalized based on the following schedule:
    - Same day before 5pm: 20% of your score for the particular homework assignment will be deducted.
    - Next day before 5pm: 40% of your score for the particular homework assignment will be deducted
    - Thereafter: No credit (See exceptions for Excused absence)
- Electronic homework assignments are due at the student's scheduled grading session.
- There is a penalty of 10 points if the student misses the grading session and the electronic homework assignment is graded the same day, assuming that can be arranged.
- An additional 10 points per day will be deducted if completed within the assigned grading period (see class schedule).
- There is a 50 point penalty after grading sessions have ended for that assignment.

Attendance Policy

- Full attendance at classes and examinations is expected of all students in accordance with the University's attendance policy.
- Roll will be taken periodically during class.
- http://policies.ncsu.edu/regulation/reg-02-20-03

Policy on Absences and Scheduling Makeup Work

- Excused absences are defined in accordance with the university's attendance policy http://policies.ncsu.edu/regulation/reg-02-20-03.

- Lectures: For both excused and unexcused absences, the student must obtain lecture notes from a classmate or the Moodle site (if posted)
- Homework and electronic homework assignments: If an excused absence prevents timely completion of an assignment, the instructor will arrange either an extension or, if this is not possible, a makeup assignment. If an unexcused absence prevents timely completion of an assignment, the late assignment policy will be applied.
- Tests: A makeup test will be arranged in the case of an excused absence. A grade of 0 will be given in the case of an unexcused absence.

Exams

There will be two regular exams (18% each) and one comprehensive final exam (24%). All exams will be closed book and closed notes. Regular exams will be administered during regular class periods, on or close to the dates listed below. The final exam will be given according to the university schedule, also given below.

- Exam 1: Wednesday, September 24 (tentative)
- Exam 2: Monday, October 22 (tentative)
- Exam 3: Monday, November 19 (tentative)
- Final exam: Monday, December 17, 8:00-11:00 am

Attendance at all exams is mandatory. Only University-approved excuses will be accepted, provided that they are accompanied by the appropriate official documentation. Makeup exams may be given for excused absences, at the discretion of the instructor. If you miss an exam without an acceptable excuse, you will receive a zero for that exam.

Do not ask for permission to take the final exam early or late because of family travel plans. These requests will not be granted.

Evidence of cheating on any exam will be investigated. If there is sufficient cause, the incident will be referred to the Office of Student Conduct as an Academic Integrity violation. **The minimum penalty for cheating on an exam is a grade of zero on the exam.** See the NCSU Code of Student Conduct for information about what constitutes cheating.

Final Course Grade

The final grade for the course will be based on a weighted average of the above components. The +/- grading system will be used for this course.

Numerical Score	Letter Grade
97 ≤ score ≤ 100	A+
92 ≤ score < 97	A
90 ≤ score < 92	A-
87 ≤ score < 90	B+
82 ≤ score < 87	B
80 ≤ score < 82	B-
77 ≤ score < 80	C+
72 ≤ score < 77	C
69 ≤ score < 72	C-
65 ≤ score < 69	D+
60 ≤ score < 65	D
57 ≤ score < 60	D-
0 ≤ score < 57	F

Incomplete Grade

The IN grade will be assigned in accordance with university policy, which states: ``At the discretion of the instructor, students may be given an IN grade for work not completed because of a serious interruption in their work not caused by their own negligence." IN is only a temporary grade and must be converted to a letter grade by the end of the next regular semester, by completing the missed work. University policy for IN grades can be found at http://policies.ncsu.edu/regulation/reg-02-50-03 .

Class Policies and Resources

Preferred Means of Communication:

The best way to reach me is through email. The preferred email is ece212-fall-2018-sup-33bcvw3@wolfware.ncsu.edu . Emails to this address will be seen by me and by all of the TAs, so you have a better chance of getting a quick answer. If you get an answer from me, or from a TA, please continue to include ece212-fall-2018-sup-33bcvw3@wolfware.ncsu.edu in your replies, so that everyone can see the discussion.

If you want to communicate with me personally, send email to **rjevans@ncsu.edu**. Unless the email needs to be confidential, I will most likely include ece212-fall-2018-sup-33bcvw3@wolfware.ncsu.edu when I reply.

I also highly encourage the use of the Moodle Discussion Forum. This allows other students to see your question, and the answer, so that we don't have to answer the same question 20 times. I also encourage students to answer each other's questions, as long as you don't provide solutions to homework or programming problems.

I am also available by phone during normal office hours: 919-513-0987.

Email aliases: ece212-fall-2018-sup-33bcvw3@wolfware.ncsu.edu (instructor and TAs)

All class announcements will be posted to the Moodle site's **Announcements** forum. All announcements will also be emailed to all students, because everyone is forced to subscribe to the Announcements forum. The Moodle site will also contain links to homework assignments and solutions, lecture notes, past exams, and other relevant information. You are expected to check the Moodle site frequently for homework assignments and other timely information.

Discussion Forums are provided for on-line class discussions. Students may add a new topic to a forum or reply to a previous posting. Please make sure that posted material is appropriate and course-related. Do not post off-color jokes, offensive material, job listings, for-sale ads, virus alerts, etc. Do not post homework solutions.

Office Appointments

You can drop by my office anytime, but if you want to make sure I'm available, call or email me to arrange an appointment. My door is open, and I will make every effort to meet with you at a convenient time.

Regrading Requests

If you have discussed your grading on an assignment with your TA and are still not satisfied, you may submit a request to me within **one (1) week** of the graded assignment being returned to you. You must write a cover sheet explaining why you feel you deserve additional points on a given problem, attach it to the front of your graded paper, and give it to me either in class or my office. Regrading requests will **NOT** be considered more than one week after the assignments are returned.

Academic Integrity

Consultation on assignments is encouraged, but copying of solutions is not. Evidence of copying or any other use of unauthorized aid on exams, homework, programming assignments, or problem sessions will be investigated and potentially referred to the Office of Student Conduct as a violation of the Code of Student Conduct.

For more information on the Code of Student Conduct, see:
http://studentconduct.ncsu.edu
http://policies.ncsu.edu/policy/pol-11-35-01

Any work submitted for this class is subject to the *Honor Pledge*: "I have neither given nor received unauthorized aid on this test or assignment." An Honor Pledge statement must be signed for every exam. For other assignments, it is the understanding and expectation of the instructor that the submission of work with your name on it means that you neither gave nor received unauthorized aid.

Students with Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 515-7653.
http://dso.dasa.ncsu.edu/

For more information on NC State's policy on working with students with disabilities, please see: http://policies.ncsu.edu/regulation/reg-02-20-01

Inclement Weather

The class will follow the University's closure policy. If classes are not cancelled, I will make every effort to be in class on time, and so should you. Please do not send me email asking whether class is going to meet. Instead, check the University website or the weather hotline (513-8888). If possible, I will provide video material to make up for a cancelled class.

Remote sites: If your local site cancels class due to inclement weather, I do not expect you to come to class. I do, however, expect you to view the recorded lecture and submit online assignments. Extended and widespread power outages can result in deadline extensions.

Laboratory Safety, Physical Activity, and Field Trips

There is no laboratory, physical activity, or field trip associated with this course.

Extra Expenses

This course has no extra expenses beyond the costs of the required textbook.

Transportation

As there are no field trips or internships associated with this course, there are no expected transportation requirements.

Course Evaluation

Online class evaluations will be available for students to complete during the last two weeks of class:

Students will receive an email message directing them to a website where they can login using their Unity ID and complete evaluations. All evaluations are confidential; instructors will never know how any one student responded to any question, and students will never know the ratings for any instructors.

Evaluation website: http://go.ncsu.edu/cesurvey
Student help desk: classeval@ncsu.edu
More information about ClassEval: https://oirp.ncsu.edu/surveys/classeval

ABET Accreditation

Our ECE department is participating in ongoing accreditation with ABET. Your complete, graded work (exams, problem sessions, homeworks, etc.) will be randomly **copied** and held for this accreditation before it is returned to you.

Important Dates

Administrative:

Aug 22	First day of classes.
Sept 3	Labor Day – University Holiday
Sept 5	Census Date / Official Enrollment Date – Last day to drop without a "W"
Oct 19	Drop/Revision Deadline
Nov 21	Thanksgiving Break
Dec 5	Last day of classes.

Class:

Sept 24	Exam 1 (tentative date)
Oct 10	e-Hmwk 1 Due
Oct 31	e-Hmwk 2 Due
Oct 22	Exam 2 (tentative date)
Nov 19	Exam 3 (tentative date)
Dec 3	e-Hmwk 3 Due
Dec 17	Final Exam (8:00-11:00 am)

Updated 9/8/2018