WESTERN UNIVERSITY
Dept. of Electrical & Computer Engineering

DIGITAL LOGIC SYSTEMS
ECE 2277a: Introductory Information (Unit 0)

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Outline of this Presentation

- Motivation for the course
- Goals
- Course Related Information
- Recommendations

Motivation

- Digital systems play a prominent role in our everyday life
- We often refer to the present technological period as DIGITAL AGE
- Digital Systems are used in communications, business transactions, traffic control, medical treatment, weather monitoring, the Internet etc.
- Home appliances such as TV, radio, dishwasher, microwave, oven etc. are all digital systems
- Many more examples can be seen that use digital systems such as Automobiles, Smartphones, tablets, and computers etc.
- The list of applications that use digital systems goes on and on

Motivation

- Digital systems have revolutionized our world: cell phones, internet, rapid advances in medicine, etc.
- Digital systems use semiconductor technology, and the semiconductor industry is growing very rapidly
- For example, the semiconductor industry grew from $21 billion in 1985 to $335 billion in 2015
- New semiconductor materials and fabrication techniques for digital systems are being discovered and invented
- Therefore, it is important that we understand the fundamental concepts that are used in the design and implementation of digital systems, which is the motivation for this course

Goals

- To understand the fundamental principles used in the systematic design of digital systems
- To learn how the digital systems are designed, and how they work (Theoretical aspects)
- Also, to learn how digital systems are designed, implemented, and verified (Practical aspects) – using industry standards

- Get a good grade!

Course Information

Course Description

- This course introduces students to design and analysis of digital electronic devices. Students will learn fundamental concepts of digital systems and apply those concepts to design problems. Three themes are emphasized: representation of digital processes using algorithms, a modular approach to design by partitioning complex systems into subsystem hierarchies, and hardware implementation and use of programmable devices.

Topics Covered

1. Number Systems
2. Boolean Algebra and Logic gates
3. Gate-Level Minimization
4. Combinatorial Circuits
5. Synchronous Sequential Circuits
6. Registers and Counters
7. Implementation of Digital Circuits (laboratory exercises)

Academic Calendar Copy/Pre-, Anti-, and Co-requisites

- **Academic Calendar**

Theory of Boolean algebra, switching circuits, Venn diagrams; Karnaugh maps; logic and memory systems, design of combinational and sequential switching machines; electronic switching circuits; data coding, storage, transmission; basic design of digital computers.

- **Antirequisite**

The former ECE3339A/B

- **Prerequisites**

Physics 1302 A/B or Physics 1402A/B or the former Physics 1026.

- **Corequisite(s)**

ECE 2205A/B or registration in Integrated Engineering or Software Engineering Program.

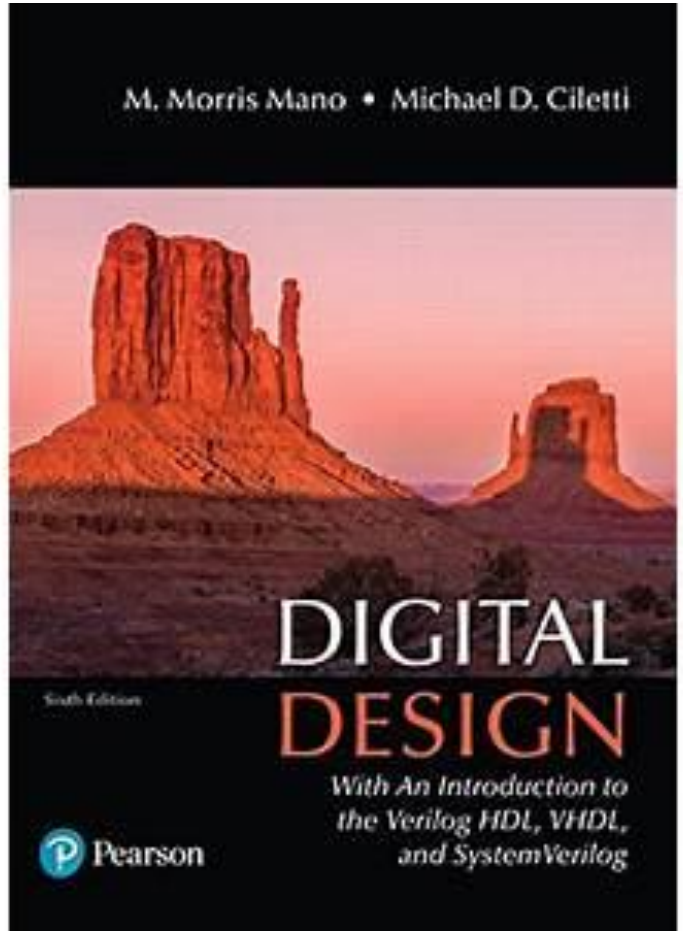
Textbook for the Course

- Title: *Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog*,
- Authors: M. M. Mano and M. D. Ciletti,
- Publisher: Pearson
- Edition: 6th ed., 2018,

(you may use the 5th ed., 2013 too)

- ISBN: 9780134549897

(0-13-277420-8 for the 5th ed.).



Textbook for the Course (Contd.)

There are three options for purchasing the textbook from Western's bookstore:

1. A traditional printed copy (ISBN 9780134549897).
2. An electronic copy with a perpetual digital license (ISBN 9780134529578).
   - This provides you with electronic access to the textbook for the rest of your life.
3. An electronic copy with a subscription digital license (ISBN 9780134529561).
   - This is the least expensive option
   - It provides you with electronic access to the textbook for 180 days. (Longer if you renew your subscription.)

It is only required to purchase the textbook using **one** of these options.

Course Website

- The course website is an integral part of this course. Familiarize yourself with the course website
- All course material including lecture slides, pre-recorded videos (from previous years), laboratory exercises, project details, supplementary material announcements etc. will be posted to the course website
- Lecture slides, and pre-recorded videos (from previous years) will be organized by unit in “Course Content”.
- All laboratory reports and project report must be submitted through portals on the course website
- Laboratory timetable, midterm details, instructions for midterm and final exams will be posted to the course website
- It is your responsibility to keep track of postings done to the course website on a regular basis

General Learning Objectives (CEAB Graduate Attributes)

Knowledge Base	I	Use of Engineering Tools	I	Impact on Society and the Environment	
Problem Analysis	I	Individual and Team Work		Ethics and Equity	
Investigation		Communication Skills		Economics and Project Management	
Design	D	Professionalism		Life-Long Learning	

I: Introductory

D: Intermediate

Course Evaluation: Components of Your Grade (100%)

Course Component	Weight
Laboratory Exercises (3)	20%
Project	10%
Midterm	25% / 0%
Final examination	45% / 70%

- To obtain a passing grade in the course, a mark of 50% or more must be achieved on the final examination, laboratory exercises, and project components. A final examination or laboratory exercises or project mark of <50% will result in a final course grade of 48% or less.
- For the midterm test and final examination, the **greater** (25% midterm + 45% final) or (0% midterm + 70% final) will be used to evaluate each student's grade.

Laboratory Exercises (20%)

- The ‘laboratory exercises’ component consists of three exercises (will be posted on the course website)
- Each laboratory exercise consist of:
  - Designing logic circuits using software, which can be done prior to attending the laboratory session,
  - And, implementing the design and testing that circuit on a FPGA development board during the laboratory session.
- Students must demonstrate their laboratory work to TAs at the end of each laboratory session
- Attendance in the laboratory is mandatory
- The details of how to prepare the report, the marking scheme, and the submission deadline for each laboratory exercise and the project will be posted on the course website.

Laboratory Exercises (20%) (contd.)

- Lab 0: Is a tutorial laboratory exercise.
  - Weeks of September 16 and September 23 are earmarked for this tutorial laboratory exercise.
  - No grades will be awarded for this exercise, and no report need be submitted
  - If you choose not to complete this laboratory exercise during the assigned laboratory slots, you take responsibility for installing and running Quartus without any assistance!
- Subsequent laboratory exercises and their submission deadlines will be posted on the course website
- This course has three graded laboratory exercises that include pre-lab design work.
- You will need Intel Quartus Lite to complete the labs.
  - It's free, it runs natively on Windows and Linux. It *probably* runs on OSX with Parallels, but we **have not tested that**.
  - A tutorial for installing Quartus Lite will be posted on the course website under "Course Content" and will be demonstrated during tutorial sessions

Laboratory Exercises (20%) (contd.)

- You may seek for help from your instructor, TAs and your classmates.
- All labs must be completed individually
- Once you understand the laboratory exercise, solve it by yourself and demonstrate it to your TA at the end of the laboratory session
- TAs may ask questions about your laboratory work to help them evaluate it
- Grade will be assigned based on your demonstration of design, submitted working model of the design, and answers you provide to questions asked by your TA

Project (10%)

- The project will be similar in format to that of the laboratory exercise but would be more open-ended design problem and would require a more extensive and detailed written report
- Students can complete their projects on their own computers using a free software tool
- Upon completion, each student must upload a project report to the course website
- The details expected in the project report, the marking scheme, and the submission deadline for report submission will be posted on the course website.

Midterm Test (25%)

- The midterm test will be held on Friday, Nov. 1, 2024, 3:45-5:15 pm
- Students will be notified of the format, instructions, and place of midterm test through the course website in advance of the test
- The midterm is expected to be an **in-person and closed-book** test.
- The midterm test is **optional**, if students do not complete the midterm test, that the weight of midterm test will be added to the weight of the final examination

Final Examination (45%)

- The final examination will take place during the regular examination period.
- The final examination will be an **in-person and a closed-book test.**
- Instructions for final exam would be posted to the course website well in advance of the exam

Late Submission Policy

- Laboratory reports should be submitted before leaving the laboratory session
- Project reports should be submitted after demonstrating the design circuit.
- Late submission of these reports is not accepted.

Special Permissions

- The midterm test is **optional**. If you do not write the midterm, your final exam will automatically be reweighted to 70% of the course grade.
  - There is no need to submit a “self-declared absence” if you cannot write the midterm test
  - No make-up midterm will be scheduled, anyone who misses the midterm will have their final exam reweighted.
- If you cannot complete a laboratory exercise/project, or unable to write the final exam, contact the Undergraduate Services ASAP with documentation. Also, contact your instructor
  - Because laboratory exercises/project have extended completion deadlines (i.e., 2 weeks of your own time to complete them), “self-declared absence” generally won’t be sufficient to avoid the submission deadline requirement.

How to Get Help?

- Contact your instructors, in person, or via Zoom by appointment please.
- Seek help from your TA(s) during scheduled laboratory sessions or by appointment.
- Use of personal email is discouraged for course related questions
- If you must contact your instructors or TAs, please use your uwo email ID, with the subject line as ECE 2277

Course Instructors

- Dr. Anestis Dounavis (Section 1)
  TEB 253, 519-661-2111 ext. 81255, adounavi@uwo.ca
  Consultation hours: By appointment, in person or via Zoom
- Dr. Arash Reyhani-Masoleh (Section 2)
  TEB 243, 519-661-2111 ext. 81253, areyhani@uwo.ca
  Consultation hours: By appointment, in person or via Zoom
- Dr. Raveendra K. Rao (Section 3)
  ACEB 4457, 519-661-2111 ext. 88231, rrao@uwo.ca
  Consultation hours: By appointment, in person or via Zoom

Teaching Assistants (TAs)

- Know your TAs by their names and their email addresses (will be made available on the course website)
- You can get help from your TAs during laboratory sessions and tutorial classes
- You can reach your TA over email

Recommendations

- Attend all lectures, tutorials, and laboratory sessions
- Make it a practice to go over the course material after every lecture and laboratory session
- Be sincere and submit laboratory/project reports on time
- Go through all lecture slides and practice worked examples in the textbook and try and solve problems at the end of Chapters from the textbook
- Be inquisitive and question yourself about contents taught in the course
- Try and relate concepts taught in the course to everyday life