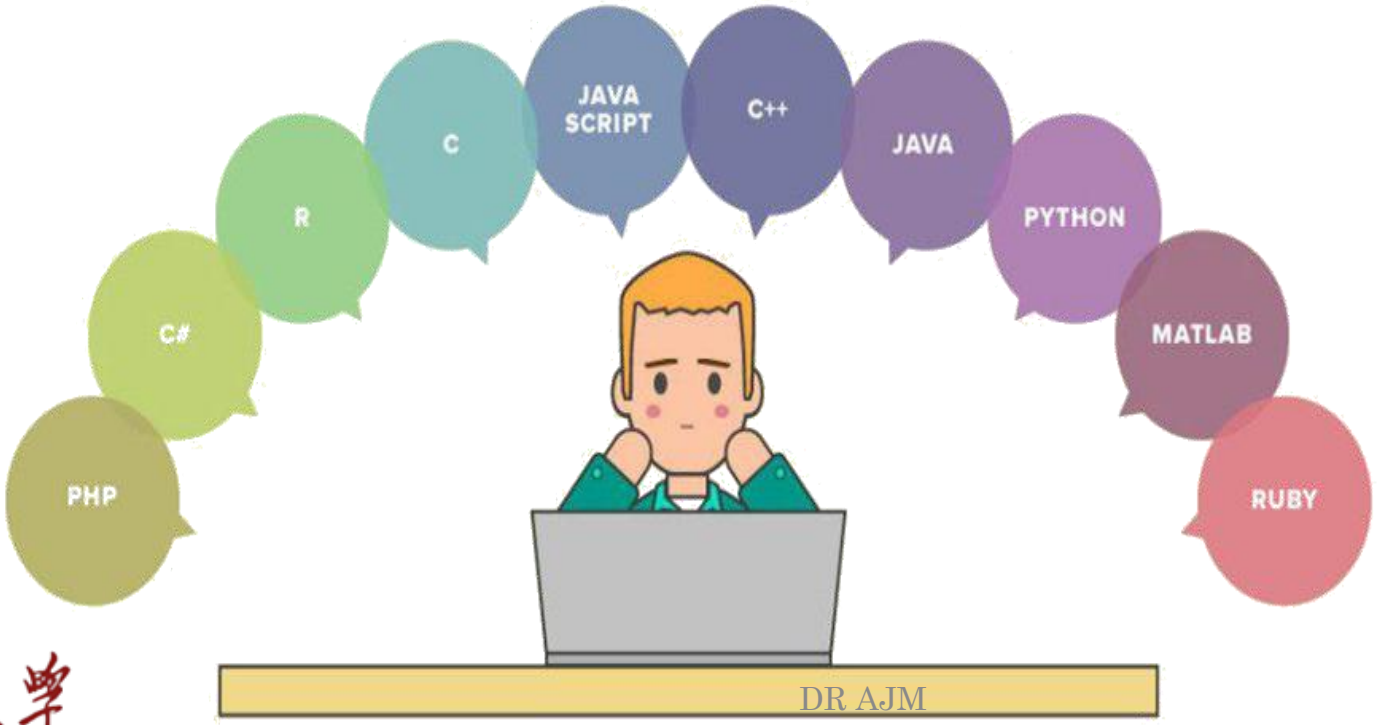
Jiangxi University of Science and Technology

DIGITAL SYSTEM DESIGN

Lecture0101 introduction / History

Nihau

- Let us have a brief view to our course
- Don’t worry we will learn lots of thing this semester



你好

Nǐ hǎo

Who Am i?

Dr. Ata Jahangir Moshayedi

Ph.D. Electronic , in the Field of Mobile olfaction system
Pune University, India

EMAIL:

Academic:
E-mail: ajm@jxust.edu.cn
moshayedi@iaukhsh.ac.ir
moshayedi@electronics.unipune.ac.in

Personal:
moshaydi@gmail.com

Prof Associate :

- **S 203, School of information engineering Jiangxi university of science and technology, China**

Web page
www.ajmoshayedi.ir

Visiting faculty of Azad University, IRAN
Researcher in the field of robotic and Automation
MSc. Instrumentation
BE. Power electronic

Course Meeting Times

Subject: Digital Logic Design

- **Date:**
- **Classroom**
- **Time:**
  - **Period 1:**
  - **Period 2:**

- **Date:**
- **Classroom**
- **Time:**
  - **Period 1:**
  - **Period 2:**

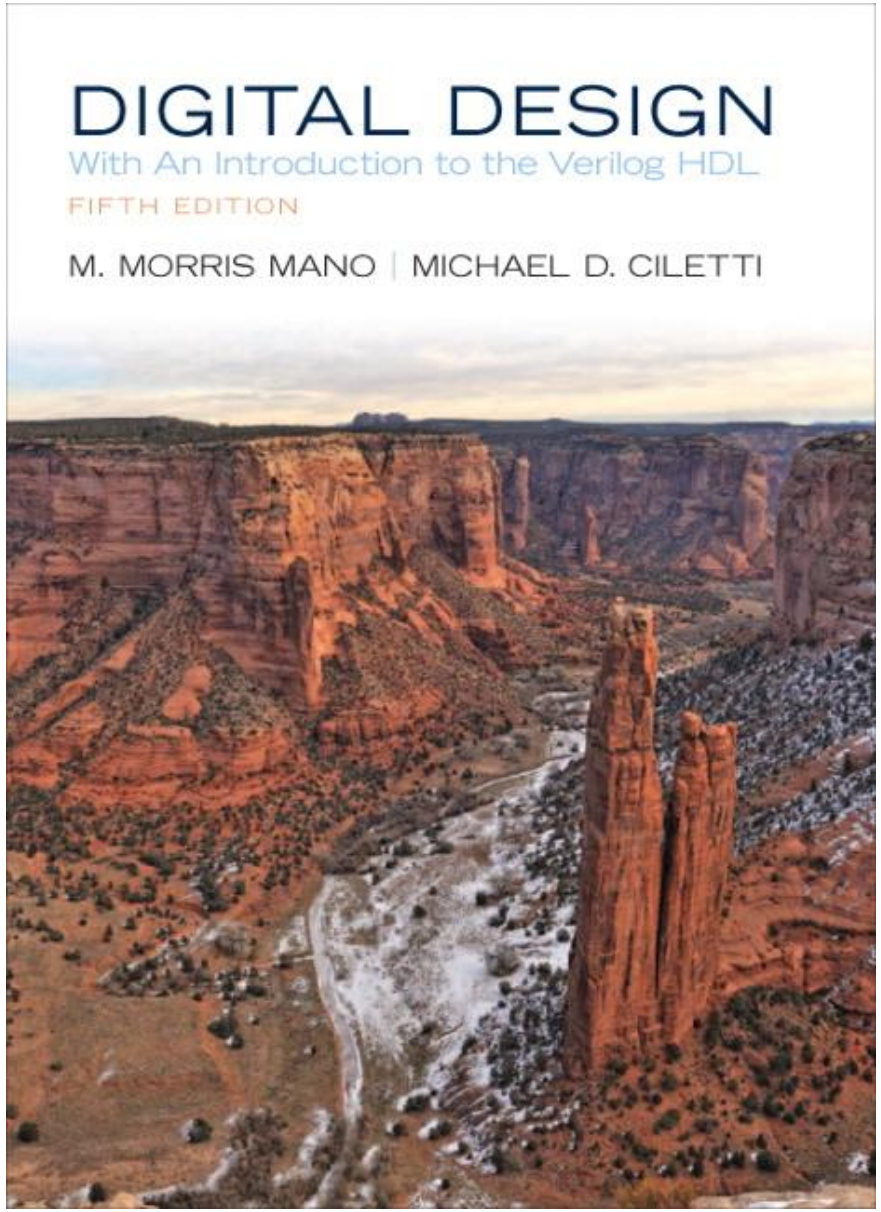
- **Z409 is at the huangjin campus**

Reference book

Digital Design

With an Introduction to the Verilog HDL

FIFTH EDITION



- M. Morris Mano

Emeritus Professor of Computer Engineering

California State University, Los Angeles

Michael D. Ciletti

Emeritus Professor of Electrical and Computer Engineering

University of Colorado at Colorado Springs

What Is Digital Logic Design?

Digital logic design is a system in electrical and computer engineering that uses simple number values to produce input and output operations. As a digital design engineer, you may assist in developing cell phones, computers, and related personal electronic devices. Continue reading to find out what training can develop skills in function algorithms and binary conversion. Schools offering Computer Science degrees can also be found in these popular choices.

- A digital system is a combination of devices designed to manipulate logical information or physical quantities that are represented in digital form; that is, the quantities can take on only discrete values.
- These devices are most often electronic, but they can also be mechanical, magnetic, or pneumatic. Some of the more familiar digital systems include digital computers and calculators, digital audio and video equipment, and the telephone system—the world's largest digital system.

Advantages of Digital Techniques

An increasing majority of applications in electronics, as well as in most other technologies, use digital techniques to perform operations that were once performed using analog methods.

Applications

- Digital logic design forms the foundation of electrical engineering and computer engineering. Digital logic designers build complex electronic components that use both electrical and computational characteristics such as power, current, logical function, protocol, and user input. Digital logic design is used to develop hardware, such as circuit boards and microchip processors. This hardware processes user input, system protocol, and other data in navigational systems, cell phones, or other high-tech systems.

The chief reasons for the shift to digital technology are:

1. Digital systems are generally easier to design. The circuits used in digital systems are switching circuits, where exact values of voltage or current are not important, only the range (HIGH or LOW) in which they fall.
2. Information storage is easy. This is accomplished by special devices and circuits that can latch onto digital information and hold it for as long as necessary, and mass storage techniques that can store billions of bits of information in a relatively small physical space. Analog storage capabilities are, by contrast, extremely limited.
3. Accuracy and precision are easier to maintain throughout the system. Once a signal is digitized, the information it contains does not deteriorate as it is processed. In analog systems, the voltage and current signals tend to be distorted by the effects of temperature, humidity, and component tolerance variations in the circuits that process the signal.
4. Operation can be programmed. It is fairly easy to design digital systems whose operation is controlled by a set of stored instructions called a program. Analog systems can also be programmed, but the variety and the complexity of the available operations are severely limited.

The chief reasons for the shift to digital technology are:

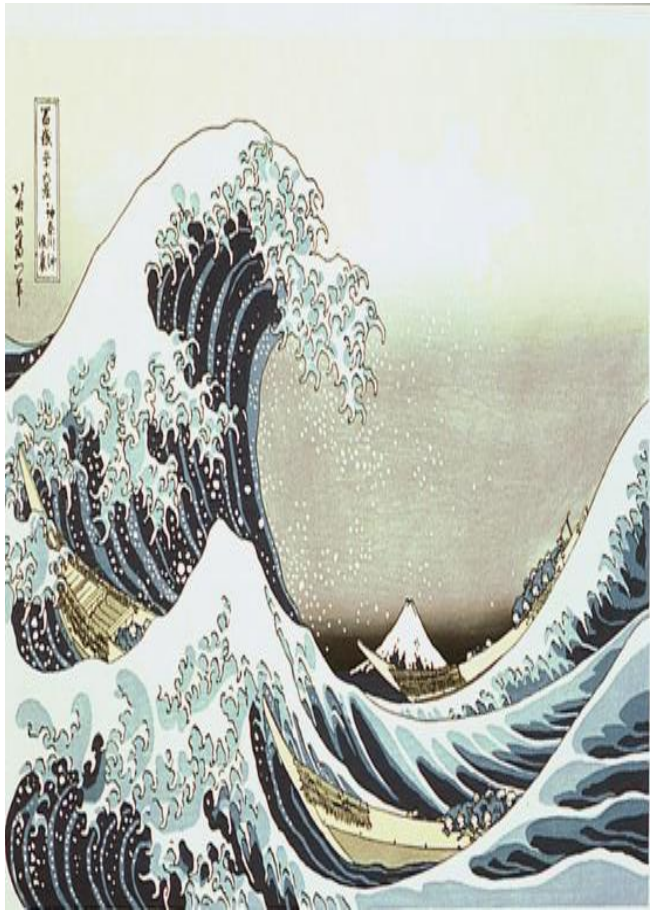
5. Digital circuits are less affected by noise. Spurious fluctuations in voltage (noise) are not as critical in digital systems because the exact value of a voltage is not important, as long as the noise is not large enough to prevent us from distinguishing a HIGH from a LOW.

6. More digital circuitry can be fabricated on IC chips. It is true that analog circuitry has also benefited from the tremendous development of IC technology, but its relative complexity and its use of devices that cannot be economically integrated (high-value capacitors, precision resistors, inductors, transformers) have prevented analog systems from achieving the same high degree of integration.

The Digital design & Why we should learn

- This course provides a modern introduction to logic design and the basic building blocks used in digital systems, in particular digital computers. It starts with a discussion of combinational logic: logic gates, minimization techniques, arithmetic circuits, and modern logic devices such as field programmable logic gates.

- The second part of the course deals with sequential circuits: flip-flops, synthesis of sequential circuits, and case studies, including counters, registers, and random access memories. State machines will then be discussed and illustrated through case studies of more complex systems using programmable logic devices. Different representations including truth table, logic gate, timing diagram, switch representation, and state diagram will be discussed.



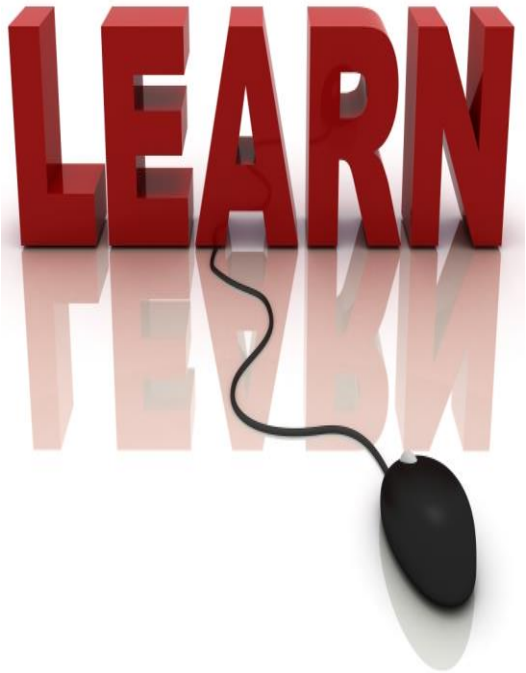
Course Aims & Objectives

- **General objectives :**
- The Objective of this course is to familiarize the student with fundamental principles of digital design.
- It provides coverage of classical hardware design for both combinational and sequential logic circuits.
- The course is supported by a digital logic design laboratory that uses the IDL-800 Digital Lab. device.
- This instrument is a circuit evaluator that enables users to design and connect standard Integrated Circuits.

Course Mechanics

Learn and Enjoy

- You are responsible for all material presented in lectures. There will also generally be some extra notes in the problem sets building on the material that you should read before attempting the problem set.
- I strongly recommend that you attend labs, as you will almost certainly need help on the problem sets but you are not required to stay for the entire lab.



ASSIGMENT

- There will become problem sets and a final project. You are encouraged to collaborate, but any code and write-ups you hand in must be your own.
- some of the assignment will be mentioned in the class during the lecture and some will be share with you in the group
- Please try to solve as much as you can and share your problem and difficulty with me

Course outline :

1. **Binary Systems** Digital Computers & Systems Binary numbers Number Base Conversion Octal & Hexadecimal Numbers 1's & 2's Complements Binary codes.
2. **Boolean Algebra & Logical Gates** Basic Definitions Boolean Algebra Theorems of Boolean Algebra. Boolean Functions Digital Logic Gates. IC Digital Logic Families
3. **Simplification of Boolean Function** Karnaugh Map Method 3 variable , 4 variable, 5 variable Map. Sum Of Product Product of Sum Dont care Tabulation Method
4. **Combinational Logic** Design Procedure Adders Subtractors Code conversion Analysis procedure.
5. **chap1 to chap7** Fundamental building blocks of logic gates. Bits, bytes, and words. Numeric data representation and number bases. Mathematical operations in different Numbering systems . Signed and twos-complement representations. Simplification of Boolean functions (algebraic method, Karnaugh maps, Quine McCluskey method) . Logic expressions, minimization, sum of product forms. Integrated combinatorial circuits. Sequential circuits. Flip-flops, registers, counters, memory units.

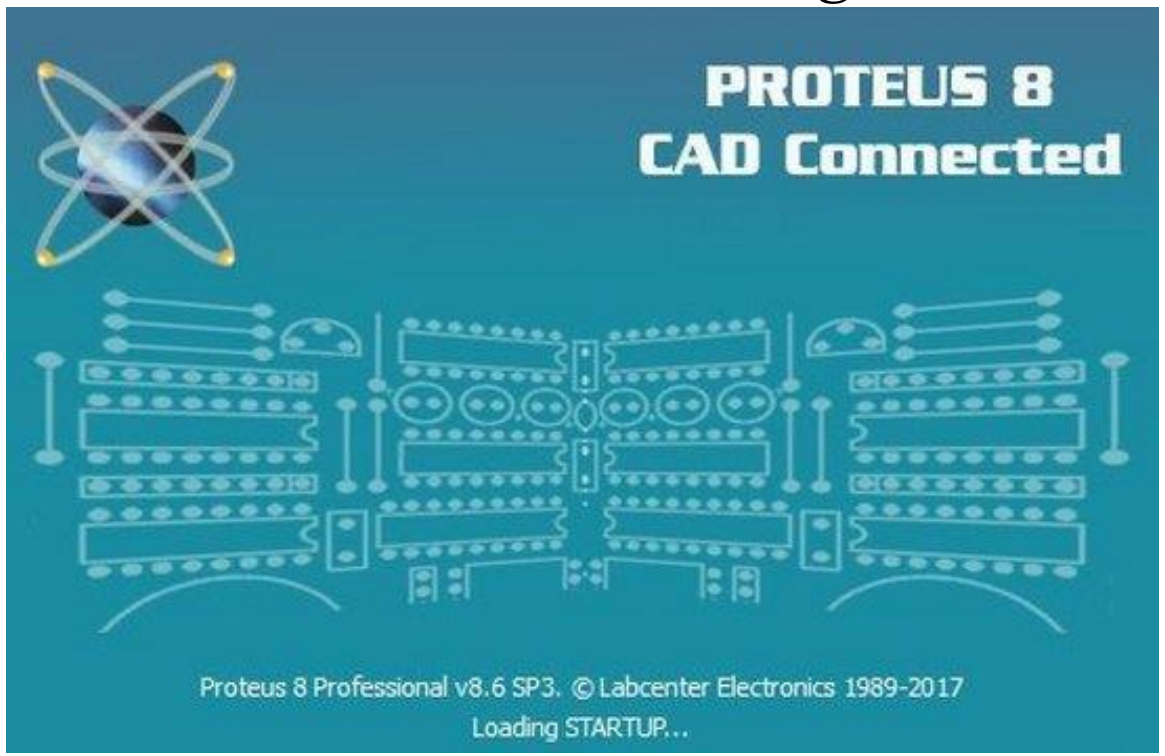
Evaluation methodology :

	First Exam	
	Second exam	
	Lab experiments	
	Mid practical/LAB	
	Final practical/LAB	
	Final Exam	

Lecture	Topic
Lecture 1	Syllabus review & Introduction
Lecture 2	**Binary Systems** Digital Computers & Systems Binary numbers Number Base Conversion Octal & Hexadecimal Numbers 1's & 2's Complements Binary codes.
Lecture 3	Truth table and symbolic representation Fundamental properties for Boolean algebra
Lecture 4	Implementing Circuits form Truth table , practice
Lecture 5	XOR gate, Demorgans Law Logical expression simplification using Fundamental properties, Demorgan , Practice
Lecture 6	Karnaugh map (3 input, 4 input), SOP,POS, practice
Lecture 7	Numbering systems, Binary numbers, Hexadecimal,Coding, Error detection, real number implementation, IEE754
Lecture 8	Combinational circuits, Design procedure, Practice
Lecture 9	Combinational circuits, Analysis procedure, Practice
Lecture 10	MSI circuits, 4Bit full adder, Decoder, Multiplexer, comparator, Building functions using MUX,or Decoder, building BCD to Ex-3 converter
Lecture 11	Design procedure Examples using design procedure, Full adder, Full subtractor BCD to Ex-3 code converter 4-bit ADDER/Subtractor using 4-bit Full adder,XOR gates, Comparator
Lecture 12	Demultiplexter, Encoder, Using Decoder for Implementing Logical functions Using Multiplexer for implementing logical fuctions
Lecture 13	Sequential circuits characteristics,synchronous, Asynchronous circuits. RS Latch(using NAND, using NOR gates),RS with Control, D Latch, JK flipflop,T-Flip flop, Characteristic table & equations for Flip flops
Lecture 14	Sequential circuits analysis procedure, Excitation table for the flip flops, Design procedure, Excitation table for sequential circuits,examples
Lecture 15	Using MSI 4 bit counter in building different counters Registers and Memory unit, course review

MY SPECIAL SUGGESTION

- Use protproteus software software for better underrating



NOW if you are agree with mentioned points

- Welcome to my lecture

- Study and Learn Like NINJA

Reference

- **Digital Design**

With an Introduction to the Verilog HDL, FIFTH EDITION

- Digital Design book by:
- My note
- Other famous lecturer in the world