Digital Electronics

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Chapter 0
Introduction of Digital Electronics

1. What is the "Digital Electronics"
   - ➢ Digital Techniques
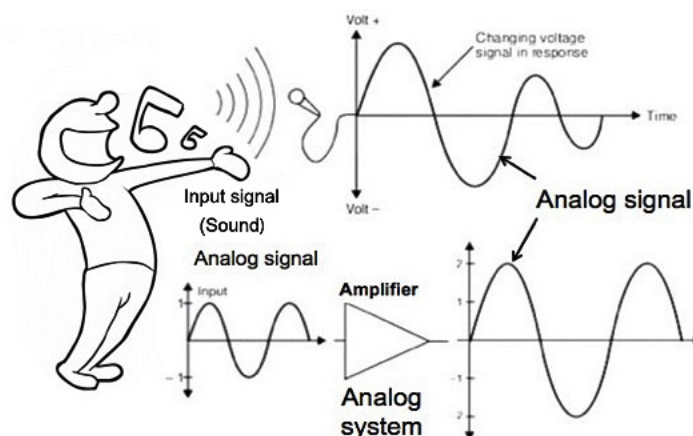   - ➢ Digital Electronics
   - ➢ Advantages and Limitations

2. Introduction of the course "Digital Electronics"
   - ➢ Overview
   - ➢ Goal
   - ➢ Contents
   - ➢ Books of Reference and Software Tools
   - ➢ Experiments and Examination

1. What is the "Digital Electronics"
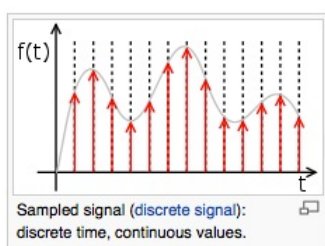
➢ Analog signal and Analog system

Analog ←→ Continuous

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1. What is the "Digital Electronics"
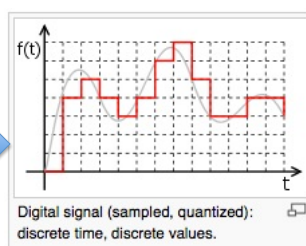
➢ Information Digitalization with 3 steps:

1. Sampling   2. Quantization   3. Coding

Sampled signal (discrete signal): discrete time, continuous values.

✓ Nyquist–Shannon sampling theorem

Digital ←→ Discrete

Digital signal (sampled, quantized): discrete time, discrete values.
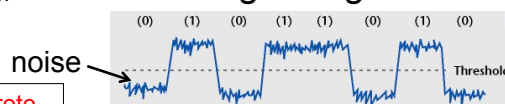
0000
0100
0101
0100
0011
0100
0110
0111
0101
0011
0011
0100
0100

Digital signal

noise

Threshold

1. What is the "Digital Electronics"

➢ **Digital system**

Analog Inputs (sensors, audio, video, tablet) → A/D

digitize
{ 0, 1 }

synchronize

Digital Inputs (peripherals, buses, switches) → Sync.

Memory
Control
Data Processing

D/A → **Analog Outputs** (actuators, motors, multimedia)

Digital Outputs (peripherals, buses, lights)

Digital processing systems
{ 0, 1 } {True, False}
Digital Circuits (or Digital Logic Circuits)

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1. What is the "Digital Electronics"

Digital Techniques
(ADC, Digital Information Processing, DAC)

Digital Electronics
(Digital Logic Circuits)

1
0
0
0
1
0
1

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1. What is the "Digital Electronics"

- **Advantages of Digital Electronics**
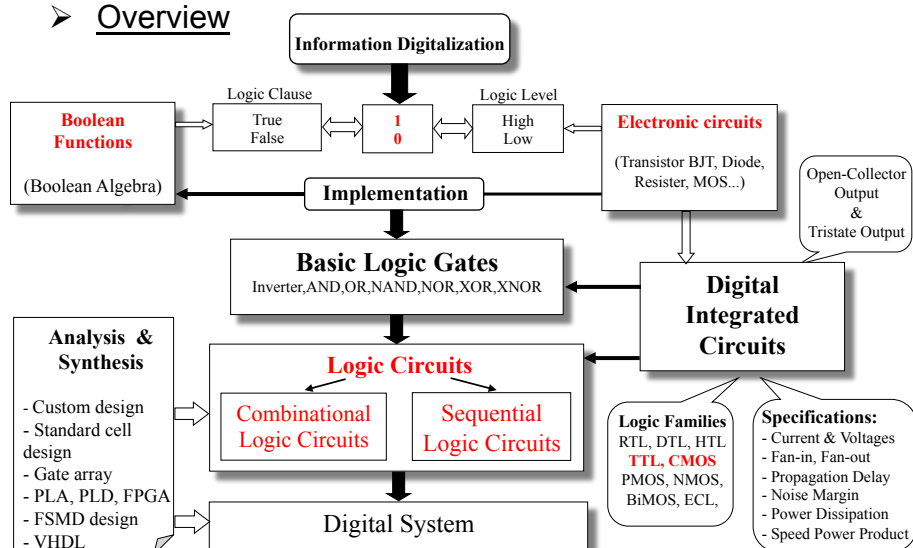   + Digital systems are generally easier to design
    + Information storage is easy
    + Precision is greater
    + Operation can be programmed
    + Digital circuits are less affected by noise
    + More digital circuitry can be fabricated on IC chips

- **Limitations**
    - Real world is mainly analog, so ADC and DAC
      are required.

2.Introduction of the course "Digital Electronics"

➢ Overview

8/13/13

2.Introduction of the course "Digital Electronics"

➢ The Goal of the Cource

→ Give insight in the design of digital electronic systems at the gate level and register-transfer level (RTL).

→After this course, the students can design and analysis two kinds of digital logic circuits : Combinational Logic Circuits and Sequential Logic Circuits. They also understand and apply all basic modular logic circuits (in IC) to a digital system.

→ Introduction some modern design tools

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2.Introduction of the course "Digital Electronics"

➢ Contents of the Course

Part I: Digital Principles
+ Binary System and Binary Codes
+ Boolean Algebra
+ Logic Gates and Digital Integrated Circuits

Part II: Combinational Logic Circuits
+ Analysis and Design

Part III: Sequential Logic Circuits
+ Analysis and Design

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2.Introduction of the course "Digital Electronics"

➢ Books of Reference

1. "Digital Electronics"
Roger L. Tokheim 4th Edition. – 1994
2. "Digital Logic Circuit Analysis & Design"
Victor P. Nelson , H. Troy Nagle, Bill D. Carroll, David Irwin. – 1995
3. "Digital Systems – Principles and Application"
Ronald J. Tocci and Neal S. Widmer - 2001
4. "VHDL: Programming by Examples"
Douglas L. Perry, 4th Edition - 2002.
5. "Điện tử số"
PGS. Ts. Đặng Văn Chuyết
6. "Toán logic và Kỹ thuật số"
Ts. Nguyễn Nam Quân -2006

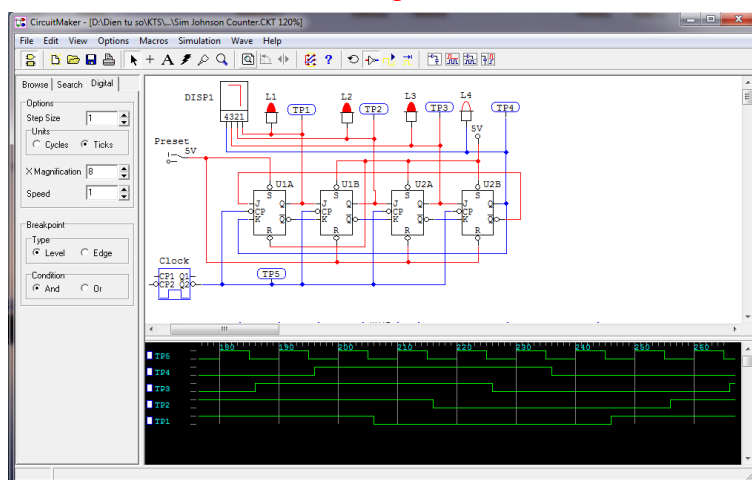## 2.Introduction of the course "Digital Electronics"

➢ Software Tools

• Circuit Maker 2000

• Proteus Professional

• Quartus II Web Edition Software

(https://www.altera.com/download/software/quartus-ii-we)

• ISE® WebPACK™ design software

(http://www.xilinx.com/tools/webpack.htm)

2.Introduction of the course "Digital Electronics"

➢ **Software Tools**

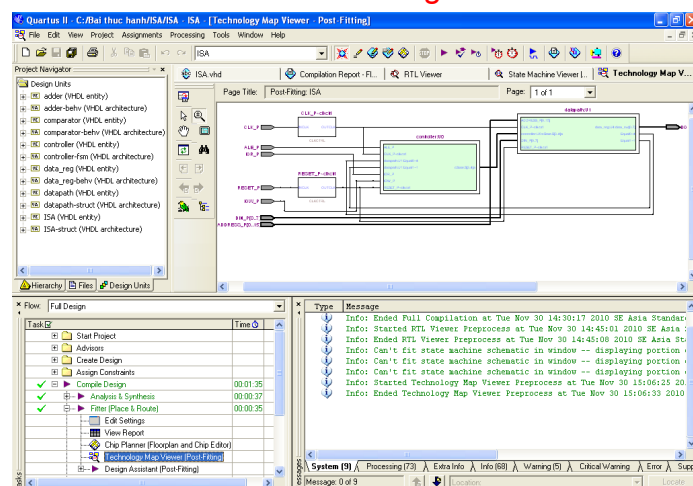Circuit Maker 2000 → Digital Circuit Simulation

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2.Introduction of the course "Digital Electronics"

➢ **Software Tools**

Quartus → VHDL Design and Test

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2.Introduction of the course "Digital Electronics"

➢ Experiments

Exp 1: Basic logic gates, Logic levels, Mux/Demux

Exp 2: RS Latch, JK – Flip Flop, Counter and 7 Segment Led

Exp 3: Introduction a software for designing the digital circuit

Exp 4: Design a 3- bits comparator

Exp 5: Design a sequential logic circuit.

2.Introduction of the course "Digital Electronics"

➢ Examination
- Midterm exam: 30%
- Final exam: 70%
  - → Completing lab sessions is a must before taking the exam

➢ **How to learn this course effectively ?.**
- Attend all lessons
- Using a open-notebooks
- Doing home works
- Reading the references
- Trying make the questions and answers the question from the lecturer