

**EE 200**  
**DIGITAL LOGIC CIRCUIT DESIGN**  
**(3 – 3 – 4)**

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# Introduction to Digital Logic

The material covered in this class will be as follows:

- Introduction.
- Digital and analog quantities.
- Digital system examples.
- Course material.
- Course syllabus.
- Policies on home works, quizzes, exams, and term design project.

After finishing this class, you should be able to:

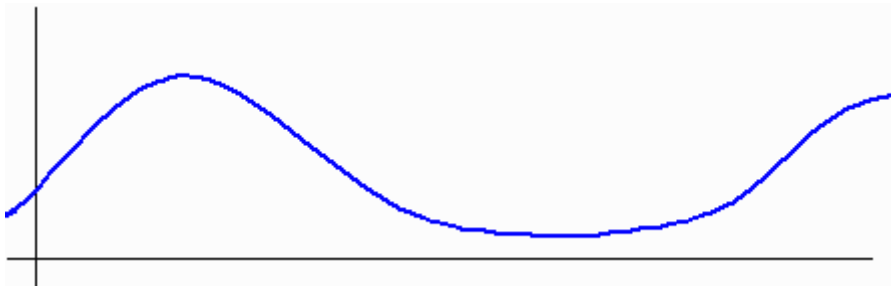
- Identify the importance of this introductory course on digital logic.
- Appreciate the arrangement of the course material units.
- Become familiar with the assessment method through home works, quizzes, projects and exams.

## Introduction:

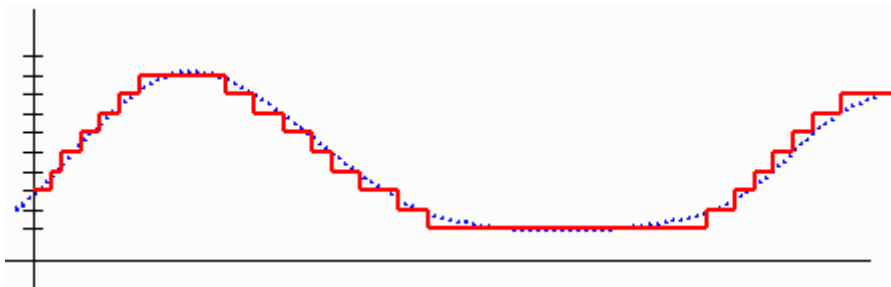
- Prominence of digital systems in everyday life.
- The present time could be referred to as the Digital Age.
- Some examples are the digital computers, mobile phones, digital cameras, digital watches, control systems in cars and aeroplanes...etc.
- Digital systems are used in almost all aspects of life, in communications, business transactions, traffic control, medical treatment, the internet...etc.
- Digital logic is the first course in studying digital systems, which is an essential part of almost all branches of Electrical Engineering.
  - Digital Communications
  - Digital Electronics
  - Digital Control
  - Digital Signal and Image Processing
  - Power System Analysis
- Digital systems are able to manipulate discrete elements of information e.g. 10 decimal digits, 26 letters of the alphabet...etc.
- Discrete elements of information are represented in digital systems by physical quantities called signals. The most common are the voltage and current signals in electronic devices.
- The signals in most present day electronic digital systems use two discrete values (binary signal).
- A binary digit called bit has two values: 0 and 1.
- Discrete elements of information are represented with groups of bits called binary codes.
- A digital system is an interconnection of digital modules. Their operation can be understood from the basic knowledge of digital circuits and their logic functions.

- An important new trend in digital design is the use of hardware description language (HDL). It resembles a programming language and is suitable for describing digital circuits in textual form.
- HDL is used to simulate a digital system and verify its operation before hardware is built.

## Analog and Digital Signals



An analog signal



A digital signal

## Course contents:

1. BINARY SYSTEMS
  - 1-1 Digital Systems
  - 1-2 Binary Numbers
  - 1-3 Number Base Conversions
  - 1-4 Octal and Hexadecimal Numbers
  - 1-5 Complements
  - 1-6 Signed Binary Numbers
  - 1-7 Binary Codes
2. BOOLEAN ALGEBRA AND LOGIC GATES

- 2-1 Axiomatic Definition of Boolean Algebra
  - 2-2 Theorems and Properties of Boolean Algebra
  - 2-3 Boolean Functions
  - 2-4 Digital Logic Gates
  - 2-5 Canonical and Standard Forms
3. GATE-LEVEL MINIMIZATION
- 3-1 Simplification of Boolean Functions Using K-Maps
  - 3-2 Product of Sums Simplification
  - 3-3 Don't-care Conditions
  - 3-4 NAND, NOR, and other two Level Implementation
  - 3-5 X-OR Function
  - 3-6 Introduction to HDL
4. COMBINATIONAL LOGIC
- 4-1 Combinational Circuits
  - 4-2 Analysis and Design Procedures
  - 4-3 Code Conversion
  - 4-4 Adder-Subtractor Circuits
  - 4-5 Decimal Adder
  - 4-6 Binary Multiplier
  - 4-7 Magnitude Comparator
  - 4-8 Decoders
  - 4-9 Encoders and Multiplexers
  - 4-10 Example of HDL for Combinational circuit
5. MEMORY AND PROGRAMMABLE LOGIC
- 5-1 Programmable Logic Devices
  - 5-2 Read Only Memory
  - 5-3 Programmable Logic Array
  - 5-4 Programmable Array Logic
6. SYNCHRONOUS SEQUENTIAL LOGIC
- 6-1 Sequential Circuits
  - 6-2 Latches
  - 6-3 Flip-Flops
  - 6-4 Characteristic Tables
  - 6-5 Analysis of Clocked Sequential Circuits
  - 6-6 Examples of HDL for Sequential Circuits
  - 6-7 State reduction and Assignment
  - 6-8 Design Procedure
  - 6-9 Synthesis Using Different Flip-Flops

## 7. REGISTERS AND COUNTERS

- 7-1 Registers and Shift Registers
- 7-2 Ripple Counters
- 7-3 Synchronous Counters
- 7-4 Other Counters