

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

Instructor: Dr. Mahmoud M. Dawoud

My office hours: SMW 8:00 – 8:50 AM

Or by appointment

Office Location: 59/2070

Email: mmdawoud@kfupm.edu.sa

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:

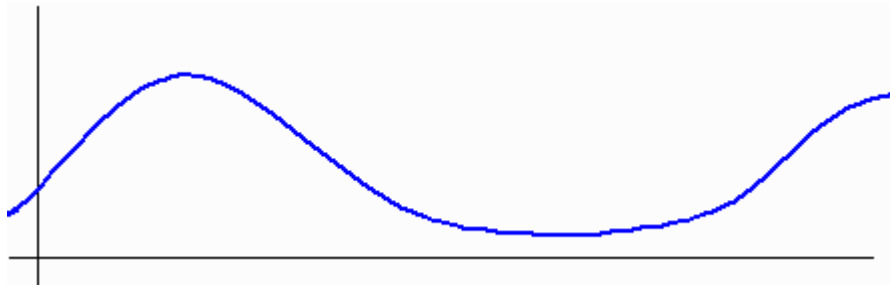
- Identify the importance of this introductory course on digital logic circuit design.
- Appreciate the arrangement of the course material units in relation to each other.
- Become familiar with the assessment method through home works, quizzes, projects and exams.

Introduction:

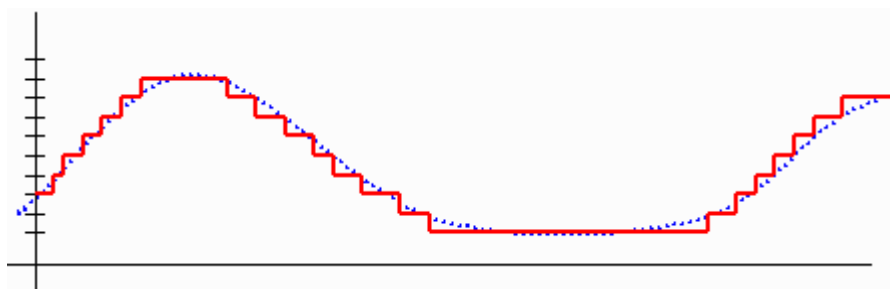
- Prominence of digital systems in everyday life.
- The present time could be referred to as the Digital Age.

- 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