Fundamentals of Computer Engineering COE 200 (3-3-4)

Course Outline

Instructor

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Office hours shall be announce in the class and posted on the door			

Course Description

Introduction to Computer Engineering. Digital Circuits. Boolean algebra and switching theory. Manipulation and minimization of Boolean functions. Combinational circuits analysis and design, multiplexers, decoders and adders. Sequential circuit analysis and design, basic flip-flops, clocking and edge-triggering, registers, counters, timing sequences, state assignment and reduction techniques. Register transfer level operations.

Prerequisite: PHYS 102.

Text Book: *Logic and Computer Design Fundamentals*, Morris Mano and Charles Kime, Prentice-Hall, Second Edition (Updated), 2001.

Course Rationale

The course teaches the basic issues involved in the design and analysis of digital systems. This is the *alphabet* of computer engineering. Virtually all of the computer's hardware is composed of nothing but digital circuits! So this is the first step for studying and understanding computers

Course Objectives

Insha'Allah by the end of this course students are expected to be able to:

- Know the Binary numbering system and perform math operations (addition, subtraction …etc.) on binary numbers

- Minimize any Boolean expression using various techniques

- Implement any Boolean expression using various logic gates

- Analyze any logic circuit and obtain a Boolean expression for its output

- Synthesize a combinational or sequential circuit from a set of specifications

Learning Methodology

The course objective shall be met insha'Allah though lectures, hands-on lab experiments, in-class exercises, assignments and the use of software for logic simulations/design.

Course Topics:

1. *Introduction:* Information representation (Digital vs Analog), and Computer Organization (CPU, Memory, I/O devices, instruction execution and flow of information).
2. *Binary Systems*: Binary numbers, Number base conversion, Complement, Signed binary numbers, Binary codes, Binary arithmetic.

3. ***Boolean Algebra and Logic Gates:*** Axiomatic definitions of Boolean algebra, Basic theorems and properties of Boolean algebra, Boolean functions, Canonical and standard forms, Other logic operations, Digital logic gates.

4. ***Simplification of Boolean Functions:*** The map method, two-, three-, four-, five-, and six-variable maps, Simplification into sum-of-products, NAND and NOR implementation. Other 2-level implementations. Don't-care conditions. XOR and equivalence functions, Parity generation and checking

5. ***Combinational Logic:*** Introduction, Analysis procedure, Design procedure, Code conversion, Propagation delay and timing analysis.

6. ***Combinational Logic with MSI and LSI:*** Introduction, Decoders and Encoders, Multiplexers and Demultiplexers, Binary Adders and Subtractors, Decimal Arithmetic, Magnitude Comparator, Binary Multiplier, ALU design.

7. ***Synchronous Sequential Logic:*** Introduction, Latches, Flip-Flops, Triggering of flip-flops, Behavior and timing analysis of clocked sequential circuits, State assignment and reduction, Flip-Flop characteristic and excitation tables, Design procedure.

8. ***Registers, Counters and Register Transfer:*** Introduction, Registers, Shift and Multi-mode registers, Synchronous and Asynchronous counters, Register transfer operations.

9. ***Programmable Logic:*** ROMS, PLAs, PALs.

Grading Policy

Grading is meant only as a way of assessing the student's achievements in the course. Students should not feel too much pressured by this process. The adopted grading policy allows and indeed rewards improvements. A student failing to achieve a good grade in the first exam should not feel that he has no chance. The whole purpose of the adopted grading policy is to give the student a second and even a third chance if he needs it to achieve the best result he wants.

Lab	20 points
Assignments & Quizzes	10 points
1st & 2nd Major	30 points
Final Exam	0 points
Total	100 points

Attendance Policy

- Attendance will be taken regularly. Students who are more than 10 minutes late are considered absent,
- There will be a 0.5% grade deduction for every unexcused absence,
- Excuses for officially authorized absences must be presented no later than one week following resumption of class attendance.