Digital Logic
CS106 *: 4 (2, 2, 0)*

Prerequisites:
Discrete Structures (CS104)

Objectives:

1. Summary of the main learning outcomes for students enrolled in the course.
Upon successful completion of the course, the student should be able to:
(a) Grasp basic principles of combinational and sequential logic design.
(b) Determine the behavior of a digital logic circuit (analysis).
(c) Translate descriptions of logical problems to efficient digital logic circuits (synthesis).
(d) Present a well-organized laboratory report.
(e) Have a high-level understanding of how to design a general-purpose computer, starting with simple logic gates.
2. Briefly describe any plans for developing and improving the course that are being implemented. (eg increased use of IT or web based reference material, changes in content as a result of new research in the field)

Course Description:
- General description in to be used for the Bulletin or Handbook

This course focuses on the fundamental constructs and concepts underlying computer hardware and software which includes: number systems, binary arithmetic, codes, Boolean algebra, gates, Boolean expressions, Boolean switching function synthesis, iterative arrays, sequential machines, state minimization, flip/flops, sequential circuits, simple processors.

Syllabus:

1- **Number Systems**: - Decimal, Binary, Octal and Hexadecimal number systems and their conversion. Binary weighted codes; Signed number binary order, 1's and 2's complement codes. Arithmetic operations – add/subtract/multiply; Decimal codes - BCD, Floating point representation.
2- **Boolean Algebra and Logic Gates**: - Boolean Algebra - Boolean laws, Basic theorems and properties, Boolean functions, Truth tables, Binary logic, Digital logic gates; Implementation of Boolean function with gates. Complement of a Boolean function; Canonical and Standard forms – Minterms, Maxterms, Sum of Minterms, Product of Maxterms, Conversion between Canonical forms, Standard forms - SoP, PoS.
3- **Gate-Level Minimization**: - The map methods (Karnaugh maps) – 2, 3 and 4 variables maps. Prime implicants, Don't-care conditions; NAND and NOR implementation - Two-level and Multi-level implementations; Exclusive-OR gates.
4- **Combinational LogicCircuits**: - Combinational circuits, Design Procedure, Half adder and Full adder. Half subtractor and Full subtractor, Decoders, Encoders, Multiplexers and MUX implementations.
5- **Sequential logic**: Sequential circuits, Basic latches and flip-flops, Analysis of Clocked Sequential Circuits, State reduction and assignment, Sequential Circuit Design, Synthesizing sequential circuits.
6- **Registers and counters:** Registers, Shift Registers, Ripple Counters, and Synchronous Counters.

References:

1- Required Textbox :
Digital Design, Mano, M. Morris, 4th edition, Prentice-Hall, 2007.
2- Essential References
Fundamentals of logic Design, 5th edition, Brooks/Cole Thomson Learning, 2004.