CLUSTER UNIVERSITY SRINAGAR
SYLLABUS (FYUP UNDER NEP 2020)
Offered by the Department of Information Technology,
Batch 2022, 2023, 2024

1st Semester - Minor : Digital Electronics

Course Code: UGICT24N101
Credits: 4 (Theory: 3, Practical: 1)
Contact HRS: 75 (Theory: 45, Practical: 30)

Max. Marks: 100
Theory External: 60; Min Marks: 24
Theory Internal (Continuous Assessment): 15 Marks, Min Marks: 06
Practical Experimental Basis = 15, Min. Marks: 06
Practical Experimental (Continuous Assessment) = 10, Min. Marks: 04

Objectives

- To introduce concepts of number systems and Boolean algebra.
- To familiarize students with the operation and use of basic digital logic gates as well as the design and minimization of combinational logic circuits.
- To introduce the concept of microprocessors and familiarize them with the basic operation of a CPU.

Learning Objectives

1. Students will be able to design, analyze, and implement digital electronic circuits and systems, including understanding logic gates, combinational and sequential logic, and digital system components.
2. Students will be able to apply Boolean algebra principles, including Boolean operations, laws, and DeMorgan's Theorems, to construct, simplify, and minimize Boolean expressions and logic circuits, using methods such as Karnaugh Maps and handling don't-care conditions effectively.
3. Students will be able to design and analyze arithmetic circuits, Sequential elements and understand their characteristics, operations, and applications in digital systems.

Syllabus

UNIT 1: (15 Hrs)

Introduction to Digital and Analog Quantities, Binary Digits, Logic Levels, Pulse, Waveforms, Clock and Timing Diagrams. Number Systems - Decimal, Binary, Octal, Hexadecimal and their Conversions. Unsigned Binary Arithmetic, One's Complement, Two's Complement. Signed Numbers and their arithmetic. Binary Coded Decimal. Error Codes-Parity Code. Logic Gates—AND, OR, NOT, NAND, NOR, XOR and XNOR Gates.

UNIT 2: (15 Hrs)

Boolean Algebra: Boolean Operations, Laws and Rules of Boolean Algebra, DeMorgan's

Theorems. Constructing a Boolean Expression for a Logic Circuit, Logic Simplification.
SOP and POS forms, Karnaugh Maps and minimization up to 4 variables, Don't-care conditions. Combinational Logic Circuits: AND-OR, AND-OR-INVERT, XOR and XNOR logic, Converting Boolean Expression or Truth Table to a Logic Circuit, NAND and NOR as Universal Gates.

UNIT 3: (15 Hrs)

Half Adder, Full Adder, 4-bit Parallel Binary Adder, Comparator, Binary Decoder, Encoder, Multiplexer, Demultiplexer, Latches: SR Latch, D Latch, Gated SR and D Latch (2 Hours) Flip Flops: Difference between Flip Flop and Latch, Level vs Edge-Triggered. D Flip Flops, JK Flip Flops and their operation, Characteristics and Applications of Flip Flops (storage, counting), Conversion of Flip-Flops.

Sample Lab Work (indicative) (1 Credits, 30 Hours)

1. User a Verilog/SystemVerilog simulator like ModelSim or Icarus Verilog to simulate the following digital circuits:
2. Implement the following logic gates in Verilog:
    a. A 2-input AND Gate
    b. A 3-input OR Gate
3. Implement the following logic gates in Verilog and simulate them using a test bench:
    a. A 2-input NAND Gate
    b. A 2-input NOR Gate
4. Design and simulate 3-input XOR gate in Verilog.
5. Design and simulate a module in Verilog that implements the various boolean logic expressions.
6. Design and simulate a half adder in Verilog
7. Design and simulate a full adder in Verilog
8. Design and simulate a 4-bit binary adder in Verilog
9. Design and simulate a 2-to-1 multiplexer in Verilog
10. Design and simulate a 4-to-1 multiplexer assembled from three 2-to-1 multiplexers in Verilog
11. Design and simulate a 3-to-8 decoder in Verilog
12. Design and simulate a clocked D Flip Flop with reset input in Verilog

SUGGESTED TEXTBOOKS:

1. Thomas Floyd, Digital Fundamentals, 11th Edition (2015), Pearson.

2. Morris Mano, Michael Ciletti, Digital Design with an Introduction to the Verilog HDL, VHDL, and SystemVerilog, 6th Edition, Pearson (2017)
3. Malvino, Principle of Digital Electronics, McGraw-Hill
4. R.P. Jain - Modern Digital Electronics, McGraw-Hill, 4th ed. 2010
5. LaMerez, Quick Start Guide to Verilog, Springer (2019)
6. M. Rafiquzzaman - Digital Logic, with an Introduction to Verilog and FPGA-Based Design, Wiley (2019)