NIRMA UNIVERSITY

Institute:	Institute of International Study
Name of Programme:	Bachelor of Science (Computer Science and Engineering) [2+2 Dual Degree]
Faculty:	Faculty of Technology & Engineering
Course Code:	1CS503
Course Title:	Digital Design: Theory and Practice
Course Type:	Core
Year of Introduction:	2022-23

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Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. identify digital components in computer organization (BL1)
2. explain Boolean algebra and logic gates (BL2)
3. describe the basic building blocks of various digital circuits (BL2)
4. design combinational logic and sequential logic circuits using basic components. (BL6)
5. understanding for the concepts of HDL-Verilog, data flow and behavioral models for the design of digital systems. (BL2)

Syllabus: **Total Teaching Hours: 30**

Unit	Syllabus	Teaching hours
Unit I	**Binary Systems:** Introduction, Binary numbers, conversions, Octal, Hexadecimal Numbers, Complements, Binary Codes, binary storage, registers, Binary Logic Boolean Algebra and Logic Gates, Boolean algebra, theorems and properties, Boolean functions simplification, canonical and standard forms, other logic operations, Digital logic gates, IC logic families	04
Unit II	**Boolean Function Simplification:** The Map-method, SOP/POS Simplification with don't care conditions using basic and universal gates, Tabulation method	05
Unit III	**Combinational Logic**: Introduction, analysis and design of various combinational circuits such as Adders, Subtractors, Code Convertors, Comparators, Binary Parallel Adder, Decimal Adder, magnitude comparators, ROMS, decoders, multiplexers, PLA	06
Unit IV	**Sequential Logic**: Introduction, flip-flops, triggering of flip-flop, analysis and design of clocked sequential circuits, design with state equations, registers, shift registers, ripple counters, synchronous counters	07
Unit V	**Digital Integrated Circuits:** Introduction, BJT characteristics, RTL and DTL logic. IIL and TTL Logic. ECL and MOS Logic CMOS Logic, ADC, DAC	05

Unit VI	**Introduction to Verilog:** Structure of Verilog module, Operators, data types, Styles of description- Data flow description, Behavioral description, implement logic gates, half adder and full adder using Verilog data flow description.	03

Self-Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents

Suggested Readings/ References:

1. M. Morris Mano, Digital Logic and Computer Design, PHI
2. Malvino and Leach, Digital Principals and applications, McGraw-Hill
3. Virendra Kumar, Digital Technology Principals and Practices, New Age International Holdsworth, Digital logic design, Elsevier Science.
4. Design through Verilog HDL –T.R. Padmanabhan and B. Bala Tripura Sundari, WSE, IEEE Press, 2004.
5. HDL Programming (VHDL and Verilog) Nazeih M. Cengage Learning 1St Edittion 2011

Suggested List of Experiments:

Sr. No.	Title	Hours
1	Study of Basic Logic Gates along with verification of their truth tables.	02
2	Implementation of basic logic gates using NAND and NOR gates.	02
3	Design and Implementation of Half and Full Adder and Subtractor circuits.	02
4	a) Design and implementation of binary to Gray and vise–versa code converter. b) Design and implementation of a combinational circuit that converts the given BCD number into equivalent 84-2-1 number. c) Design and implementation of a combinational circuit that converts a decimal digit from the 2421 code to 84-2-1 code.	06
5	Implementation of the following Boolean function using a multiplexer: F (A, B, C, D) = BC + ABD' + A'C'D	02
6	Verification of truth tables of RS, D, JK and T flip-flops.	02
7	Design and implementation of modulo-N Synchronous counter using JK flip-flops	04
8	Design and implementation of a bidirectional shift register with parallel load.	04
9	Write Verilog code to realize all logic gates.	02

10	Write Verilog program for the following combinational designs a. 2 to 4 decoders b. 8 to 3 (encoder without priority & with priority) c. 8 to 1 multiplexer. d. 4 bit binary to Gray converter. e. Multiplexer, de- multiplexer, comparator.	04	