MCPC1001 DIGITAL LOGIC DESIGN (3-0-0)

Course Objectives:

1. To introduce the fundamental concepts of digital logic and Boolean algebra.
2. To develop and understanding of combinational and sequential logic circuits.
3. To explore advanced topics such as memory elements, state machines, and programmable logic devices.

Course Outcomes: Upon successful completion of this course, students should be able to:

CO1 : Analyze and design combinational logic circuits using Boolean algebra and Karnaugh maps.
CO2 : Design and implement sequential logic circuits, including flip-flops, counters, and registers.
CO3 : Apply knowledge of digital logic to solve real-world engineering problems.

Unit 1:

Binary Systems: Digital Computers and Digital Systems, Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers, Complements, Signed Binary Numbers, Boolean Algebra and Logic Gates: Boolean functions, Logic Operators, digital Logic Gates, Simplification of Boolean functions: Two and Three Variable Maps, Four Variable Map, Five Variable Map, Product of Sums Simplification, NAND and NOR Implementation, Don't Care Conditions.

Unit 2:

Combinational Logic: Design Procedure, Adders, Subtractors, Code Conversion, Analysis Procedure, Multilevel NAND Circuits, Multilevel NOR Circuits, Exclusive OR Functions, Binary Adder and Subtractor, Decimal Adder, Magnitude Comparator, Decoders and Encoders, Multiplexers, Programmable Logic Array (PLA), Programmable Array Logic (PAL).

Unit 3:

Flip-Flops: RS Flip-Flop, D Flip-Flop, JK and T Flip-Flops, Triggering of Flip-Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Design Procedure, Design of Counters, Registers, Shift Register, Ripple Counters, Synchronous Counters, Timing Sequences, Random-Access Memory (RAM)

Unit 4:

Semiconductor RAM Memories: Internal Organization of Memory Chips, Static Memories, Dynamic RAMs, Read-only Memories: ROM, PROM, EPROM, EEPROM, Flash Memory, Direct Memory Access, Memory Hierarchy, Cache Memory, Virtual Memory, Secondary

Storage: Magnetic Hard Disks, Optical Disks, Magnetic Tape Systems Memory elements: SRAM, DRAM, ROM, Programmable logic arrays (PLAs) and field-programmable gate arrays (FPGAs), Introduction to hardware description languages (HDLs) such as Verilog or VHDL, Introduction to digital simulation tools

Text Books:

1. "Digital Design" by M. Morris Mano and Michael D. Ciletti
2. "Fundamentals of Digital Logic with Verilog Design" by Stephen Brown and Zvonko Vranesic
3. “Computer Organisation and Embedded Systems” by Carl Hamacher, Z Vranesic, S Zaky and N Manjikian

Reference Books:

1. "Digital Systems: Principles and Applications" by Ronald J. Tocci, Neal S. Widmer, and Greg Moss
2. "Introduction to Logic Design" by Alan B. Marcovitz