B.Tech II Year I Semester

DIGITAL ELECTRONICS

Course Code: 21EC303PC **L/T/P/C: 3/0/0/3**

Course Objectives:

To study the theory of Boolean algebra and to study representation of switching functions using Boolean expressions and their minimization techniques.

- To study the combinational logic design of various logic and switching devices and their realization, Verilog programming concepts.
- To study the sequential logic circuit design both in synchronous and Asynchronous modes for various complex logic and switching devices, their minimization techniques and their realizations using Verilog.
- To study the sequential elements like registers, counters and their usage in the real world.
- To understand characteristics of memory and their classification, concept of Programmable Devices, PLA, PAL and CPLD and implement digital system using Verilog.

Course Outcomes: Upon successful completion of the course student will be able to

- Aware of theory of Boolean algebra, Logic gates & the underlying features of various number systems.
- Use the concepts of Boolean algebra for the analysis & design of various combinational logic circuits, can able to write Verilog program.
- Use the concepts of Boolean algebra for the analysis & design of various sequential logic circuits, can able to write Verilog program.
- Apply the fundamental knowledge of analog and digital electronics to design different circuit elements like registers and counters which are very useful for real world with different changing circumstances.
- Classify different semiconductor memories, Design various logic gates starting from simple ordinary gates to complex programmable logic devices & arrays and implement digital system using Verilog.

UNIT-I

Boolean algebra & Logic Gates: Number systems, Number- Base Conversions, Signed Binary Numbers, Binary Codes, Axiomatic Definition of Boolean Algebra, Basic Theorems, Boolean Functions, Canonical and standard Forms. Logic Gates: Digital Logic Gates, NAND and NOR Implementation, Exclusive-OR Function, Integrated Circuits, Gate-level Minimization, The K-Map Method, Four- Variable Map, FiveVariable Map, Don't-care Conditions.

UNIT-II

Combinational logic circuits: Introduction to Combinational circuits, Analysis Procedure, Design Procedure, Code conversion, Binary Adder-Subtractor, Carry Propagation, Half Subtractor, Full Sub tractor, Binary Subtractor, Decimal Adder, BCD adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers with design examples. Introduction to verilog to implement combinational circuits.

UNIT-III

Sequential Logic circuits: Difference between combinational and sequential logic circuits, Flip- Flops, Triggering of Flip Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, FlipFlop Excitation Tables, Design Procedure, Fundamentals of Asynchronous Sequential Logic: Introduction, Analysis procedure, Circuits with Latches, Design Procedure. Verilog code to implement sequential circuits.

UNIT-IV

Registers and Counters: Registers with parallel load, Shift registers, Serial Transfer, Serial Addition, Universal Shift Register, Ripple Counters, Binary Ripple Counter, BCD Ripple Counter, Synchronous Counters, Binary Counter, Up-Down Counter, BCD Counter, Binary Counter with Parallel Load, Counter with Unused States, Ring Counter, Johnson Counter, verilog to design Registers and Counters.

UNIT-V

Memory and Programmable Logic: Types of Memories, Random-Access Memory, Read-Only Memory, Memory Operations, Timing waveform, Memory Decoding, Internal Construction, Address Multiplexing, Combinational Circuit Implementation, PROM, Combinational PLDs, Programmable Logic Array, Programmable Array Logic.

Text/Reference Books:

1.M Morris Mano and Michael D.Ciletti, Digital Design, Pearson 6th ed2018.
2.Charles H.Roth Jr.,Larry L. Kinney, Fundamentals of Logic Design, Cengaue learning 6th edition, 2013
3.J. Bhaskar, "A Verilog HDL Primer Hardcover"
4.Switching and Finite Automata Theory - Zvi Kohavi & Niraj K. Jha, 3rdEdition, Cambridge, 2010.
5.Modern Digital Electronics – R. P. Jain, 3rd edition, 2007- Tata McGraw-Hill.
6.Introduction to Switching Theory and Logic Design – Fredric J. Hill, Gerald R. Peterson, 3rd Ed, John Wiley & Sons Inc.
7.Switching Theory and Logic Design – A Anand Kumar, PHI, 2013.