Course Code	**EC20005**
Course Title	**Digital Systems Design**
Number of Credits	**3-0-0-3**
Pre-requisites (Course Code)	**EC 10001**
Course Type	**PC**

Course Objectives

- To understand the overview on the design principles of digital computing systems
- To learn the Verilog modelling techniques
- To learn Boolean Algebra and Understand the various logic gates
- To be familiar with various combinational circuits
- To be familiar with designing synchronous and asynchronous sequential circuits
- To be exposed to CMOS level gate design

Course Contents:

UNIT I (5 hrs)

Basic VLSI System Design: Introduction to digital systems and VLSI design, Moore's Law, VLSI Design flow, Design hierarchy, Introduction to Verilog HDL, operators and Modelling techniques (gate-level, data-flow,and behavioral)

UNIT II (10 hrs)

Binary Codes & Boolean Algebra: Signed Binary numbers and its arithmetic (1's and 2's complement form), Binary codes (Weighted and non-weighted codes, Gray codes, BCD codes), Boolean Algebra-Laws and Axioms, SOP and POS (Min-term and Max-term), K-Maps (2-,3-,4- variables with don't care condition)

UNIT III (12 hrs)

Combinational Circuits: Adders (Half adder, Full adders, Binary Parrallel Adders), Subtractor (Half Subtractor, Full Subtractor), Code conversion algorithms, Combined Adder-Subtractor Block, Design of code converters, Decoders and Encoders, Multiplexer and Demultiplexer. Implementation of Combinational Circuits using Gate-level and Data-flow level of modelling.

UNIT IV (12 hrs)

Sequential Circuits:

Basic latch, Flip-flops (SR, D, JK, T, Master-Slave), Triggering of flip-flops, FF conversions, Shift Registers (SISO, SIPO, PISO, PIPO), Counter Design (Synchronous and Asynchronous), Implementation of sequential circuits using Behavioral level of modelling.

UNIT V (6 hrs)

Advanced Concepts: Overview of CMOS, CMOS level gate design (Basic and Universal gates), Design of general Boolean circuits using CMOS gates, CMOS level design of latches and flip-flops. Verilog description of CMOS level design.

Course Outcomes

Upon completion of this course, the students will be able to:

CO1: demonstrate the design principles of digital electronic and VLSI systems

CO2: apply the concept of different Verilog HDL models in realising various digital circuits

CO3: evaluate and simplify Boolean functions by using Boolean algebraic methods like K-maps

CO4: design and analyse different combinational circuits

CO5: design and analyse different sequential circuits

CO6: design and analyse CMOS-based combinational and sequential logic circuits

Text Books

1. Morris Mano, and Michael D. Ciletti, "Digital Design", Fifth Edition, PHI, 2012.
2. CMOS Digital Integrated Circuits – Sung-Mo Kang, Y. Leblebici, C. Kim, TMH, 4th Edition, 2016

Reference Books

1. Anand Kumar, "Fundamentals of Digital Logic", Fourth Edition, PHI, 2016.
2. Samir Palnitkar, "Verilog HDL", Second Edition, Pearson Education, 2003.