III B.Tech I Semester

15AEC26 - DIGITAL IC APPLICATIONS

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Course Objectives:

1. *To be able to use computer-aided design tools for development of complex digital logic circuits*
2. *To be able to model, simulate, verify, analyze, and synthesize with hardware description languages*
3. *To be able to design and prototype with standard cell technology and programmable logic*
4. *To be able to design tests for digital logic circuits, and design for testability*

UNIT-I

CMOS Logic: Introduction to logic families, CMOS logic, CMOS steady state electrical behavior, CMOS dynamic electrical behavior, CMOS logic families.

Bipolar Logic And Interfacing: Bipolar logic, Transistor logic, TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing, Emitter coupled logic, Comparison of logic families, Familiarity with standard 74XX and CMOS 40XX series-ICs – Specifications.

UNIT-II

The VHDL Hardware Description Language: Design flow, program structure, types and constants, functions and procedures, libraries and packages.

The VHDL design elements: Structural design elements, behavioral design elements, time dimension and simulation synthesis.

UNIT-III

Combinational Logic Design: Decoders, encoders, three state devices, multiplexers and demultiplexers, Code Converters, EX-OR gates and parity circuits, comparators, adders & subtractors, ALUs, Combinational multipliers, VHDL models for the above ICs.

UNIT- IV

Design Examples (using VHDL): Barrel shifter, comparators, floating-point encoder, and dual parity encoder.

Sequential logic Design: Latches & flip flops, PLDs, counters, shift register and their VHDL models, Design process of FSM: Moore and Mealy machines and their VHDL models, Synchronous design methodology and it's impediments.

UNIT-V

ROMs: Internal Structure, 2D – decoding commercial types, timing and applications.

Static RAMs: Internal Structure, timing and standard SRAMs, Synchronous SRAMs.

Dynamic RAMs: Internal Structure, timing and standard DRAMs, Synchronous DRAMs.

Course Outcomes: *Students can*

a. *Able to understand digital integrated circuits design*
b. *Able to use computer-aided design tools for development of complex digital logic circuits.*
c. *Able to model, simulate, verify, analyze, and synthesize with hardware description languages.*
d. *Able to design and prototype with standard cell technology and programmable logic.*
e. *Able to represent any combinational and sequential circuits using digital ICs.*
f. *Able to design tests for digital logic circuits, and design for testability.*

TEXT BOOKS:

1. John F. Wakerly, "Digital Design Principles & Practices," 3rd Edition, PHI/ Pearson Education Asia, 2005.
2. J. Bhasker, "A VHDL Primer," 3rd Edition, Pearson Education/ PHI.

REFERENCES:

1. Charles H. Roth Jr., "Digital System Design Using VHDL," 2nd Edition, PWS Publications, 2008.
2. Stephen Borwn and ZvonkoVramesic, "Fundamentals of Digital Logic with VHDL Design," 2nd Edition, McGraw Hill, 2005.