

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**COLLEGE OF ENGINEERING (Autonomous) PULIVENDULA**

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**II B.Tech II Semester (E.C.E)**

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**DIGITAL INTEGRATED CIRCUITS & APPLICATIONS**

**COURSE OBJECTIVES:**

1. To introduce digital logic families and interfacing concepts for implementing digital systems.
2. To gain knowledge on VHDL fundamentals, compilers, simulators and synthesis tools.
3. To design and implement different combinational logic circuits.
4. To understand how to implement sequential logic circuits.
5. To get a comprehensive idea about different types of memories.

**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, Transistor-transistor logic (TTL) families, Integrated injection logic (I<sup>2</sup>L), CMOS/TTL interfacing, low voltage CMOS logic and interfacing, Emittercoupled logic, Comparison of logic families, Familiarity with standard 74XX and CMOS 40XX series ICs, Specifications.

**Learning Outcomes:**

*At the end of the unit, the student will be able to*

- Understand the structure of digital integrated circuit families and their characteristics.
- Learn how to interface different logic families.

**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.

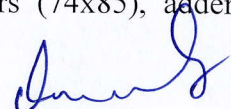
**Learning Outcomes:**

*At the end of the unit, the student will be able to*

- Learn the Hardware Description Language (VHDL).
- Model the complex digital systems at different levels of abstractions.

**UNIT III**

**Combinational Logic Design:** Decoders (74x138), Dual Decoder (74x139), 8 to 3 Encoders, Priority Encoder (74x148), three state devices, multiplexers (74x151) and de-multiplexers (74x155), Code Converters, EX-OR gates and parity circuits, comparators (74x85), adders



& subtractors, ALUs, Combinational multipliers, Design considerations of the above mentioned combinational logic digital IC's, VHDL models for the above ICs.

**Learning Outcomes:**

*At the end of the unit, the student will be able to*

- Understand the implementation of different combinational logic circuits.
- Design and analyze combinational logic circuits using VHDL.

**UNIT- IV**

**Sequential logic Design:** Latches & flip flops, counters (74x163), shift register (74x164 and 74x166) and PLDs. Design considerations of the above mentioned sequential logic digital IC's, VHDL models for the above ICs. Design process of FSM: Moore and Mealy machines and their VHDL models, Synchronous design methodology and its impediments.

**Learning Outcomes:**

*At the end of the unit, the student will be able to*

- Acquire knowledge about different sequential logic circuits.
- Implement sequential logic circuits using VHDL.

**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.

**Learning Outcomes:**

*At the end of the unit, the student will be able to*

- Understand the internal architectures of ROM and RAM.
- Use ROM and RAM for different memory applications.

**TEXT BOOKS:**

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

**REFERENCES:**

1. Morris Mano M, Michael D. Ciletti, "Digital Design", Pearson Education, 4<sup>th</sup> Edition, 2007
2. Charles H. Roth Jr., "Digital System Design Using VHDL," 2<sup>nd</sup> Edition, PWS Publications, 2008.
3. Stephen Borwn and Zvonko Vramesic, "Fundamentals of Digital Logic with VHDL Design," 2<sup>nd</sup> Edition, McGraw Hill, 2005.



**COURSE OUTCOMES:**

*At the end of this course the student will be able to:*

1. Learn about digital logic families and interfacing concepts for implementing digital systems.
2. Gain knowledge on VHDL fundamentals, compilers, simulators and synthesis tools.
3. Design and implement different combinational logic circuits.
4. Understand how to implement sequential logic circuits.
5. Get a comprehensive idea about different types of memories.

