

**University of Computer Studies (Thaton)**  
**2023-2024 Academic Year**  
**Fourth Year (B.C.Tech.)**

**CT-4132 Digital Design**

**First Semester**

**References :**

- [1] “Digital Systems Design Using VHDL”, 3<sup>rd</sup> Edition, by Charles H. Roth, Jr. and Lizy Kurian John
- [2] “Advanced Digital System Design - A Practical Guide to Verilog Based FPGA and ASIC Implementation” by Shirshendu Roy, 2023
- [3] “A Practical Guide for Simulation and FPGA Implementation of Digital Design” by Bekkay Mellit Adel Bouselham Loubna Hajji, 2022
- [4] “Introduction to VLSI Systems”, Ming-Bo Lin, 2012
- [5] “Digital System Design with FPGA”, by Cem Unsalan, Bora Tar, © 2017 by McGraw-Hill Education

**Prerequisite :** CST-2133 Digital Logic Design  
 CT-3234 Computer Architecture and Organization II

**Credit Unit :** 3 ACUs

**Periods :** 64 periods for 16 weeks (4 periods \* 16 weeks) (1 period – 1 hr)

No.	Lecture	Period	References
1	<b>Review of Logic Design Fundamentals</b> Combinational Logic Hazards in Combinational Circuits Mealy and Moore Sequential Circuit Design Sequential Circuit Timing Tristate Logic and Busses	4	[1]
2	<b>Programmable Logic Devices</b> Brief Overview of Programmable Logic Devices Simple Programmable Logic Devices Complex Programmable Logic Devices Field Programmable Gate Arrays Programmable SoCs (PSOC) Problems	6	[1]
3	<b>Design Examples</b> Counters BCD to Seven-Segment Display Decoder Traffic Light Controller State Graphs for Control Circuits Multiplier	5	[1]
4	<b>State Machine Charts and Microprogramming</b> State Machine Charts Derivation of SM Charts Realization of SM Charts Implementation of the Dice Game Microprogramming Linked State Machines	6	[1][2]

No.	Lecture	Period	References
	Problems		
5	<b>Designing with Field Programmable Gate Arrays</b> Implementing Functions in FPGAs Implementing Functions Using Shannon's Decomposition Carry Chains in FPGAs Cascade Chains in FPGAs Examples of Logic Blocks in Commercial FPGAs Dedicated Memory in FPGAs Dedicated Multipliers in FPGAs FPGAs and One-Hot State Assignment FPGA Capacity: Maximum Gates versus Usable Gates Design Translation (Synthesis) Mapping, Placement, and Routing Problems	7	[1][2][3][5]
6	<b>Design of RISC Microprocessors</b> The RISC Philosophy The MIPS ISA MIPS Instruction Encoding Implementation of a MIPS Subset VHDL Model of the MIPS Subset	3	[1]
7	<b>VLSI</b> Introduction to VLSI MOS Transistors as Switches VLSI Design and Fabrication Implementation Options of Digital Systems Summary	3	[4]
8	<b>Lab</b>		
	Review of VHDL	12	[1]
	Additional Topics in VHDL	12	[1]
	Project	6	
	<b>Total</b>	<b>64</b>	

### Assessment Plan for the Course

Exam	: 60%
Quiz/ Test	: 10%
Tutorial/ Assignment	: 10%
Lab	: 10%
Project	10 %