

3EC42: DIGITAL SYSTEMS DESIGN USING HDL
CREDITS – 4 (LTP: 3,0,2)

Course Objective:

This course intends to provide the strong foundation of the design of digital systems using a hardware description language, HDL. The students will have design practice sessions and implementing digital logic systems with electronic design tools.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	150	
3	0	2	4	60	40	20		30

Course Content:

Unit No.	Topics	Teaching Hours
1.	Introduction : History, About HDL, VLSI Design Flow, EDA Tools, Fundamental HDL Units, VLSI design Styles, Programmable Logic Devices, Standard Cell, Full-Custom Design, Basic details of Verilog, Comparison of Verilog and VHDL	08
2.	Basic Language constructs and conventions-I : Fundamental HDL Units, Data Types, Objects, Array, Overloading, Type Conversion, Legal versus Illegal Assignments, Operators and Attributes, Concurrent versus Sequential, Signals and Variables, Conditional – Loop – Case Statements, Examples	08
3.	Basic Language constructs and conventions-II : Introduction, package, component, port map , generic map , function, procedure, function versus procedure, assert - examples	06
4.	HDL design of State Machines and Memory circuits : Template for FSMs, Poor FSM Model, FSM Encoding Styles, The State-Bypass Problem in FSMs, Systematic Design Technique for Timed Machines, FSMs with Repetitive States, Bidirectional Buses ,ROM Design ,RAM Design, External Memory Interfaces, ALU -Examples.	08
5.	HDL design of the basic display and Serial Communications Circuits : Basic LED-SSD-LCD Driver, Seven-Segment Display, Frequency Meter, Digital Clock, Data Serializers / Deserializers, PS2 Interface, I2C Interface, SPI Interface	09
6.	Test bench and Verification : Introduction of Testbench and Verification Methods, Introduction to UVM, Introduction basics of DFT	06
Total		45

List of References:

1. Pedroni, Volnei A., "*Circuit Design and Simulation with VHDL*", 2nd Edition, MIT Press, MIT press, 2004.
2. Samir Palnitkar, "*Verilog HDL*", Pearson Education, Second Edition, 2009.
3. Bhasker J., "*VHDL Primer*", Englewood Cliffs, NJ: Prentice Hall, 3rd Edition, 1999.
4. P. J. Ashenden, "*The Designer's Guide to VHDL*", Elsevier Science, 2010.
5. Perry D. L., "*VHDL Programming By Example*", New York: McGraw-Hill, 2nd Edition, 1994.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Understand the VLSI design flow and use of HDL for digital systems design.
2. Target an HDL design to an FPGA board.
3. Discriminate between combinatorial and sequential digital circuits.
4. Analyze, understand the design of State Machine based digital applications.
5. Develop a digital logic and apply it to solve real-life problems.
6. Develop the skill to understand the importance of test bench and verification methods.