

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS & COMMUNICATION (EMBEDDED SYSTEM) (54)

ADVANCED DIGITAL CIRCUIT DESIGN

SUBJECT CODE: 2715410

SEMESTER: I

Type of course: Digital Integrated Circuit Design

Prerequisite: Fundamental knowledge of Digital Logic Design and VLSI

Rationale: Students of ME in Embedded Systems must possess a good understanding of concepts of design implementation. Students also must learn about various programming language which are necessary for the implementation of system on chip.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	PA (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2	2	5	70	30	20	10	20	0	150

Content:

Sr. No.	Contents	Total Hrs.	% Weightage
1	Overview of Digital design with Verilog: Hierarchical modeling, Number specification, data types, Operator types, Modules and Ports, Gate level modeling, Data Flow Modeling, Behavioral Modeling, Tasks and Functions, Modeling Techniques, Logic Synthesis, Verification Techniques	15	40
2	Basics of Sequential and Combinational logic circuits, Two-level and multi-level logic optimization of combinational circuits, state assignment of finite state machines	12	30
3	Technology mapping for FPGAs, Techniques for partitioning, floor planning, placement and routing, Architectural models, scheduling, allocation and binding for high-level synthesis, Hardware-software co design, Test generation, fault simulation	15	40

Reference Books:

1. Contemporary Logic Design, Second Edition, Author: R. H. Katz, Publisher: Addison-Wesley.
2. Verilog Hdl: A Guide to Digital Design and Synthesis, Second Edition, Author: Samir Palnitkar Publisher: Pearson
3. Verilog HDL Synthesis: A Practical Primer, First Edition, Author: J. Bhasker, Publisher: Star Galaxy Publication

Course Outcome:

Students will get sound knowledge in following topics which are required for design of advanced digital circuits.

1. Different programmable logic devices.
2. Hardware descriptive language
3. Placement, routing and floor-planning
4. Advanced digital circuit specification, implementation, testing and trouble shooting

List of Experiments:

1. Introduction to Verilog and to familiar with Quartus-II tool
2. Implementation of basic logic gates, Universal logic gates and it's Testing and also verify the functionality of Arithmetic and Logical operators.
3. Verify the functionality of Half Adder, Full Adder, Half Subtractor and Full Subtractor.
4. Design and verify (1) 4:1 Mux (2) 8:1 Mux and 16:1 Mux using various statements.
5. Design and verify the functionality of 8:3 Encoder and 3:8 Decoder using case statement.
6. To Verify the functionality of Shift Register.
7. Design and verify binary to gray and gray to binary code convertor using dataflow modeling.
8. Design and verify D Flip-flop and JK Flip-flop with behavioral modeling.
9. Design and Implementation of 4-Bit up-down counter.
10. Design and verify (1) MELAY MODELING (2) MOORE MODELING.
11. Design and Implementation of 1K RAM and its verification.

Open Ended Problems

1. Design and Implementation of UART on FPGA
2. Design and Implementation of image processing on FPGA
3. Design and Implementation of receiver circuits

Major Equipments:

- i. Personal Computer
- ii. ALTERA DE-I and DE-II Board

List of Software:

Quartus-II, (Open Source Software)

Learning website:

www.nptel.ac.in