

GUJARAT TECHNOLOGICAL UNIVERSITY

FUNDAMENTALS OF VLSI CAD

SUBJECT CODE: 3712609

SEMESTER: I

Type of course: Basic of Graph theory.

Prerequisite: Basic matrices operation.

Rationale: This course provides students with the mathematical foundations that are the basis of computer aided-design techniques used in VLSI Design flow.

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)		
3	0	2	4	70	30	30	20	150

Content:

Sr No	Course Content	Teaching hours	Module weightage
1	Introduction: Introduction to VLSI Design methodologies and abstraction levels, The VLSI Design Problem, The design domains, design actions, design methods and technologies.	4	10
2	Algorithmic Graph Theory: Terminology of graph. Data Structures for the Representation of Graphs, Computational Complexity, Examples of Graph Algorithms- Depth-first Search, Breadth-first Search etc, Time and space complexity of algorithms	5	12
3	Tractable and Intractable Problems: Combinatorial Optimization Problems, Decision Problems, Complexity Classes, NP-completeness and NP-hardness, Consequences.	5	12
4	General-purpose Methods for Combinatorial Optimization: The Unit-size Placement Problem, Backtracking and Branch-and-bound, Dynamic Programming, Integer Linear Programming, Local Search, Simulated Annealing, Tabu Search, Genetic Algorithms	6	15
5	Logic Synthesis and Verification: Introduction to Combinational Logic Synthesis, Binary-decision Diagrams, Two-level Logic Synthesis.	6	15
6	High-level Synthesis : Hardware Models for High-level Synthesis, Internal Representation of the Input Algorithm, Allocation, Assignment and Scheduling, Some Scheduling Algorithms, Some Aspects of the Assignment Problem, High-level Transformations.	12	26
7	Simulation: General Remarks on VLSI Simulation, Gate-level Modeling and	4	10

	Simulation, Switch-level Modeling and Simulation		
		42	100

Reference Books:

1. Algorithms for VLSI Design Automation, Sabih H. Gerez, John Wiley & Son.
2. Evolutionary Algorithms for VLSI CAD, Rolf Drechsler, Springer Science and Business media, 1998
3. Spectral Techniques in VLSI CAD, Mitchell Aaron Thornton, Rolf Drechsler, D. Michael Miller, Springer Science and Business media

Course Outcome:

- 1 To establish comprehensive understanding of the various phases of CAD for VLSI Design.
- 2 To demonstrate knowledge and understanding of fundamental concepts in CAD.
- 3 To demonstrate knowledge of computational and optimization algorithms and tools applicable to solving CAD related problems.
- 4 To establish capability for CAD tool development and enhancement.

List of Experiments:

- 1 Write a program to generate all possible trees for a given graph.
- 2 Write a program to implement Depth-first Search algorithm.
- 3 Write a program to implement Breadth-first Search algorithm.
- 4 Write a program to implement Binary-decision diagrams.
- 5 Write a program to implement Binary-search algorithm.
- 6 Write a program to implement Genetic algorithm.
- 7 Write a program to implement Integer linear programming.
- 8 Write a program to implement Dijkstra's Shortest-path algorithm
- 9 Write a program to implement ASAP Scheduling algorithm.
- 10 Write a program to implement Mobility-based Scheduling algorithm.

List of Open Source Software/ Learning website:

- 1 Xilinx/C++ (software)/Matlab
- 2 www.nptel.ac.in
- 3 www.ocw.mit.edu
- 4 www.berkeley.edu