

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS & COMMUNICATION (SIGNAL PROCESSING AND VLSI TECHNOLOGY) (26)

FUNDAMENTALS OF VLSI CAD

SUBJECT CODE: 2722609

SEMESTER: II

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)			
					ESE	OEP	PA	RP		
3	0	2#	4	70	30	20	10	10	10	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	13
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,	10	25

	High-level Transformations.		
7	Simulation: General Remarks on VLSI Simulation, Gate-level Modeling and Simulation, Switch-level Modeling and Simulation	3	10
		39	100

Reference Books:

1. Algorithms for VLSI Design Automation, Sabih H. Gerez, John Wiley & Son.
2. Evolutionary Algorithms for VLSI CAD, Rolf Drechsler, kluwer academic publishers.
3. Spectral Techniques in VLSI CAD, Mitchell Aaron Thornton, Rolf Drechsler, D. Michael Miller, kluwer academic publishers

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.

Open Ended Problems:

- 1 Design a CAD GUI tool which generates all possible trees for a given graph.
- 2 Design a CAD GUI tool for Depth-first Search algorithm.
- 3 Design a CAD GUI tool for Breadth-first Search algorithm.
- 4 Design a CAD GUI tool for Binary-decision diagrams.
- 5 Design a CAD GUI tool for Binary-search algorithm.
- 6 Design a CAD GUI tool for Genetic algorithm.
- 7 Design a CAD GUI tool for Dijkstra's Shortest-path 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

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.