Dept Number	CS 402	Course Title	Theory and Applications of Computer Aided Design
Semester Hours	3	Course Coordinator	Mehdi Zargham
Catalog Description	A study of algorithmic techniques which solve high complexity design rules. Graph algorithms and formulations, randomized solutions, techniques from operations research and statistics, computational geometry algorithms and data structures are introduced. The techniques are mainly applied on the physical design/automation problem for integrated circuits and systems.		

Textbooks

References

Layout Design and Verification by T. Ohtsuki, Elsevier Publishers B.V. (North-Holland),1986

Combinatorial Algorithms for Integrated Circuit Layout by Thomas Lengauer, John Wiley and Sons, 1990

Course Learning Outcomes

- To learn algorithmic techniques which solve high complexity design rules.
- To learn graph algorithms and formulations, randomized solutions, techniques from Operations Research and Statistics, Computational Geometry algorithms and data structures.
- To apply techniques on the Physical Design Automation problem for Integrated Circuits and Systems

Assessment of the Contribution to Program Outcomes

Outcome →	1	2	3	4	5	6	7	8	9	10
Assessed →	X	X	X		X					

Prerequisites by Topic

315 and 330 each with a grade of *C* or better.

Major Topics Covered in the Course

1. Introduction to optimization problems: deterministic, randomized algorithms and their analysis, Pseudo polynomial, approximation algorithms and heuristics, upper and lower bounds{3 classes}
2. Graph and theoretic methods: search and path problems, flows and matching planarity{4 classes}
3. Techniques from operations research and statistics: local search simulated annealing, Markov chains, linear, integer, and dynamic programming, non linear optimization. {6 classes}
4. Computational geometry techniques: basic data structures and algorithm, intersection problems, geometrical search and transformation problems, decomposition and covering of polygonal regions, grid less routing {6 classes}
5. Introduction to interconnection networks {7 classes}
6. An introduction to physical design automation {2 classes}
7. Partitioning, placement and floor planning: partitioning heuristics, algorithms for planar graphs and trees, partitioning based placement and floor planning, simulated annealing in partitioning and placement, nonlinear optimization techniques {6 classes}
8. Global routing: maze running, line searching algorithms {3 classes}
9. Channel routing: two layer channel routing heuristics, LEA based algorithms, three and multi-layer channel routing heuristics {5 classes}
10. Compaction: one and two dimension compaction, hierarchical compaction {2 classes}
11. Layout problems in architecture, multimedia and robotics {2 classes}