20VL013 - PHYSICAL DESIGN AUTOMATION

CO1 Understand the relationship between design automation algorithms and variousconstraints posed by VLSI fabrication and design technology.
CO2 Adapt the design algorithms to meet the critical design parameters
CO3 Identify layout optimization techniques and map them to the algorithms
CO4 Develop proto-type EDA tool and test its efficacy.

UNIT I
VLSI design Cycle, Physical Design Cycle, Design Rules, Layout of Basic Devices, and Additional Fabrication, Design styles: full custom, standard cell, gate arrays, field programmable gate arrays, sea of gates and comparison, system packaging styles, multi chip modules.

UNIT II
Design rules, layout of basic devices, fabrication process and its impact on physical design, interconnect delay, noise and cross talk, yield and fabrication cost.

UNIT III
Factors, Complexity Issues and NP-hard Problems, Basic Algorithms (Graph and Computational Geometry): graph search algorithms, spanning tree algorithms, shortest path algorithms, matching algorithms, min-cut and max-cut algorithms, Steiner tree algorithms.

Basic Data Structures, atomic operations for layout editors, linked list of blocks, bin based methods, neighbour pointers, corner stitching, multi-layer operations.

UNIT IV
Graph algorithms for physical design: classes of graphs, graphs related to a set of lines, graphs related to set of rectangles, graph problems in physical design, maximum clique and minimum coloring, maximum k-independent set algorithm, algorithms for circlegraphs.

UNIT V
Partitioning algorithms: design style specific partitioning problems, group migrated algorithms, simulated annealing and evolution, and Floor planning and pin assignment, Routing and placement algorithms.

Physical Design Automation Lab

Cycle 1:

1) Graphalgorithms
1) Graph searchalgorithms
1) Depth firstsearch
2) Breadth firstsearch
2) Spanning treealgorithm
1) kruskal'salgorithm
3) Shortest pathalgorithm
1) Dijkstraalgorithm
2) Floyd- Warshallalgorithm
4) Steiner tree algorithm

2) Computational geometryalgorithm
1) Line sweep method
2) Extended line sweep method

Cycle 2:

1) Partitioningalgorithms

1) Group migrationalgorithms
1) Kernighan –Linalgorithm
2) Extensions of Kernighan-Linalgorithm
1) Fiduccias –Mattheysesalgorithm
2) Goldberg and Bursteinalgorithm
2) Simulated annealing and evolutionalgorithms
1) Simulated annealingalgorithm
2) Simulated evolutionalgorithm
3) Metric allocationmethod

2) Floor planningalgorithms

1) Constraint basedmethods
2) Integer programming basedmethods
3) Rectangular dualization basedmethods
4) Hierarchical tree basedmethods
5) Simulated evolutionalgorithms
6) Time driven Floorplanningalgorithms

3) Routingalgorithms

1) Two terminalalgorithms
1) Maze routingalgorithms
1) Lee's algorithm
2) Soukup'salgorithm
3) Hadlockalgorithm
2) Line-Probealgorithm
3) Shortest path basedalgorithm
2) Multi terminalalgorithm
1) Steniertree based algorithm
1) SMSTalgorithm

Text Books:

1. Naveed Shervani, Algorithms for VLSI Physical Design Automation, 3rd Edition, Kluwer Academic, 1999.
2. Charles J Alpert, Dinesh P Mehta, Sachin S Sapatnekar, Handbook of Algorithms for Physical Design Automation, CRC Press,2008