CS 708: COMPUTATIONAL GEOMETRY (3-0-0: 3)

Convexity and convex hulls
Naive algorithms for extreme points, gift wrapping, quickHull, Graham's algorithm, incremental algorithm, divide and conquer.

Line segment intersections
Plane-sweep algorithm, doubly-connected edge list, overlay subdivisions.

Triangulation
Triangulating monotone polygons, partitioning simple polygons , convex partitioning, lower and upper bounds, linear time triangulation, guarding art gallery - problem.

Linear programming
Incremental and randomized algorithms, unbounded linear programs, linear programming in higher dimension.

Range searching
Geometric data structures, 1-D range searching, quad-tree; kd-tree; improvements on range searching, range tree; fractional cascading, inverse range search- segment tree; interval tree; priority search tree.

Voronoi diagrams
Farthest point Voronoi diagram, other distance metrics, Fortune's plane sweep algorithm, Delaunay triangulation- empty circles, local Delaunay-hood, edge-flip, lifting, analysis, max-min angles, randomized incremental algorithm; backward analysis.

Point location
DAG structure for point location in triangulations, a randomized incremental algorithm, degenerate cases.

Arrangements
Duality, line arrangements, levels and discrepancy, complexity, incremental algorithm, zone theorem.

Visibility
Art gallery problems, visibility graphs, motion planning and shortest paths for a point robot, for a translating polygonal robot.

References:

1. F. P. Preparata and M. I. Shamos, “Computational Geometry: An Introduction”, Springer-Verlag.
2. J. O'Rourke, “Computational Geometry in C”, Cambridge University Press.
3. M. Laszlo, “Computational Geometry and Computer Graphics in C++”, Prentice-Hall.
4. M. De Berg, M. van Kreveld, M. Overmars, O. Schwarzkopf, “Computational Geometry: Algorithms and Applications”, Springer –Verlag.