**Computational Geometry syllabus**

**Unit I**: Introduction to Computational Geometry; Line Segment Intersection –

The Doubly-Connected Edge List, Computing Overlay of Two Subdivisions,

Boolean Operations; Polygon Triangulation – Guarding and triangulations,

Partitioning a polygon into monotone pieces, triangulating a monotone polygon.

**Unit II**: Linear Programming – The geometry of casting, Half-plane intersection,

Incremental and Randomized linear programming; Orthogonal range Searching –

One Dimensional range searching, kd-trees, Range trees, higher dimensional

range trees.

**Unit III**: Point location – Point location and trapezoidal maps, a Randomized

incremental algorithm, dealing with degenerate cases; Voronoi Diagrams –

Definition and basic properties, computing the Voronoi diagram; Arrangemnets

and Duality – Computing the discrepancy, duality, arrangements of lines, levels

and discrepancy.

**Unit IV**: Delaunay Triangulations – Triangulations of planar point sets, the

Delaunay triangulation, computing the Delaunay triangulation, the analysis;

Geometric Data Structures – Interval trees, priority search trees, segment trees.

**Unit V**: Convex Hulls – The complexity of convex hulls in 3-space, computing

convex hulls in 3-space, the analysis, convex hulls and half-space intersection;

Binary Space Partitions – the definition of BSP trees, BSP trees and the Painter’s

algorithm, constructing a BSP tree, the size of BSP tree in 3-space.

**Unit VI**: Quadtrees – Uniform and non-uniform meshes, quadtrees for point

sets, from quadtree to meshes; Simplex Range Searching – Partition trees,

multi-level partition trees, cutting trees.

**Text Books:**

1. Computational Geometry – Algorithms and Applications, Second Revised

Edition, Mark de Berg, et al., Springer, 1998.

2. Discrete and Computational Geometry, Satyan L. Devadoss and Joseph

O’Rourke, Princeton University Press, 2011.

**Reference Books:**

1. Computational Geometry – an Introduction, Franco Preparata and Michael

Shamos, Springer-Verlag, 1985.