

**Department:** Mathematics and Computer Sciences

**Division:** Computer Sciences

**Level and Major:** Graduate

**Course Title:** Computer Geometrical Design

**Number of Credits:** 3

**Prerequisite:** Data Structures and Algorithms

**Lecturer:**

**Course Description:** It is a course at the undergraduate or graduate level with a variable subject in computer science:

- Insert the additive algorithms: insertion sort, find a convex surface (surface additive), triangulation monotone polygons
- Plane –Sweep Algorithm Finding the intersections of line segments Finding convex hulls: insertion hull revisited Contour of union: of Rectangles
- Spatial Subdivision 1. The Range Searching Problems 2. Kd (kd-Trees) 3. The Grid Method 4. Quad trees 5 2D Search Trees 6. Removing Hidden Surfaces 7. Rang Trees, fractional cascading

**Course Goals and Objectives:** In this course, algorithms that can be effective in solving geometric problems are studied and analyzed and problems of computational geometry are designed and analyzed. This course can help strengthen the student's ability to use efficient algorithms to solve complex problems, especially geometric problems.

**Course Topics:**

- Introduction to the definition of algorithm and its analysis and data structure
- Geometric data structure (point, polygon, side, geometric objects in space, intersection)
- Incremental algorithms: Insertion sorting, Finding a convex surface (incremental procedure), Insert the additive triangles (Insert the additive algorithms: insertion sort, find a convex surface (surface additive), triangulation monotone polygons)
- Selective incremental algorithms: Selective sorting, Convex surface weaving (gift-wrapping algorithm, Graham algorithm), Elimination of hidden surfaces, Convection of convex polygons, Devonian triangulation
- Sweeping line algorithms: Finding the intersection of line segments, finding the convex surface, Counting the community of triangles, Parting the polygon into sections of a single line (Plane – Sweep Algorithm Finding the intersections of line segments Finding convex hulls: insertion hull revisited Contour of Rectangles)
- Split and Solve Algorithms: Merge Sort, Find Half-Page Intersection, Find Polygon Core, Find Veronese Area, Merge Procedure, Problem of Nearest Points, Polygon Triangulation
- Spatial division methods: area search problem, lattice method, quadruple tree, two-dimensional search tree, removal of hidden surfaces

**Reading Resources:**

- Laszlo, M. J. (1996). *Computational geometry and computer graphics in C++* (Vol. 5). Upper Saddle River, NJ: Prentice Hall.
- o'Rourke, J. (1998). *Computational geometry in C*. Cambridge university press.