



# COMPUTATIONAL GEOMETRY

**PROF. AMIT KUMAR**

Department of Computer Science and Engineering  
IIT Delhi

**TYPE OF COURSE** : Rerun | Elective | UG

**COURSE DURATION** : 12 weeks (24 Jan' 22 - 15 Apr' 22)

**EXAM DATE** : 23 Apr 2022

**PRE-REQUISITES** : Data Structures and Algorithms

**INTENDED AUDIENCE** : 4 th year undergraduate or beginning graduate students

**COURSE OUTLINE :**

The course covers lessons in Introduction using Basic Visibility Problems , The Maximal Points Problem, The Plane Sweep Technique and applications ,Convex Hull Different Paradigms and Quickhull , Dual Transformation and Applications , Lower Bounds on Algebraic tree model , Point Location and Triangulation , Voronoi Diagram and Delaunay Triangulation , Randomized Incremental Construction and Random Sampling , Arrangements and Levels , Range Searching , Clustering Point Sets using Quadtrees and Applications , Epsilon-Nets VC Dimension and Applications , Shape Analysis and Shape Comparison.

**ABOUT INSTRUCTOR :**

Prof. Amit Kumar is Tarwinder and Jaswinder Chadha Chair Professor in the Dept. of Computer Science and Engineering at IIT Delhi. He obtained B.Tech. degree from IIT Kanpur in 1997 and Ph.D. from Cornell University in 2002. He works in the area of combinatorial optimization, with emphasis on problems arising in scheduling, graph theory and clustering. He received IBM Faculty Award in 2005, INAE (Indian National Academy of Engineering) Young Engineer Award in 2006 and INSA (Indian National Science Academy) Medal for Young Scientists in 2011. He was a Max Planck-India partner group research fellow during 2005-09. He received the prestigious Shanti Swarup Bhatnagar Award for Mathematical Sciences in 2018, and was elected Fellow of Indian Academy of Sciences in 2019.

**COURSE PLAN :**

**Week 1:** Introduction and Basic Problems

**Week 2:** Plane Sweep Technique

**Week 3:** Convex Hull and Algorithm

**Week 4:** Duality Transform and Application

**Week 5:** Lower Bound Techniques

**Week 6:** Point Location and Triangulation

**Week 7:** Voronoi Diagram and Delaunay Triangulation

**Week 8:** Arrangements and Levels

**Week 9:** Range Search

**Week 10:** Clustering Point sets using Quadtrees and Applications

**Week 11:** Epsilon-nets and VC Dimension

**Week 12:** Shape Analysis