Birla Institute of Technology & Science, Pilani
Hyderabad Campus

**SECOND SEMESTER 2018-2019**

# Course Handout Part II

**Date: 07/01/2019**

In addition to Part I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

**Course No.** : **CS F402**
**Course Title** : **Computational Geometry**
**Instructor-in-charge** : Tathagata Ray

## Scope and Objective

In theoretical computer science, the algorithms for geometric problems are a subject which needs special attention. This subject is called Computational Geometry. It has emerged as a research area in itself with dedicated conferences and journals. These geometric problems are coming from the requirements of real life problem in computer graphics, Geographical Information Systems, Cartography, Robotics, and many more entailing all the disciplines of engineering.

The objective of the course is to impart students with state of the art data structures and algorithms in computational geometry. The students at the end of the course will be able to

- To identify suitable algorithms or data structure to apply for a given geometric problem.
- Will be able to argue about the time complexity of geometric algorithms.
- Will be able to write the proof of correctness of geometric algorithms.
- Will be able to understand the intricacies involved in implementing such algorithms.
- Will get acquainted with state of the art computational geometric algorithm libraries.
- Will be able to implement computational geometric algorithms.

**Pre-requisites:**
CS F111 (Computer Programming), CS F211 (Data Structure and Algorithms)

**Text Books:**

- T1: Mark de Berg et al. Computational Geometry: Algorithms and Applications, Springer

**Reference books:**

- R1: Joseph O'Rourke ,Computational Geometry in C, Cambridge univ press
- R2: Preparata and Shamos “Computational Geometry: An Introduction” Springer
- R3: Research papers as discussed in the class

**Course Plan:**

Evaluation Scheme:

| Lecture No. | Learning Objectives | Topics | References |
|---|---|---|---|
| 1-3 | Understanding Computational Geometry and its applications | Introduction to computational geometry. | T1 (Chapter 1) |
| 4-10 | Understanding Convex Hull and Different algorithms to make it. | Convex Hull algorithms in 2D and 3D | R1, T1, R3 (Chapter 1) |
| 11-14 | Understanding Map overlay problem and how it can be solved using Line Segment Intersection Algorithms | Line Segment Intersection | T1(Chapter 2) |
| 15-20 | Understanding classic Art Gallery Problem and how it is solved using Polygon Triangulation | Polygon Triangulation | T1(Chapter 3) |
| 21-25 | Understanding data structures to search all the points in a given space efficiently. | Orthogonal Range Search | T1 (Chapter 5) |
| 26-30 | Understanding data structures to give the regions containing given a query point. | Point Location | T1 (Chapter 6) |
| 31-35 | Understanding a specific kind of triangulation called Delaunay triangulation and its Dual data structure Voronoi diagram used in many applications. | Delaunay Triangulation and Voronoi Diagram | T1 (Chapter 7 and 9) |
| 36-40 | Understanding an arrangement of lines can be nicely studied using their dual representation i.e points. | Arrangement and Duality | T1 (Chapter 8) |
| 40-42 | Understanding real life applications using these algorithms. | Applications of Computational Geometry | R2, R3 |

| S. No. | Evaluation Component | Duration | Date and Time | Weightage (%) | Nature of Component |
|---|---|---|---|---|---|
| 1. | Quiz-1 (2) | 30 minutes | 7/2, 9/4 | 10 | Closed Book |
| 2. | Midterm | 90 minutes | 15/3 9:00-10:30 a.m. | 25 | Closed Book |
| 3 | Assignments/Practical | | | 20 | Open Book |
| 4. | Project | | | 10 | Open Book |
| 5. | Comprehensive | 3 Hours | 10/05 FN | 35 | Closed Book |

**Chamber Consultation Hour**: 12-1:00 p.m. on every Saturday

**Notices:** All notices pertaining to this course will be displayed on the CS & IS Notice Board or CMS.

**Make-Up Policy:**
**No makeups will be given for quizzes under any circumstance.**
Makeup for tests can be given only for genuine cases and that too with prior approval from the instructor in charge on providing letter from Chief Warden certifying the reason of leave.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor-in-charge**
**Tathagata Ray**