BITS Pilani, K K Birla Goa Campus, India
CS F402: Computational Geometry
Dynamic Handout - SEM II, 2024-25

(Last Updated: May 19, 2025)

Instructors: Prof. Siddharth Gupta
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Lecture Timings: 9:00 am - 9:50 am (Mon, Wed, Fri) [C402]
Office Hours: Walk-in (Drop an email first to make sure I am in the office)

The course will consist of two main themes. The *Basics* theme will cover the fundamental concepts and techniques for the course. The *Graph Drawing* theme will explore various topics from Graph Drawing and Visualization. Below is a list of tentative topics from each theme.

Course Outline

- **Basics:**
  - Graphs
  - Lower and Upper bound
  - Complexity Classes (P, NP, NP-hard, NP-Complete)
  - Approximation and Parameterized Algorithms
- **Graph Drawing:**
  - Drawing Trees and Series-Parallel Graphs
  - Forced Directed Algorithms
  - Straight-Line Drawings of Planar Graphs
  - Orthogonal Drawings
  - Upward Planar Drawings
  - Hierarchical Drawings

Reference Books

R1: G. Di Battista, P. Eades, R. Tamassia, I. Tollis: "Graph Drawing: Algorithms for the Visualization of Graphs", Prentice Hall, 1998.

R2: M. Kaufmann, D. Wagner: "Drawing Graphs: Methods and Models", Springer, 2001.

R3: T. Nishizeki, Md. S. Rahman: "Planar Graph Drawing", World Scientific, 2004.

R4: R. Tamassia: "Handbook of Graph Drawing and Visualization", CRC Press, 2013.

Lecture Schedule

Date	Lecture	Topic	Slides Ref.	Book Ref.
Jan 8	1	**Overview:** Organizational & Overview	Lect1 (1:25-2)	NA
Jan 10	2	**Overview:** Organizational & Overview; **Basics:** Graphs (Graphs, Digraphs, Planar Graphs)	Lec1 (26-1:27-4), Lect2 (1:3-15), Lect3 (1:2-19)	**R1:** 2.1, 1
Jan 13	3	**Basics:** Graphs (Planar Graphs)	Lect3 (2-20:3-24)	**R1:** 1
Jan 15	4	**Basics:** Graphs (Complete Graphs, Trees)	Lect4 (1:5-39)	**R1:** 1, 3.1.1
Jan 17	5	**GD:** Drawing Trees (Layered Drawing)	Lect5 (1:6-25)	**R1:** 3.1.2
Jan 20	6	**GD:** Drawing Trees (Layered Drawing, HV-Drawings)	Lect5 (6-26:7-27), Lect6 (1:3-6)	**R1:** 3.1.2, 3.1.4
Jan 22	7	**GD:** Drawing Trees (HV-Drawings, Radial Drawings)	Lect6 (4-1:5-12), Lect7 (1:4-20)	**R1:** 3.1.4, 3.1.3
Jan 24	8	**GD:** Drawing Trees (Radial Drawings), Drawing Series-Parallel Graphs	Lect7 (5-1:8-5), Lect8 (1:5-2)	**R1:** 3.1.3
Jan 27	9	**GD:** Drawing Series-Parallel Graphs	Lect8 (6-1:9-6)	**R1:** 3.2
Feb 5	10	Tutorial 1	NA	NA
Feb 12	11	Tutorial 1, **GD:** Force-Directed Algorithms	Lect9 (1:4-12)	**R1:** 10.1
Feb 14	12	**GD:** Force-Directed Algorithms	Lect9 (5-1:8-11), Lect10 (1:6-42)	**R1:** 10.1, 10.2
Feb 17	13	**GD:** Force-Directed Algorithms	Lect10 (7-1:9-20)	**R1:** 10.2
Feb 19	14	**GD:** Force-Directed Algorithms	Lect10 (9-21:10-42)	**R1:** 10.2
Feb 21	15	**GD:** Straight-Line Drawings of Planar Graphs I	Lect11 (1:4-30)	**R4:** 6.4
Mar 10	16	Midsem Discussion	-	-
Mar 11	17	**GD:** Straight-Line Drawings of Planar Graphs I	Lect11 (5-1:7-31)	**R4:** 6.5
Mar 12	18	**GD:** Straight-Line Drawings of Planar Graphs I	Lect11 (8-1:10-25)	**R4:** 6.5
Mar 17	19	**GD:** Straight-Line Drawings of Planar Graphs I	Lect11 (11-1:16-4)	**R4:** 6.6
Mar 19	20	Tutorial 2	NA	NA
Mar 21	21	**GD:** Straight-Line Drawings of Planar Graphs II	Lect12 (1:7-16)	**R4:** 6.7
Mar 24	22	Quiz 2 Discussion	NA	NA
Mar 26	23	**GD:** Straight-Line Drawings of Planar Graphs II	Lect12 (1:9-18)	**R4:** 6.7
Apr 2	24	**GD:** Straight-Line Drawings of Planar Graphs II	Lect12 (10-1:14-11)	**R4:** 6.7
Apr 4	25	**GD:** Straight-Line Drawings of Planar Graphs II	Lect12 (14-12:20-15)	**R4:** 6.7
Apr 7	26	Quiz 3 + Discussion about Paper Presentation and Take Home Assignment	NA	NA
Apr 9	27	Midsem Paper + In class assignments (1-4) Distribution	NA	NA
Apr 11	28	**GD:** Orthogonal Layouts	Lect13 (1:7-31)	**R1:** 5.1, 5.2
Apr 16	29	**GD:** Orthogonal Layouts	Lect13 (8-1:19-3)	**R1:** 5.2, **R4:** 7.2.4
Apr 21	30	**GD:** Orthogonal Layouts	Lect13 (20:26-5)	**R1:** 5.3

Apr 23	31	**GD:** Orthogonal Layouts	Lect13 (27:33-17)	**R1:** 5.4
Apr 25	32	Quiz 4 + Discussion about Paper Presentation and Take Home Assignment	NA	NA
Apr 28	33	**GD:** Upward Planar Drawings	Lect14 (1:8-26)	**R1:** 6.1, 6.2

Grading Policy

- **Midsem:** 30% - Open Book - March 8, 2025 (9:30 am - 11:00 am)
  - Syllabus: Lecture 1-15
- **Compre:** 35% - Open Book - **To Be Announced**
  - Syllabus: Lecture 15-33
- **Research paper presentation:** 10%
  - Duration - 20-30 mintues
  - Max. 2-3 students
  - Every student needs to present
- **Quizzes:** 10% - Closed Book (Best 3 out of 4)
  - Q1 - Feb 15, 2025 (Saturday) (10:00 am - 11:00 am) - DLT6
    - Syllabus: Lecture 1-12
  - Q2 - Mar 22, 2025 (Saturday) (10:00 am - 11:00 am) - CC [MCQ]
    - Syllabus: Lecture 12-20
  - Q3 - Apr 7, 2025 (Monday) (09:00 am - 09:20 am) (C402 - In class)
    - Syllabus: Lecture 21-25
  - Q4 - Apr 25, 2025 (Friday) (09:00 am - 09:20 am) (C402 - In class) [MCQ]
    - Syllabus: Lecture 28-31
- **Take-home Assignment + Oral Exam:** 15%
- **Extra Credit - In class assignments:** 10% (Best $n-1$ out of n)
  - Can be swapped with Quiz marks.

Makeup Policy

- Quizzes - No makeup.
- Midterm - Only in genuine and exceptional cases of absence.
- Comprehensive - Contact Associate Dean, AUGSD.

Malpractice Policy

The course has a strict policy against any form of academic dishonesty during the examinations and assessments. Any student found guilty of such misconduct will face disciplinary action, including receiving negative marks equivalent to the weightage of that assessment/exam.