



# Birla Institute of Technology & Science, Pilani

Hyderabad Campus

## FIRST SEMESTER 2022-2023

### Course handout (Part II)

Date: 29/08/2022

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

**Course No.** : IS F311  
**Course Title** : Computer Graphics  
**Instructor-in-charge** : Prof. Tathagata Ray

### Scope and Objectives of the Course

The course mainly covers Graphics I/O hardware, Generation of dot, lines, conics, curves, surfaces & polygons; Filling closed regions, 2D & 3D Graphics & Transformations, Windowing, Viewing & Clipping, Efficient algorithms, Solid Modeling, Color Models & Dithering, Visible surface detection, Rendering, Animation Techniques, Advanced modeling and Future directions.

The objectives of the course are to

- Able to compute all the transformations used in a graphics pipeline.
- Able to compute all the required algorithms used in every phase of the graphics pipeline.
- Able to implement it in OpenGL.
- Able to implement and compute basic geometric modeling constructs.
- Able to calculate lighting models.

### Text Book

T1: James D. Foley, A. Van Dam, S.K. Feiner, and J.F. Hughes, Computer Graphics: Principles and Practice in C, 2<sup>nd</sup> edition Pearson education.

### Reference Books

R1: Rogers B., "Mathematical elements of Computer Graphics", Tata McGraw Hill, 2002.  
R2: D. Hearn and M.P. Baker, Computer Graphics: C Version, Pearson Education, 2002.  
R3: Sumanta Guha, "Computer Graphics through OpenGL, From Theory to experiments", 3<sup>rd</sup> Ed., CRC Press, 2019.

### Course Plan

L.No.	Learning Objectives	Topics to be covered	Chapter in the Text Book
01-03	Definition Why to study Applications I/O Devices	Overview of graphics systems – What, Why & Where about Graphics, Hardware & Software, Input & Output Technology, Mathematical complexity involved - Demonstration through some	Ch 1 Ch 4.4 Class Notes

		examples	
04-07	Fast algorithms to draw Lines, Conic, And filled regions	Raster Graphics Algorithms for Drawing 2D objects: Lines, Circle, Ellipse, Parabola, Hyperbola, Polygon & Filled Closed Objects	Ch 3.1-3.9
08-10	Concepts of 3D and OpenGL	Introduction to 3D- Graphics & 3D Coordinate Geometry and Introduction of OpenGL	Class Notes
11-13	How & why to manipulate objects	2D & 3D Scaling, Translation, Rotation, Shear, Reflection, Projection and Composite Transformations	Ch 5.1–5.3 Ch 5.5-5.8
14-16	Mapping 2D from World to Screen	Viewing & Clipping in 2D (Cohen's and Parametric Line Methods)	Ch 5.4 Ch 3.11-3.12
17-20	Mapping 3D from World to Screen, and Foreshortening	Viewing & Clipping in 3D (Perspective & Parallel projection, Clipping against a Canonical View Volume, Clipping in Homogeneous Coordinates, and Mapping into a View-port	Ch 6
21-25	Drawing Smooth Curves & Surfaces	Hermite, Bezier, Continuities, Bspline Curves & Surfaces Rational Cubic Polynomial Curves & Quadric Surfaces)	Ch 11
26-28	Representation of Solid Objects	Solid Modeling (Representations, Operations, Geometry, and Interface)	Ch 12
29-33	Detection of Hidden portions	Visible Surface Detection (Need & Algorithms, Ray Tracing) and Hidden Line elimination	Ch 15
34-35	Perception of light and Color, Dithering	Light & Color Models (Light, half-toning, Color Models, Color Conversion & Interpolation, Dithering Matrix)	Ch 13
36-38	How to shade surfaces and solids	Rendering (Models, Physics, Shading Polygons & Surface, & Shadows)	Ch 16
39-40	Programming Pipeline of OpenGL	Shaders and the programmable pipeline-basics	R3: Ch 15

#### Evaluation Scheme:

E.C.NO	Evaluation Component	Duration (minute)	Weightage (%)	Date & time	Nature of component
01	Midterm	90	30	03/11 1:30 -3:00 p.m.	Closed Book
02	Project		10	Will be announced in class	Open Book
03	Coding Assignments (10% pre mid sem grading)	-	20	Will be announced in class	Open Book
04	Comprehensive	120	40	26/12 AN	Closed book

Note: minimum 40% of the evaluation to be completed by midsem grading.

**Chamber Consultation Hour: TBA**

**Notices:** Will be displayed on the CMS. Specific instructions will be often given in the class only.

**Makeup Policy:** Makeup is highly discouraged for this course. Makeup will be given only in genuine cases and that too with prior notification only (following AUGSD rules). Makeup in Comprehensive Exam will be decided as per the guidelines issued by AUGSD.

**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**