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**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, 2nd 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”, 3rd Ed., CRC Press, 2019.

**Course Plan**

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| **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 examples | Ch 1  Ch 4.4  Class Notes |
| 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:**

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| **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**