**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI**

**HYDERABAD CAMPUS**

**SECOND SEMESTER 2019-2020**

**Course handout (Part II)**

## Date: 6/01/2020

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 Objective 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 objective of the course is 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: N Krishnamurthy, “Introduction to Computer Graphics”, 1st Ed., TMH, 2002.

**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 | How to show graphics in motion | Animation (Languages, Techniques, Control, Basic Rules & Problems) | Ch 21 |
| 41-42 | Research Agenda | Applications of 3D Graphics in Visualization | Class Notes |

**Evaluation Scheme:**

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| --- | --- | --- | --- | --- | --- |
| **E.C.NO** | **Evaluation Component** | **Duration**  **(minute)** | **Weightage (%)** | **Date & time** | **Nature of component** |
| 01 | Midterm | 90 | 20 | 4/3 9.00 - 10.30AM | Closed Book |
| 02 | In Class Quizzes |  | 10 | Each quiz is 1% worth and will be conducted in class. Almost 1 quiz/week. No makeups. | Closed Book |
| 03 | Project |  | 10 | Will be announced in class | Open Book |
| 03 | Coding Assignments | - | 20 | Will be announced in class | Open Book  (take home) |
| 04 | Comprehensive | 180 | 40 | 06/05 AN | Closed book |

**Chamber Consultation Hour: TBA**

**Notices:** Will be displayed only on the CS&IS notice board and announced in class.

**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 ID rules). In any case, the discretion to give makeup for any component except Comprehensive Exam lies with IC entirely.

**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**