Syllabus for CSE 167, Winter 2003

Instructor: Dr. Farhana Bandukwala

1. Introduction to basic raster graphics
   Lecture 1: Intro to graphics
     a) Historical perspective
     b) Graphics vs Vision
     c) Applications of graphics
     d) Introduction to OpenGL
   Lecture 2: Concepts of raster graphics
     a) Raster vs vector: pixels vs strokes
     b) Advantages & Disadvantages:
     c) Algorithms
     d) Bit and pixel operations in OpenGL
   Lecture 3: Graphics system
     a) Input and Output devices
     b) Random scan display processor
     c) Pipeline architecture
     d) Client Server model
   Assignment 1 handed out

2. Geometry and Transformations
   Lecture 4: User Interfaces
     a) Goals
     b) Styles
     c) Design considerations
     d) User Interface Management system
     Assignment 1 due beginning of class
   Lecture 5: 2D Geometrical Objects & transformations
     a) Geometrical Objects
     b) Operations
     c) Homogeneous coordinates and matrix representation of transformations
   Lecture 6: OpenGL objects and transformations
     a) Primitives in OpenGL
     b) World coordinate system
     c) Screen coordinate
     d) OpenGL transformation matrices

3. Curves
   Lecture 7: Parametric Polynomials
     a) Explicit vs Implicit representation
     b) Linear approximations
     c) Parametric form
     d) Polynomial cubic curves
   Assignment 1 due beginning of class
   Lecture 8: Types of cubics
     e) Hermites, Beziers and BSplines
4. Three dimensional rendering
   Lecture 9: Three dimensional objects and transformations
   a) Geometrical objects
   b) Coordinate systems and transformations
   c) Matrix representation of 3D transformations
   d) Composite transformations
   Lecture 10: Projections
   a) Perspective projections
   b) Parallel projection
   c) Camera position
   d) Clipping planes
   Lecture 11: Surfaces
   a) Linear representations: Polygon meshes
   b) Parametric bicubic surfaces
   c) Subdivision Surfaces
   Lecture 12: Rendering in Open GL
   a) View setup:
   b) Projections in Open GL
   c) Surfaces in Open GL

5. Illumination
   Lecture 13: Light sources
   a) Achromatic
   b) Colored light
   c) Illumination models
   Assignment 2 due beginning of class
   Lecture 14: Surface shading
   a) Reflection models
   b) Computational issues
   c) Polygon shading
   Assignment 3 handed out
   Lecture 15: Illumination and Shading in OpenGL
   a) Specifying light sources
   b) Material properties
   c) Texture mapping
   d) Transparency

6. Hidden surface removal
   Lecture 16: General concepts
   a) Functions of two variables and horizon line algorithm
   b) Techniques for efficient algorithms
   Lecture 17: Image space algorithms
   a) Painter’s algorithm
   b) Z Buffer algorithm
c) A Buffer algorithm
d) Z-buffers in Open GL
Lecture 18: Object space algorithms
   a) Depth sort algorithm
   b) BSP trees
   c) Octree-based algorithms

7. Object hierarchy
   Lecture 19: General concepts and tree structures
      a) Uses for object hierarchy
      b) Trees and DAGs
   Assignment 3 due beginning of class
Lecture 20: Scene graphs in OpenGL
   a) Geometry nodes
   b) Camera
   c) Lights and materials
   d) Transformations
   e) Display Lists
   Assignment 4 handed out

8. Animation
   Lecture 21: Basic concepts
      a) Animatable parameters
      b) Conventional vs computer-based
   Lecture 22: Languages
      a) Linear list notations
      b) General purpose
      c) Graphical animation languages
      d) Controlling animation
   Lecture 23: Animation tricks in OpenGL
      a) Problems:
      b) General rules:
      c) Implementation in OpenGL
      d) Hardware-based animation: sprites

9. Graphics pipeline
   Lecture 24: Standard graphics pipeline revisited
      a) Front end vs back end
      b) Performance barriers
      c) Multiprocessor architectures
      d) Unique architectures

10. Advanced topics
    Lecture 25: Raytracing
    Lecture 26: Radiosity
    Lecture 27: Volume visualization
    Assignment 4 due beginning of class