CSC/CPE 471 Introduction to Computer Graphics

1. CSC/CPE 471 Introduction to Computer Graphics

2. credit units 4  
   contact hours 6

3. Course Coordinator: Zoe Wood

4. Textbook:(and/or other required material)  
   Peter Shirley, “Fundamentals of Computer Graphics”

5. a. Course Description:  
   Graphics software development and use of APIs for 3D graphics.  
   The graphics pipeline, modeling, geometric and viewing transforms, lighting and shading, rendering, interaction techniques and graphics hardware. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 471.

   b. Prerequisite: CSC/CPE 357.

   c. Required/Elective/Selective Elective for CPE, CSC, EE, SE

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6. a. Course Goals/Outcomes
   The student will be able to:
   - Gain a working as well as a theoretical knowledge of CG hardware and algorithms, as well as experience in the use of a major toolkit (currently OpenGL). The course is taught from a tool builder’s point of view; with a focus on the mathematical foundations necessary to support interactive three dimensional graphics applications.

   b. How Student Outcomes addressed
   (“B” = Basic level, “I” = Intermediate level, “A” = Advanced level)

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7. Major Topics Covered: (number of lecture hours each)
   - The graphics pipeline (4.5 hours): Geometry front end; Raster back end
     - Modeling objects (3 hours)
     - Points, lines, polygons, and planes
     - Smooth surfaces
     - Triangle meshes (indexed face sets)
     - Volumes
- Constructive Solid Geometry
  - Curves

- Modeling transformations (4 hours)
  - Translation, rotation, and scale
  - Composition of transformations
  - Hierarchical modeling
  - Trivial clip of objects

- Illumination (2.5 hours)
  - Diffuse and specular reflectance (1.5 hours)
  - The Phong lighting model (.5 hours)
  - Fast cosines and normals (.5 hours)

- Projection (2.0 hours): Perspective and parallel; The viewing transformation, & virtual camera

- Clipping to the screen (1.0 hours): Sutherland-Hodgeman clipping

- Scan-conversion of primitives (2.0 hours): Scan-converting polygons; Scan-converting points and lines

- Hidden-surface removal (1.0 hours): Z-buffering; Other methods: Painter's, Warnock's algorithm, and BSP trees

- Shading (3 hours)
  - Flat shading
  - Gouraud shading
  - Phong shading
  - Raytracing and radiosity
  - Texture mapping

- Perception (1 hours): The human visual system (0.5 hours); Color systems: RGB cube, HSV, YIQ, CIE (0.5 hours)

- The GPU (2.5 hours): General organization of the GPU, including programming the GPU via shaders

- Advanced topics (1 hour): animation, geometric modeling, advanced rendering