

2. credit units 4  contact hours 6

3. **Course Coordinator**: Zoë Wood

4. **Textbook (or other required material)**: None

5. **a. Course Description**: Basic and advanced algorithms for real-time, interactive, 3D graphics software. Modeling (polygon mesh, height field, scene graph), real-time rendering and shading (visibility processing, LOD, texture and light maps), collision detection (bounding volumes, complexity management), interactive controls, multi-player game technology, game engine architecture. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 476.

   **b. Prerequisite**: CSC/CPE 471.

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

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6. **a. Course Learning Objectives**
   The student will be able to:
   - Describe and evaluate the graphics pipeline and the basic implementation of the pipeline in modern hardware (and graphics libraries)
   - Articulate programmatic choices related to geometry in real-time games; use basic vocabulary, demonstrate general computation, and compare the tradeoffs of:
     - Various spatial data structures
     - Various culling algorithms
     - Various geometric representations (polygonal, volume, parametric, etc.)
   - Articulate programmatic choices related to lighting and shading in real-time games; use basic vocabulary, demonstrate general computation, and compare the tradeoffs of:
     - Various global illumination algorithms (i.e., shadow algorithms, ambient occlusion, etc.)
     - Various BRDFs and deferred shading
     - Related technologies, including texture mapping and framebuffers
   - Articulate programmatic choices related to animation in real-time games; use basic vocabulary, demonstrate general computation, and compare the tradeoffs of:
     - Introductory physically-based modeling
• Character animation (specifically skinned meshes)
  • Program a basic game with multiple moving components and interaction, shadow mapping, view frustum culling, and two advanced graphics technologies from a provided list.
  • Write a large C++ real-time computer graphics application either as an individual or on a team and experience the joy of software engineering while working on a larger quarter-long project.

b. Level at which Student Outcomes are addressed
   (“B” = Basic level, “I” = Intermediate level, “A” = Advanced level)

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7. Major Topics Covered: (number of lecture hours per)
   • Graphics pipeline review (2 hours)
   • Geometry in games (8 hours)
   • Animation basics (3 hours)
   • Spatial data structures (3 hours)
   • Illumination and rendering (8 hours)
   • Visual effects (3 hours)