CSE 4413  
Principles of Computer Graphics

REQUIRED/ELECTIVE:
  Computer Science – Elective  
  Software Engineering – Elective  
  Computer Engineering – Elective

CATALOG DATA:
  (Prerequisite: CSE 2383 with a grade of C or better and MA 3113). Three hours lecture. Graphics hardware, algorithms; graphics primitive, windowing and clipping; transformations; 3D graphics; shading; hidden surfaces; standards.

PREREQUISITE BY TOPIC:
  1. Data Structures  
  2. Object Oriented Programming  
  3. Linear Algebra/Calculus

TEXTBOOKS AND OTHER REQUIRED MATERIAL:
  Online course material available from http://courses.webct.msstate.edu/

COORDINATOR:
  Dr. T.J. Jankun-Kelly

COURSE OBJECTIVES:
  1. To provide students with an understanding of the fundamental techniques and mathematical foundations of computer graphics  
  2. To expose students to the common computer graphics APIs  
  3. To establish a foundation for further course work and research in computer graphics and related fields (visualization, CGAD, etc.)

TOPICS COVERED:  
  (Number of class hrs)
  1. Image Processing  
  2. User Interfaces and Interaction  
  3. Rasterization: Line drawing, curves, antialiasing  
  4. Scan Conversion: Polygon filling  
  5. Clipping: Lines, polygons  
  6. 2D & 3D Graphics Pipeline  
  7. Transformations in 2D & 3D  
  8. Viewing Transformations  
  9. Visible Surface Detection  
  10. Lighting and Shading, Color Theory  
  11. Texture Mapping, Bump Mapping, Environment Mapping  
  12. Scene modeling: Octrees, Fractals  
  13. Rendering: Ray Tracing, Radiosity, NPR  
  14. Applications: Visualization and Animation  
  15. Programmable Graphics Hardware

CONTRIBUTION TO PROFESSIONAL COMPONENT:
  Engineering Topics of Engineering Science and Engineering Design
ASSESSMENTS:
1. Individual programming assignments (4)
2. Group on-line note writing/reviewing (1 each per student)
3. Mid-term (for all) and final exams (for undergraduates)
4. Group final project (for graduates and undergraduates who opt out of final exam)

RELATIONSHIP TO PROGRAM OUTCOMES:
Note: Parenthesized list indicates the ABET criteria.

Performance Criteria:
1. Students will be able to specify the components of a virtual scene and translate this to a working implementation using a computer graphics API such as OpenGL (c, k).
2. Students will be able to implement the core functionality of components in the graphics pipeline (vertex processing (modeling, transformation, and lighting), rasterization (clipping, projection, and scan conversion), and fragment processing (hidden surface detection and texture mapping) (a, c).
3. Students will be capable of expressing the mathematical forms of geometric transformations and implementing these transforms (a, c).

PREPARED BY:
T.J. Jankun-Kelly, Assistant Professor, Department of Computer Science and Engineering, February 8, 2005.