COMPUTER SCIENCE 315

COMPUTER GRAPHICS

I. Introduction

A. Catalog Description

This course is an introduction to the process of generating images with a computer. The emphasis is on the design and use of graphical facilities for two- and three-dimensional graphics. Students study the mathematical theory underlying computer generated graphics, and will implement programs utilizing these techniques. The mathematical topics covered include rotations, translations, and perspective. The core pieces of the graphics pipeline used in current graphics hardware are studied. *Prerequisite: CSCI 261*. Offered Fall term only.

B. Objectives

This course should provide the student with an understanding of many aspects of modern interactive graphics: hardware, software, data structures, mathematical manipulation of graphical objects, and the fundamental implementation algorithms.

C. Prerequisites

CSci 261. This course will emphasize the mathematical and programming techniques of computer graphics as opposed to a graphics application course. Students must have an adequate background in matrix operations in order to follow discussions of three-dimensional transformations and projections. A high level language will be used extensively; students must be fully familiar with the implementations of abstract data structures. A grade of C- is required in the prerequisite courses.

D. Evaluation

Evaluation will include a major graphics project.

II. Required Topics

A. Background and Applications

1. History of Computer Graphics
2. Modern Applications of Computer Graphics

B. Architecture

1. Hardware and Output Devices
2. Graphics Pipeline
3. The Frame Buffer

C. Theory and Techniques

1. Coordinate Systems
2. Mathematical Transformations
3. Camera Models

C. Theory and Techniques (cont.)

4. Classical Viewing and Perspective Projections
5. Polygon meshes and 3D models
6. Texture Mapping
7. Culling and Clipping
8. Transparency, Blending, and Compositing
9. Shading

III. Optional Topics

1. User Interfaces and Picking
2. Hierarchical Models
3. Particle Systems
4. BSP Trees
5. Fractals
6. Curves and Surfaces
7. Line Drawing Algorithms
8. Scan Conversion Algorithms

IV. Bibliography

Possible Textbooks:

Hearn & Baker	Computer Graphics with OpenGL.
Francis S. Hill	Computer Graphics using OpenGL.
Edward Angel	Interactive Computer Graphics: A Top-Down Approach with OpenGL.
Alan Watt	3D Computer Graphics.
Peter Shirley	Fundamentals of Computer Graphics.
Foley & Van Dam	Fundamentals of Interactive Graphics.
Shreiner, et. al.	OpenGL Programming Guide: The Official Guide to Learning OpenGL.

Other Resources:

Shreiner	OpenGL Reference Manual: The Official Reference Document to OpenGL.
Randi J. Rost	OpenGL Shading Language.
Wright & Lipchak	OpenGL SuperBible.
Gilbert Strang	Introduction to Linear Algebra.
Schneider & Eberly	Geometric Tools for Computer Graphics.
Moller & Haines	Real-Time Rendering.