EECS 104 FUNDAMENTALS OF COMPUTER GRAPHICS
(Elective for CpE and CSE)

Catalog Data:
EECS 104 Fundamentals of Computer Graphics (Credit Units: 4)
Instruction in the fundamental algorithms and data structures used in computer image generation and manipulation including: output primitives, linear transformations, windowing, hidden-line removal, and shading. Prerequisite: EECS40. Formerly ECE104. (Design units: 2)

Textbook:
Angel, Edward, *Interactive Computer Graphics: A Top-Down Approach with OpenGL,* Addison Wesley, 2005.
Shreiner, Woo, Neider, Davis, *OpenGL Programming Guide: The Official Guide to Learning OpenGL,* Addison Wesley, 2004.

References:
http://eee.uci.edu

Coordinator:
Joerg Meyer

Course Objectives:
To provide a comprehensive introduction to hardware, software and applications aspects of computer graphics. The goals are to acquaint students with the basic principles and problems of computer graphics; give students the mathematical background to understand and implement these concepts and give students the computer science underpinnings for research in computer graphics. Students taking this class will design and document a complete computer graphics modeling and rendering system that contains a complete transformation/clipping package; an elementary modeling package which will enable construction of complex scenes and an advanced shading, lighting and texture mapping package. Students are required to design and implement all of the system components. Examinations will include questions based on the design concepts learned during the individual projects in addition to formal concepts taught in class.

Course Outcomes:
Students will:
Write graphics applications using C/C++, OpenGL and GLUT.
Write concisely structured and documented application programs.
Implement a complete transformation, clipping, lighting and texture mapping package.
Design a modeling package for the construction of complex scenes.

Prerequisites By Topic:
Advanced programming techniques including data abstraction, object-orientation, code reuse, and design methodology. Techniques for windows programming and advanced user interface design. Good knowledge of algorithms, data structures, basic linear algebra and trigonometry.

Lecture Topics:
Graphics Systems & Models (graphics architectures and software, imaging, synthetic camera, modeling vs. rendering), OpenGL (architecture, programming), Input & Interaction (input devices, event-driven programming), Geometric Objects & Transformations (affine transformations, translation, rotation, scaling, shear, homogeneous

coordinates, concatenation, current transformation and matrix stacks), Viewing & Projections (transformation in 3D, projective transformations), Shading (light sources, reflections, polygonal shading, recursive subdivision, ray tracing), Rendering (clipping, hidden surface removal, scan conversion), Texture Mapping , Image Based Modeling and Rendering.

Class Schedule: Meets for 3 hours of lecture and 1 hour of lab each week for 10 weeks.

Computer Usage: C and/or C++ programming language.

Laboratory Projects: The programming projects for this class are chosen to enhance the lecture material in the course. Students gradually learn the basic steps that are needed for programming a graphics application.

Professional Component: Contributes toward the Computer Engineering Topics Courses and Major Design experience.

Relationship to Program Outcomes: This course relates to Program Outcomes: Computer Science a, b, c, d, e, f, h and j as stated at: http://undergraduate.eng.uci.edu/degreeprograms/computer/mission and Electrical Program Outcomes a ,b , c, d, and f as stated at: http://undergraduate.eng.uci.edu/degreeprograms/electrical/mission

Design Content Description

Approach: Write a program to satisfy certain minimum specifications as part of a computer graphics oriented project (i.e. a computer aided design tool). Using OpenGL API, write a computer program to satisfy the assignment requirements. The project is organized such that the students can include additional features to enhance the original assignment. Work in a lab or on a home computer.

Lectures: 50%

Laboratory Portion: 50%

Grading Criteria:

4 Programming assignments:	15% each
Midterm exam	20%
Final exam	20%
	100%

Estimated ABET Category Content:

Mathematics and Basic Science: 0 credit units or 0%

Engineering Science: 2 credit units or 50%

Engineering Design: 2 credit units or 50%

Prepared by: Joerg Meyer **Date:** July 2007

CEP Approved: Fall 2004