**COEN 4830 Introduction to Computer Graphics**

**Credits and contact hours:** 3 credit course, meeting for 3 50-minute periods each week.

**Course coordinator:** Dr. Chandana Tamma

**Text:** F. S. Hill, Jr. and Stephen M. Kelley, Computer Graphics using OpenGL, 3rd Edition, Prentice Hall, 2007.

**Catalog description:** Introduction to computer graphics algorithm design and implementation; includes considerable actual computer graphics experience. Topics include: point-plotting and line-drawing techniques, two-dimensional curve fitting, two-and three-dimensional graphics, clipping, windowing, hidden line removal, modeling, lighting and shading, 3D viewing, texturing, shadowing, introduction to Ray tracing, input-output devices, and other topics as future trends dictate.

**Prerequisites:** Proficiency in at least one high-level computing language.

**Selected Elective** in ELEN Computer Hardware & Software area, COEN Software area (depth only)

**Professional component:** Engineering science – 33%; Engineering design – 67%
**Course Goals:**

The goals of this course are to provide the student with an introduction to computer graphics and an appreciation of the state of the art of computer rendering. The students will enhance their working knowledge of the computer language of their choice through the implementation of various computer graphics algorithms.

**Specific outcomes of instruction***By the end of this course, you should be able to*

1. Provide an overview of the computer graphics field
2. Describe important input and output graphics devices
3. Write programs that produce pictures using the basic ingredients found in every OpenGL program
4. Develop some elementary graphics tools for drawing lines, polylines, and polygons
5. Write a program allows a user to control a program with the mouse and keyboard
6. Write a program using viewports and clipping
7. Write a program using the window-to-viewport transformation
8. Develop a classical clipping algorithm
9. Write a program drawing in world coordinates
10. Select windows and viewports for optimal viewing
11. Build figures based on regular polygons and their offspring
12. Draw arcs and circles
13. Describe parametrically defined curves and see how to draw them
14. Review vector arithmetic and relate vectors to objects of interest in graphics
15. Relate geometric concepts to their algebraic representations
16. Describe lines and points parametrically
17. Distinguish points and vectors properly
18. Exploit the dot product in graphics
19. Write a program working with objects in 3D space, including the cross product of two vectors
20. Develop tools for transforming one picture into another
21. Describe the fundamental concepts of affine transformations, which perform combinations of rotations, scalings, and transformations
22. Write a program that applies affine transformations to objects in computer programs
23. Write a program for transforming coordinate frames
24. Set up a camera to render a 3D scene using OpenGL
25. Design scenes in the Scene Design Language (SDL) and write programs that read SDL files and draw the scenes they describe
26. Write a program working with objects in 3D space
27. Represent solid objects using polygonal meshes
28. Draw simple wire-frame views of mesh objects
29. Write a program that creates and manipulates a "camera" producing pictures of a 3D scene
30. Write a program that "flies" a camera through a scene interactively
31. Describe mathematics of various kinds of projections
32. Describe how each operation in the OpenGL graphics pipeline operates and why it is used
33. Build a clipping algorithm for 3D objects
34. Devise a means for producing stereo views of objects
35. Add realism to drawings of 3D scenes
36. Examine ways to determine how light reflects off of surfaces
37. Render polygonal meshes that are bathed in light
38. Make a polygonal mesh object appear smooth
39. Remove hidden surface by means of a depth buffer
40. Write a program adding textures to the surfaces of objects
41. Add shadows of objects to a scene

**Student outcomes addressed by the course:**Partial fulfillment of Criterion 3 objectives A, C, E, G, I, and K

**Brief list of topics to be covered:**

Introduction to Computer Graphics (Chapter 1)

Getting Started Drawing Figures (Chapter 2)

Additional Drawing Tools (Chapter 3)

Vector Tools for Graphics (Chapter 4)

Transformations of Objects (Chapter 5)

Modeling Shapes with Polygonal Meshes (Chapter 6)

Three-Dimensional Viewing (Chapter 7)

Rendering Faces for Visual Realism (Chapter 8)

Ray Tracing (if time allows) (Chapter 2)

Last modified: November 17, 2017