**ABET Course Syllabus – CS4550**

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| **Code** | CS4550 | **Credits** | 3 |
| **Title** | Computer Graphics | **Coordinator** | Eun-Young Kang |

**Course Information**

1. **Catalog Description:** Programming in object oriented graphics environment implementing primitive operations in two and three dimensions; image modeling using affine transformations; polygonal meshes and other topics.
2. **Prerequisites:** CS 3112 and MATH 2550.
3. **Contact Hours:** Lecture 2 hours, Laboratory 3 hours /week
4. **Required/Elective:** This course is an elective in the BS program.

**Textbook**

F. S. Hill, Computer Graphics using OpenGL, 3rd Ed., Prentice Hall, 2007

**Course Goals**

The Student Learning Outcomes that are addressed by the course are:

*SLO #1. Students will be able to apply concepts and techniques from computing and mathematics to both theoretical and practical problems.*

*SLO #2. Students will be able to demonstrate fluency in at least one programming language and acquaintance with at least three more.*

*SLO #3. Students will have a strong foundation in the design, analysis, and application of many types of algorithms.*

*SLO #5. Students will have the training to analyze problems and identify and define the computing requirements appropriate to their solutions.*

*SLO #6. Students will have the training to design, implement, and evaluate large software systems working both individually and collaboratively.*

Other outcomes of instruction. At the end of the course, students are able to

1. Describe how graphics display devices work and what graphics primitives are.

2. Explain and work with coordinate spaces, coordinate conversion, and transformations of graphics objects.

3. Explain the graphics modeling process and create polygonal meshes models.

4. Describe the 3D graphics rendering pipeline.

5. Create virtual scenes, transform objects, and work with a camera.

6. Acquire skills in programming with OpenGL/WebGL and/or 3D modeling with Maya.

**Topics covered**

This course covers topics in 2D rendering and 3D rendering/modeling: lines, polygons, windows/viewports, transformations, polygonal meshes, and rendering pipeline. It also introduces widely used graphic libraries/tools in academia and industry such as OpenGL, WebGL and Maya (if time permits).

1. Introduction to Computer Graphics

- Graphics Display Devices and Input/Output Primitives

- Steps to Generate Computer Images

- CG Application and Research Areas

2. Drawing Graphics Primitives

- OpenGL Basic Graphics Primitives

- Drawing: Lines, Polygons, Arcs, Circles, and Ellipse

- Event Handling and Callback Functions

- Parametric Curves

3. Linear Algebra (Vector Tools)

- Vectors, Matrices, and Operations on them

- Coordinate Systems and Coordinate Frames

- Mapping Coordinate Systems

- Affine Combination

- Linear Interpolation

- Line Segment Intersection

- Polygon Intersection Problems

4. Transformation of Objects

- Types of Transformations

- Affine Transformations and Inverse

- Coordinate Conversions

5. Clipping

6. Three Dimensional Viewing

- Camera Controls

- Projections

- Graphics Rendering Pipeline

7. Shading

- Shading Models

- Shading in OpenGL

- Shader and GLSL (WebGL)

8. Raster Display

- Line Drawing Algorithms

- Polygon Filling Algorithms

9. Others

- Modeling

* Modeling Shapes with Polygonal Meshes
* Extrusion and Surface Revolution
* Mesh Approximation to Smooth Objects
* Polygonal Meshes for a Curved Surfaces and Surface Normals
* Modeling with a Tool (eg. Maya)

- Texture Mapping

- Aliasing

- Curve and Surfaces