New Course: Introduction to Computer-Aided Modeling CGS 3220, Credits 3
Prerequisite: Precalculus: Algebra and Trigonometry MAC 1147 or equivalent
Instructor: Kristian Linn Damkjer, http://www.cise.ufl.edu/~kdamkjer/

Justification for Course:

Introduces undergraduates, especially those within the Digital Arts and Sciences degree programs, to applied computer graphics topics for non–real-time rendered media. The course will not be limited to DAS students and can be taken by anyone who meets the prerequisite course requirement. The interdisciplinary nature of this course stresses the application of computer science and engineering to creative disciplines.

Catalog Course Description:

Introduction to topics relating to computer-aided modeling. Polygonal mesh, NURBS, and subdivision surface meshes. Materials and shading networks. Lighting, shadows, and rendering.

Goal of Course:

Introduce students to topics in applied computer graphics, specifically in computer-aided modeling. Present standard model topologies and modeling methods, shading, texturing, and rendering.

Course Content Overview:

1. Regular multimedia-enhanced lectures in a CIRCA-equipped classroom
2. Peer critique and Socratic seminars to discuss relevant works
3. Multimedia demonstrations (VHS, DVD, Internet)

Required Text:

Book: Lewis, G. and J. Lammers, *Maya 5 Fundamentals*, New Riders Publishing, 2004. ISBN 0735713723

Required Software:

Latest version of Maya Unlimited (currently 6.0). Available in UF computer labs, students do not need to purchase.

Attendance Policy:

Attendance is required and will be checked by the instructor.

Makeup Policy:

In general there are no late submissions or make-ups permitted except in the following circumstances: religious holidays, student illness or medical impairment, absence subject to the twelve-day rule, examination conflicts, or legal impairment. In these circumstances the student should notify the instructor as soon as they are aware of a potential exam or deadline conflict so that an alternative may be established.

Grading:

1. Attendance.....5%
2. Homework.....30%
3. Critique Participation 10%
4. Final Project 20%
5. Midterm Examination 15%
6. Final Examination 20%

Lecture Topics:

1. Basic 3-D Concepts: Cartesian Coodinate System, Pivots, Transformations, Scene Graph, Coordinate Spaces (World, Object, Local)
2. Polygonal Mesh Surfaces. Advantages and disadvantages. Components (vertices, edges, faces) and relationships. Mesh normals (face and vertex). Manifold vs. non-manifold geometry.
3. Standard polygonal modeling techniques. Face and edge extrusion. Face division techniques, split polygon, cut, subdivide, and poke faces. Beveling and chamfering.
4. Polygonal mesh manipulation and maintenance. Make/Fill hole. Combining meshes. Reversing normals. Merging vertices. Triangulating/Quadrangulating meshes. Identifying and correcting various undesirable mesh conditions.
5. NURBS Surfaces. Advantages and disadvantages. Components (control vertices, edit points/knots, isoparametric lines, patches, hulls). Properties (degree and order, form, continuity normals). Tesselation.
6. Standard NURBS modeling techniques. Lofting, Extrusion, Curve Bi-Rail and Bounded Area patch creation.
7. NURBS mesh manipulation and maintenance. Adding more control by inserting knots. Extending surfaces. Opening and closing surfaces. Splitting and joining surfaces. Filleting and rounding. Stitching, Trimming. Rebuilding surfaces to change parameterization, form, degree, or to match topology.
8. Subdivision surfaces. Advantages and disadvantages. Working modes (standard vs. coarse mesh)
9. Extension of polygonal mesh modeling techniques for subdivision. Refining local areas for more control in areas of higher curvature. Creasing edges and vertices (weighted/partial creasing if supported).
10. Subdivision mesh maintenance. Maintaining ideal subdivision surface topology: quadrangulated manifold mesh.

11. Modifying Surface Appearances. Shaders and shading networks. Surface materials Lambertian, Blinn, Phong, Anisotropic. Shader attributes. Bump and displacement mapping. Volumetric materials.
12. Texturing. File-based, procedural, and environment mapping. Texture space vs. object space. Texture projections planar, spherical, cube, cylindrical. Texture baking.
13. Lighting and shadows. Faking lighting for 3-D environments. Three-point lighting scheme. Types of lights: area, directional, ambient, spot, point, volume. Depth map shadows. Photorealistic lighting and shadows: ray-trace and radiosity.
14. Rendering: virtual cameras. Camera types. Camera attributes. Setting up scene for rendering to specific media.