

**Course Title:** 3D Computer Animation: Form, Light, and Motion.

**Course Number:** Arts College 749

**Prerequisites:** Graduate standing or permission of instructor

**Course Description:**

This course presents concepts and techniques of 3D computer animation for graduate students in multiple disciplines, providing an overview of the integral production methods of modeling, lighting, and motion. Students are encouraged to apply the coursework to their thesis research. The course also serves as a foundation for students interested in advanced topics courses offered in computer animation.

**Course Objectives / Student Learning Outcomes:**

Students completing this course can expect to have a fundamental understanding of the process for producing computer-generated animation as it applies to their own graduate research and as a multidisciplinary application.

- Representation of 3D perspective and geometry
- Basic polygonal and parametric modeling techniques
- Key-frame animation
- Concepts of expressivity in movement
- Organization of hierarchies and grouping in a 3D scene
- Basic concepts of digital lighting
- Basic concepts of shaders and texture mapping
- Basic concepts of rendering process, file formats, and project management

**Course Methodology:**

The course will consist of instructor lectures and demonstrations, class participation in reviews and critiques, individual student presentations, lab sessions, and screenings of animated works. Students are expected to seek and apply their own unique creative voice in designing solutions for the tasks presented.

**Course texts and resources:**

Principles of Three-Dimensional Computer Animation: Modeling, Rendering & Animating with 3D Computer Graphics. Michael O'Rourke. W.W. Norton & Company ISBN 0-393-73024-7

Visual Quickstart Guide: Maya for Windows and Macintosh 7.0 (or current software version). Danny Riddel and Adrian Dimond. Peachpit Press. ISBN 0-321-24746-9

Maya Learning Resources – on-line documentation

<http://www.highend3d.com>

<http://www.cgtalk.com/>

<http://www.learning-maya.com>

<http://www.3dcafe.com>

**Grading Policy:**

All students are required to be on time and in attendance for each and every class. Two absences will lower a final grade by 1/2 a letter, three absences will lower a final grade by one letter and four absences will result in failure of the course.

Adherence to deadlines is expected. It is the individual student's responsibility to keep track of deadlines and to present the work to the class and instructor on the specified dates. Revision is part of the process in preparing work for the final due date, not after. Make use of production time in class to receive feedback on work in progress from the instructor and classmates. Work presented late will be marked down one grade letter for each class meeting missed. See the calendar below for value of each assignment or exam towards the final grade

Students choosing to use "at home" hardware and software must have their current working files on the system and available for review at the beginning of each and every class. Problems with home systems and/or incompatibility will not be an acceptable excuse for missed goals. Technical problems will happen frequently during the semester and students will have trouble accessing the computer lab during "prime time" hours. Students must make their own arrangements for overcoming these difficulties and submitting their work on time. Unless there is a complete system failure in a computer-related course, technical difficulties are never an acceptable excuse for not meeting a deadline.

Assignment 1 = 20%

Assignment 2 = 20%  
Assignment 3 = 20%  
Final Project = 20%  
Completion of in-class exercises = 10%  
Course participation = 10%

**Schedule:**

Week 1: Cartesian space and representation, definition of geometry

Navigating the software interface

*Principles of Three-Dimensional Computer Animation*: Pages 9-36: Introduction, Chapter 1. Modeling: [Introduction, Polygonal Modeling, Splines and Patches, Coordinate Systems, Viewing Windows, Geometric Primitives]

*Learning Maya Tutorials* –

Lesson 1: Overview of the Maya Interface

Lesson 2: Creating, Manipulating, and viewing objects

Lesson 3: Viewing the Maya 3D scene

*Towards Assignment 1: Begin research on applications of animation and visualization within your area of research*

Week 2: Polygon modeling techniques

*Principles of Three-Dimensional Computer Animation*: Pages 36-59: Chapter 1. Modeling: [Transformations, Common Modeling Techniques, Hierarchies]

*Learning Maya Tutorials* –

Lesson 4: Components and attributes

Polygonal Modeling

Lesson 1: Modeling a polygonal surface

Week 3: Polygon and NURBS modeling techniques

*Learning Maya Tutorials* –

Polygonal modeling.

Complete the on-line Maya Tutorial, “Lesson 1 Modeling a polygonal surface”. In this tutorial you will create a hammer using a variety of polygon editing tools.

NURBS Modeling

Lesson 1: Revolving a curve to create a surface

Lesson 2: Sculpting a NURBS surface

Lesson 3: Lofting curves to create a surface

*Assignment 1: Modeling an object or environment* – sketches assigned

Week 4: NURBS modeling techniques continued

*Principles of Three-Dimensional Computer Animation*: Pages 60-64: Chapter 1. Modeling: [Boolean Operations and Trims]

*Assignment 1: Modeling an object or environment* – sketches reviewed

Week 5: Shaders and texturing techniques

*Learning Maya Tutorials* –

Polygon shaders and texturing

Lesson 1: UV texture mapping

Rendering

Lesson 2 Shading Surfaces

*Assignment 1: Modeling an object or environment* – models completed

Week 6: Lighting and rendering

*Principles of Three-Dimensional Computer Animation*: Pages 77-146: Chapter 2 Rendering  
Three point lighting configurations – light design

*Learning Maya Tutorials* – Rendering

Lesson 1: Rendering a scene  
Lesson 3: Lights, shadows, and cameras

*Assignment 2: Still life / rendered model* - assigned

Week 7: Key frame animation – expressivity

*Principles of Three-Dimensional Computer Animation*: Pages 147-157: Chapter 3. Animation:  
[Introduction, Key framing Simple Transformations, Interpolations, Parameter-curve Editing]

*Learning Maya* Tutorials –

Animation Lesson 1: Key frames and the graph editor

Exercise: Bouncing ball

*Assignment 2: Still life / rendered model* - due

Week 8: Camera animation – composition over time

*Principles of Three-Dimensional Computer Animation*: Pages 179-183: Chapter 3. Animation: [Camera Animation]

*Learning Maya* Tutorials -

Animation Lesson 3 Path animation

*Assignment 3: Camera and motion* - assigned

Week 9: Hierarchies and animation – articulated motion

*Principles of Three-Dimensional Computer Animation*: Pages 158-159: Chapter 3. Animation:  
[Hierarchical Animation]

Grouping and parenting. Articulated limbs. Solar system.

*Assignment 3: Camera and motion* – due

Week 10: Proposals for final project

*Principles of Three-Dimensional Computer Animation*: Pages 263-274: Chapter 4. Production Planning  
Final project production

Finals Week: Final project

### **Assignment Descriptions:**

For each assignment: *Research, Case Studies, and Documentation*.

From the date at which each assignment is given, research and document resources and examples of computer animation applications relevant to your research interests. Assemble this documentation on a web page for presentation in class during the project proposal stage or presentation of final work, as indicated by the instructor. In addition to this documentation of influences in your field of study, create web documentation of the processes involved in the development of your own personal work for the project.

On the due date for each assignment, submit a one to two page written statement summarizing your implementation of the project parameters relative to your research, including references to current practices using similar techniques and the impact of incorporating aspects of the project in your own current and future work.

*Assignment 1: Modeling an object or environment.*

Sketch designs on paper for a 3D model. Plan the design as something that can be accomplished in the time allotted for the assignment. Sketches will be discussed in class prior to starting the modeling process. Create the model using software tools reviewed in class. Plan to apply surface shaders to the object later, so consider how different materials will add to the final result.

In designing the model, focus on your area of interest: industrial design, an interior space, architecture, sculpture, etc. You can look ahead to using the result in the following assignments if appropriate for your application. See also *Research, Case Studies and Documentation*, above.

Finished models will be reviewed during class as scene files in Maya.

### Assignment 2: *Shaders and rendering*

Use the model created in assignment 1. You can rework models or design entirely new ones if desired. The emphasis in this assignment is on lighting and materials. Create shaders and textures that complement and emphasize features of your model. Use a variation of the lighting schemes shown in class to light your model. Be careful not to overpower your model with confusing backgrounds or too much lighting resulting in a “flat” scene. Render the scene from five different viewpoints. Some of the viewpoints can be close-ups or detail views. You may have to change some of the lights for different views. Render still images at a resolution of 1280x1024 for review during class. See also *Research, Case Studies and Documentation*, above.

### Assignment 3: *Camera and motion*

Using the models created for the previous assignments, compose a camera animation for a scene approximately ten seconds in length. If the previous model is a single object, consider building a simple environment for it. Using the techniques shown in class, animate the camera to create a moving composition with the intent of showing the viewer important details or events in your scene. Other elements of the scene can be animated as well. Avoid the “rollercoaster” effect, erratic or confusing camera motions, or camera motion conflicting with the motion of other objects. A continuous camera motion or breaking the scene into separate moving shots is acceptable. “Playblast” preview movies will be reviewed in class prior to final rendering. See also *Research, Case Studies and Documentation*, above.

### Final project:

This is an open project for application of your research interests. You may use materials created in the prior assignments and refine them further or apply them to a larger project. Developing new models and animation is acceptable but be sure to prioritize work so you have a substantial presentation for the final review. Proposals will be reviewed during class prior to start of production. A final rendered animation is not required. Minimum requirements for final review are presentation of completed models, still image render tests, and motion tests in “playblast” format.

See also *Research, Case Studies and Documentation*, above.

### **Statement of Academic Misconduct:**

In accordance with Faculty Rule 3335-5-487, all instances of alleged academic misconduct will be reported to the department chairperson and the Committee on Academic Misconduct (The University’s rules on academic misconduct can be found at <http://oaa.osu.edu/coam/home.html>). Academic misconduct is grounds for failing the course and may be grounds for further sanctions. Academic misconduct includes, but is not limited to, giving or receiving information during an exam and submitting plagiarized work for academic requirements. The University provides guidelines for research on the web at <http://gateway.lib.ohio-state.edu/tutor/>.

### **Students with Special Needs/Disabilities:**

If you need an accommodation based on the impact of a disability, you should contact us to arrange an appointment as soon as possible. At the appointment, we can discuss the course format, anticipate your needs, and explore potential accommodations. We rely on the Office of Disability Services for assistance in verifying the need for accommodations and developing accommodations strategies. If you have not previously contacted the Office of Disability Services, we encourage you to do so by calling 292-3307.