

## **CTAN 464L Digital Lighting and Rendering**

17909D, Fall 2016, 2 Units

**Instructor :** Eric Hanson, hanson@usc.edu 310.962.7261 cell  
Class meets Tuesdays 1-3:50p, RZC117  
Lab meets Thursdays 7-9:50p, RZC117  
Office hours Tuesdays and Thursdays 1-4p, SCB210P

**Student Assistant:** Hyeon Jeong Cho, hyeonjec@usc.edu

### **Course Description:**

This course will survey the tools and techniques to successfully create cinematic lighting and rendering in computer-generated imagery (CGI), using Autodesk Maya 3D animation software. The course will assist the advancing animation or visual effects student with all aspects of CGI rendering, from developing fully digital scenes to integrating CGI with live-action. Traditional direct lighting as well as advanced global illumination techniques used in the visual effects industry will be presented. The course will encompass a series of hands-on workshops, so a prior working knowledge of Maya is essential. Approaches to final compositing is also covered using The Foundry Nuke.

### **Prerequisites:**

CTAN 462, Visual Effects, or CTAN 452, Introduction to 3D Computer Animation

### **Course Length:**

15 weeks, meeting once a week, three hours each class meeting.

### **Optional Books:**

"Advanced Maya Texturing and Lighting" (second edition), Lee Lanier, Sybex, 2008. (\$38.00)  
"Digital Lighting and Rendering" (second edition), Jeremy Birn, New Riders 2000. (\$35.00)  
"Encyclopedia of Visual Effects", Damian Allen and Brian Connor, Peachpit Press 2006. (\$40.00)  
"Matter of Light and Depth", Ross Lowell, Lowel-Light, 1992. (\$35.00)  
"Light-Science and Magic", Fil Hunter, Focal Press, 2007. (\$32.00)  
"Lighting for Television and Film", Gerald Millerson, Focal Press, 1991. (\$45.00)  
"Maya 6 Killer Tips", Eric Hanson, New Riders 2004. (\$26.00)  
"The Art of Maya", Alias Wavefront, 2000. (\$60.00, www.sybex.com)

### **Optional Educational DVD's:**

"Practical Light and Color", Jeremy Vickery, The Gnomon Workshop, 2007.  
"Digital Sets 2- Lighting and Texturing", Eric Hanson, The Gnomon Workshop, 2005.  
"Digital Sets 3- Rendering and Compositing", Eric Hanson, The Gnomon Workshop, 2005.

### **Software Used:**

Autodesk Maya, Solid Angle Arnold, Pixar RenderMan, Foundry Nuke, Adobe Photoshop

### **Grading Breakdown:**

Participation @10%  
Weekly Assignments @30%  
Final Project @30%  
Final Exam 30%

The final project consists of (3) final still renderings of a supplied 3d model. The work will serve to demonstrate the range of techniques conveyed throughout the class, and allows the student to develop polished, elaborate work for their showreel.

Weekly assignments are due in the following class from when they are assigned.

Final exam is multiple choice in format.

**Schedule:**

**Week 1, Aug 23: Introduction to CGI Lighting**

Basics of Cinematic Lighting  
Light Properties  
Key to Fill Ratio  
Establishing Emotion  
Establishing Key  
Working with Color

*Assignment: Light Scene*

*Optional Reading pg. 22-32 Lanier*

**Week 2, Aug 30 : Character Lighting**

Review of CG Light Sources

3 Point Setup

Basic Maya Rigs

IPR

*In-Class Exercises- Buddha*

*Assignment: Light Scene- 3 Point, Hi/Lo Key*

*Optional Reading pg. 1-21, 38-51 Lanier*

**Week 3, Sept 6: Direct Lighting Fundamentals 1**

Direct Lighting Technique

Direct Lighting Rigs

Light Linking

Lighting Interiors

Point Arrays

Shadow Mapping

Color Mapping

Incandescence Mapping

*In-Class Exercises- Cave Temple*

*Assignment: Light Scene- Interior of Room*

*Optional Reading pg. 53, 62, 69-99 Lanier*

**Week 4, Sept 13: Direct Lighting Fundamentals 2**

Shader Glow Blooms

OptiFX Review

Fogs, Glows, Flares

Lighting Exteriors

Environment Skies

HDR Cheats

*In-Class Exercises*

*Assignment: Light Scene- Lighthouse*

*Optional Reading pg. 54-60 Lanier*

**Week 5, Sept 20: Global Illumination Fundamentals**

Global Illumination Terms

Mental Ray Review

HDR Lighting

Physical Sky

Photon Mapping  
Hemispherical Sampling  
Caustics  
Subsurface Scattering  
Portal Light  
Renderman  
*In-Class Exercises- MR ex, Hand*  
*Assignment: Light Scene- Car w/ HDR*  
*Optional Reading pg. 338-357, 375-411, 416-424 Lanier*

**Week 6, Sept 27: Introduction to Texturing 1**

Texturing Fundamentals  
UV Mapping  
3D Texture Painting  
Texture Nodes- 2D  
Texture Nodes- 3D  
Label Mapping  
Projection Types  
*In-Class Exercises*  
*Assignment: UV Map Scene- Silo*  
*Optional Reading pg. 103-133, 266-272 Lanier*

**Week 7, Oct 4: Introduction to Texturing 2**

Animated Maps  
Mipmaps  
Mapping Fractal Noise  
Ramp Texture  
Layered Textures  
Environment Textures  
PSD Texture Node  
*In-Class Exercises*  
*Assignment: Texture Scene- Silo, Train*

**Week 8, Oct 11: Introduction to Shaders 1**

Basic Shader Review  
Advanced Shader Review  
Shader Networks  
Data Types and Flow  
Color Mult and Offset  
Age and Weathering  
Specular Mapping  
*In-Class Exercises- Sunset, Ramp, Weathering*  
*Assignment: Render Scene- Train, Silo*  
*Optional Reading pg. 170-176, 234 Lanier*

**Week 9, Oct 18: Introduction to Shaders 2**

Rendering Metals  
Bump and Displacement Mapping  
Rendering Glass  
Use Background Shader  
*In-Class Exercises*  
*Assignment: Render Scene- Train, Silo*  
*Optional Reading pg. 129-133, 289-293, 366-371 Lanier*

**Week 10, Oct 25: Introduction to Shaders 3**

Utility Nodes

Facing Ratio

Surface Luminance

FX Animation w/ Shaders

*In-Class Exercises*

*Assignment: Render Scene-Train, Silo*

*Optional Reading pg. 201-227 Lanier*

**Week 11, Nov 1: Camerawork**

Basic Camera Attributes

Perspective Correction

Camera Animation Strategies

Curve Randomization

Shaker Node

Tracked Curves

Multi-Node Camera Setup

Motion Control Rigs

Camera Projection

*In-Class Exercises*

*Assignment: Animate Camera in Scene*

**Week 12, Nov 8: Production Rendering**

Rendering by Layer

Z-Depth Rendering

OpenEXR Format

Depth of Field

Vector Motion Blur

*In-Class Exercises*

*Assignment: Render Scene- Train, Silo*

*Optional Reading pg. 301-331, 405, 438-445 Lanier*

**Week 13, Nov 15: Compositing Technique in Rendering**

Nuke vs AfterEffects

Nodal Trees

Sweetening CG Renders

*In-Class Exercises*

*Assignment: Composite Scene- Train, Silo*

**Week 14, Nov 22: Wrap Up/ Studio Help**

**Week 15, Nov 29: Wrap Up/ Last Class**

*Study Days: Saturday, December 3 – Tuesday, December 6*

**Final Exam, Tues Dec 13, 11a-1p, Submission of Final Project**

## Statement on Academic Conduct and Support Systems

### Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards*<https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct,<http://policy.usc.edu/scientific-misconduct/>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity*<http://equity.usc.edu/> or to the *Department of Public Safety* <http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us>. This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men*<http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage [sarc@usc.edu](mailto:sarc@usc.edu) describes reporting options and other resources.

### Support Systems

A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute*<http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs*[http://sait.usc.edu/academicsupport/centerprograms/dsp/home\\_index.html](http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html) provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu/> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

### Disruptive Student Behavior

Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. A student responsible for disruptive behavior may be required to leave class pending discussion and resolution of the problem and may be reported to the Office of Student Judicial Affairs for disciplinary action.

### PLEASE NOTE:

**FOOD AND DRINKS (OTHER THAN WATER) ARE NOT PERMITTED IN ANY INSTRUCTIONAL SPACES IN THE CINEMATIC ARTS COMPLEX**

